CHAPTER IV

NEWTON'S VIEW OF THE RELATIONSHIP BETWEEN NATURE, SCIENCE AND RELIGION

4.1 Introduction

Unlike the dates surrounding the life and career of al-Biruni, Newton's are more easily obtained because of his extant works and the abundance of his biographies.[1] He was born prematurely on 25th December 1642, the year Galileo died, at Woolsthorpe, near the Lincolnshire town of Grantham in England and was baptized on 1st January the following year. He never saw his father, an illiterate yeoman,[2] who was buried on the preceeding 6th October.[3] When he

---

[1]For example, D. Brewster. Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton (2 vols.; Edinburgh, 1855), hereafter cited as Memoirs; F.E. Manuel. A Portrait of Isaac Newton, (New York, 1968), hereafter cited as A Portrait; R.S. Westfall. Never At Rest (Cambridge, 1980); J.W.N. Sullivan. Isaac Newton (New York, 1938) and I.B. Cohen, "Isaac Newton", in Dictionary of Scientific Biography (DSB), Vol. x, pp. 42-101.

[2]See Manuel, A Portrait...., p.24

[3]See Cohen, DSB, p.42..

was three, his mother, Hannah Ayscough, married Barnabas Smith and left the young Newton in the "farmhouse situated in a countryside" with "no protection from the frights of his imagination except that of his grandmother and such unreliable labourers as could be hired".[4] The separation was "a traumatic event in Newton's life from which he never fully recovered".[5] It is not surprising that in 1662, when he listed his earlier sins, the thirteenth was "Threatning my father and mother Smith to burne them and the house over them".[6]

Newton went to Cambridge in 1661, payed his way by performing simple university services, graduated in 1665 (Bachelor of Arts) and at the tender age of 26, succeeded Isaac Barrow as Lucasian Professor of Mathematics without being ordained.[7] Newton's successor was William Whiston, who was later expelled from the post in 1710 due to his unitarian belief which he made public.

Nicolas Fatio de Duiller was his most intimate counsel, whose friendship with Newton lasted for about twenty years.[8] Newton was

---

[4]See L.T. More, Isaac Newton, (New York, 1934), p.16.

[5]Manuel. A Potrait...., p.26.

[6]See R.S. Westfall, "Short-writing and the State of Newton's Conscience, (1662)", in Notes and Records. Royal Society of London, (18)(1963), pp. 10-16.

[7]It was a necessary requirements for fellows of Oxford and Cambridge universities in the 17th century to be first ordained in the Anglican Church. Newton managed to get the requirement waived for him with the help of Isaac Barrow.

[8]According to Manuel, "the nature of their intimacy remains obscure". See Manuel, A Potrait...., p.196.

also on familiar terms with Robert Boyle,[9] Henry More,[10] David Gregory,[11] Charles Montague,[12] Samuel Clarke,[13]William Derham,[14] John Wallis,[15]John Craig,[16]Richard Bentley,[17] George Berkeley,[18]

---

[9]Died in 1691, Newton met him in 1675 when Newton attended for the first time the meeting of the Royal Society.

[10]More was a member of the Cambridge Platonists. It has been argued that More greatly influenced some of Newton's important concepts that ran counter to Descartes. See A. Koyre',From the Closed World to the Infinite Universe, (Baltimore, 1957), p.126.

[11]Gregory communicated to Newton for the first time in 1684. He sent Newton his Exercitatio geometrica and requested the latter's opinion on it. See Vol. II, p.36 in I. Newton, The Correspondence of Isaac Newton, 7 Vols., edited by H.W. Turnbull, J.F. Scott and A.R. Hall, (Cambridge, 1959-77). Hereafter cited as Correspondence.

[12]Montague met Newton during his student years in Cambridge. The latter, at one time, considered Montague as one of his close friends. See Correspondence, II, p.464.

[13]In 1712, Clarke published his book entitled The Scripture: Doctrine of the Trinity which consists of arguments against the essential Anglican doctrine of the Trinity. According to Clarke's biographer, Whiston, Clarke was a "bosom friend" of Newton.

[14]Derham was the author of two books, Physico-theology (1713) and Astro-theology (1715) where in he argues that Newtonian science is an evidence of the existence of God, His Names and Attributes.

[15]See Wallis' letter to Newton in Correspondence, IV, p. 101, urging him to publish some of his works.

[16]John Craig was the author of Theologiae Christianae Principia Mathematica (1699). He was influenced by Newton and in the book, he furnishes mathematical reasonings to predict the time of Christ's return.

[17]For an insight into Bentley's career, see R.J. White. Dr. Bentley, A Study in Academic Scarlet (1965). Bentley was a student of Newton and in 1691, sought Newton's help in understanding the Principia. Bentley gave the first Boyle's lecture, entitled "A Confutation of Atheism" in 1693. He asked for Newton's help in preparing the lecture.

John Locke,[19] and Thomas Burnet.[20]

Newton was appointed Warden of the Mint in 1695,[21] and became its Master four years later. In 1696 he left Cambridge and moved to London. He was chosen to be the President of the Royal Society in 1703 and was knighted by Queen Anne in 1705.

Newton never married although he did have a love affair when he was eighteen years old with Apothecary Clark's step-daughter,[22] a certain Miss Storer.[23] According to a biographer, Newton endured a life of total celibacy.[24] Newton died on Monday, 20th March 1727

---

[18]Berkeley was known for his philosophical claim that esse est percipi (to be is to be perceived). He rejected Newton's conception of absolute time, space and motion. He argues that Newton's philosophy will leave his followers "thinking either that real space is God, or else that there is something besides God which is eternal". See his Principles of Human Knowledge, (1710), section 117. Newton's rebuttal can be found in the general Scholium of the Principia.

[19]There were eighteen letters sent by Newton to Locke. Both Locke and Newton had common interest in theology and alchemy. For example of Newton's letter to him, see Correspondence, III, p. 124.

[20]When Newton was upgraded to Major Fellow at Cambridge in 1668, Burnet was a proctor there. Before publishing his book, Theoria Telluris Sacra (The Sacred Theory of the Earth, containing an account of the original of the Earth, and of all the general changes which it hath already undergone, or is to undergo, 'till the consumation of all things), (England, 1960), he asked Newton's opinion about his theory. See H.S. Thayer, ed., Newton's Philosophy of Nature: Selections from his writings (New York, 1953).

[21]Montague played a vital role for promoting Newton for the post. See Correspondence, IV, p.195.

[22]See H. McLachlan, Sir Isaac Newton Theological Manuscripts, hereafter cited as Theological Manuscripts, p.9.

[23]See L.T. More. Isaac Newton, op. cit., p. 19. Miss Storer later married and became Mrs. Vincent.

[24]See Manuel, A Potrait....., p.190.

at Kensington after having problems with the stone in his bladder[25] and was buried in Westminster Abbey. Concerning his funeral, it is said that "No Englishman of science has received such extraordinary marks of respect on his death."[26]

Newton had a multitude of interests as reflected in the variety of his works. His Philosophiae Naturalis Principia Mathematica (The Mathematical Principles of Natural Philosophy), customarily referred to as the Principia, was received by the Royal Society in April 1686[27] and consequently published in 5th July 1687[28]. Another well known work of his, Opticks: or a Treatise on Reflexions, Refractions, Inflexions, and Colours of Light was printed in 1704.[29] His works continued to be published even after

---

[25]See ibid., p.387.

[26]See E.N. da G. Andrade. Sir Isaac Newton: His Life and Work, (New York, 1954). p.126.

[27]See ibid., pp. 70-71.

[28]See D.Gjertsen. The Classics of Science (New York, 1984), p.211. I.B. Cohen discusses the history of the Principia in all of its editions in his Introduction to Newton's 'Principia' (Cambridge, England, 1971). The three editions appeared in 1687, 1713, and 1726. Newton's Principia was translated into English by Andrew Motte in 1729. The translation was further revised and supplied with an explanatory and historical appendix by F. Cajori (Berkeley, 1934), pp.543-547. Quotations of the Principia in this dissertation which are from this translation are cited as "Principia, Motte-Cajori". Quotations from Alexander Koyre' and I. Bernard Cohen, eds, Isaac Newton's Philosophiae Naturalis Principia Mathematica, (Cambridge, England, 1972) are cited as "Principia, Koyre'-Cohen".

[29]See DSB, p.56. The first edition included sixteen queries and two mathematical treatises. The second edition which was printed in 1706 in Latin excluded the mathematical treatises and added seven new queries. The third and the fourth editions, published in 1717 and 1730 respectively, were in English and included all of the thirty one queries.

his death. Notable among his 'unpublished' works are Historical Account of Two Notable Corruptions of the Scriptures, The Chronology of the Ancient Kingdoms Amended, Observations on the Prophecies of Daniel and the Apocalypse of St. John.[30]

In what follows, we will examine his concept of nature, God, his view of scientific problems and the manner they are related to religion.

4.2 On nature.

Newton believed that nature is created by God. Unlike al-Biruni, Newton did not believe that God creates nature continuosly. There is an important 'mechanical aspect' of nature. His belief is a transition from a sacred nature to that of a mechanical world.

He furnishes several arguments to show the impossibility of nature to exist on its own despite its mechanical manifestation. Basically we can classify these arguments into those that do not employ verses from the Scriptures[31] and those that do. We will first examine his non-scriptural arguments.

In one of his arguments, he appeals to the 'beauty' of the cosmos. He maintains that the intricacies of nature necessarily point to the existence of the Creator. In describing the cosmos, he states:

---

[30]Some of his works on religion are reproduced in F.E. Manuel. The Religion of Isaac Newton, (Oxford, 1974), hereafter cited as Religion; H. Mc Lachlan. Sir Isaac Newton Theological Manuscripts op. cit.;and D. Castillejo. The Expanding Force in Newton's Cosmos (Madrid, 1981), hereafter cited as Expanding Force...

[31]In sofar as Newton is concerned, by the word "Scriptures" I mean the Torah and the Bible.

> The six primary planets are revolved about the sun in circles concentric with the sun, and with motions directed toward the same parts and almost in the same plane. Ten moons are revolved about the earth, Jupiter, and Saturn, in circles concentric with them, with the same direction of motion, and nearly in the planes of the orbits of those planets; but it is not to be conceived that mere mechanical causes could give birth to so many regular motions, since the comets range over all parts of the heavens in very eccentric orbits; for by that kind of motion they pass easily through the orbs of the planets, and with great rapidity; and in their aphelions, where they move the slowest and are detained the longest, they recede to the greatest distances from each other, and hence suffer the least disturbance from their mutual attractions. This most beautiful system of the sun, planets, and comets could only proceed from the counsel and dominion of an intelligent and powerful being. [32]

We can derive several things that characterize Newton's idea of 'beauty' from the above passage. 'Beauty' is synonymous with 'order', 'system' and 'regularity' and these words do not refer exactly to the rigidity of a purely mechanical world which is filled with mechanical causes alone.

In addition to appealing to the 'beauty' of nature, Newton argues that if nature was not created by God, the random behaviour of the constituents of nature would result in their own destruction. "And if the fixed stars are the centers of other like systems", says Newton, "these being formed by the like wise counsel, must be all subject to the dominion of One", because he maintains," the light of the fixed stars is of the same nature with the light of the sun and from every system light passes into all the other systems". He adds, "lest the systems of the fixed stars should, by their gravity, fall on each other, he hath placed those

---

[32]See Principia, Motte-Cajori, pp. 543-544. All quotations underlined is by the authour.

systems at immense distances from one another".[33]

In another argument, Newton appeals to the idea of complexity of the organization of matter which in his opinion, could not be attributed to natural causes alone. He writes:

> But how the matter should divide itself into two sorts, and that part of it which is fit to compose a shining body should fall down into one mass and make a sun and the rest which is fit to compose an opaque body should coalesce, not into one great body, like the shining matter, but into many little ones; or if the sun at first were an opaque body like the planets or the planet lucid bodies like the sun, how he alone should be changed into a shining body whilst all they continue opaque, or all they be changed into opaque ones whilst he remains unchanged, I do not think explicable by mere natural causes, but am forced to ascribe it to the counsel and contrivance of a voluntary Agent.[34]

We can see from the above pasage that Newton views natural causes as something different from voluntary causes; at least not all voluntary causes are natural causes. There is a sharp distinction between the 'natural' and 'supernatural.' One cannot find this sharp distinction in al-Bīrūnī's view of nature.

Newton maintains that if nature in the beginning had no Creator, there would be chaos. There is no order in nature and consequently anarchy will prevail. There would be no harmony in

---

[33] Ibid., p. 544.

[34] See Newton's first letter to Bentley in Isaac Newton, Opera quae exstant Omnia. Commentariis illustrabut Samuel Horsley, 5 Vols., (London, (1779-85)), IV, pp. 429-430. Hereafter referred to as Opera Omnia. See also R. Bentley, Sermons Preached at Boyle's Lecture: Remarks upon A Discourse of Free Thinking; Proposals for an Edition of the Greek Testament; etc. etc., edited with notes by Alexander Dyce, (London, 1838). Hereafter cited as Sermons. See p.204.

nature. An example which Newton uses to demonstrate the existence of harmony in God's creations is the particular orbits of the planets Jupiter and Saturn.

> ...considering that the planets of Jupiter and Saturn, as they are rarer than the rest, so they are vastly greater and contain a far greater quantity of matter, and have many satellites about them; which qualifications surely arose, not from their being placed at so great a distance from the sun, but were rather the cause why the Creator placed them at great distance. For, by their gravitating powers, they disturb one another's motions very sensibly, as I find by some late observations of Mr. Flamsteed; and had they been placed much nearer to the sun and to one another, they would, by the same powers, have caused a considerable disturbance in the whole system.[35]

Newton argues that the orderliness and harmony which result from the particular places in the universe occupied by Jupiter and Saturn shows that nature is created by God.

That nature did not exist out of chance without having a Creator can be ascertained if we examine the case of the earth and the Sun. According to Newton, the inclination of the earth's axis is extraordinary because the inclination results in "a contrivance for winter and summer, and for making the earth habitable toward the poles". Also "the diurnal rotations of the sun and planets...could hardly arise from any cause purely mechanical", that all of these "was the effect of choice rather than chance".[36] In response to those who claim that nature is created out of chance, he asks:

---

[35]See Newton's first letter to Bentley in Opera Omnia, IV, pp. 429-432. cf., Sermons, p. 206.

[36]See Newton's first letter to Bentley in Opera Omnia IV, pp.429-431. See also Sermons, p.207.

> Whence is it that all the eyes of all sorts of living creatures are transparent to the very bottom and the only transparent members of the body, having on the outside a hard transparent skin and within transparent layers with a crystalline lens in the middle and a pupil before the lens; all of them so truly shaped and fitted for vision that no Artist can mend them? Did blind chance know that there was light and what was its refraction, and fit the eyes of all creatures after the most curious manner to make use of it?
>
> These and such like considerations, always have, and ever will prevail with mankind, to believe that there is a being who made all things in his power, and who is therefore to be feared.[37]

Newton likewise argues that the particular pattern of distribution of matter will not be possible if God did not create them. Only God can make matter such that it is distributed homogenously throughout space and that "there should be a central particle so accurately placed in the middle to be equally attracted on all sides". He continues:

> And much harder it is to suppose all the particles in an infinite space should be so accurately poised one among another as to stand still in perfect equilibrium. For I reckon this as hard as to make, not one needle only, but an infinite number of them (so many as there are particles in an infinite space) stand accurately poised upon their points. Yet I grant it possible, at least by a divine power; and if they were one to be placed, I agree with you [Bentley, that is] that they would continue in that posture without motion forever, unless put into new motion by the same power.[38]

---

[37]See his unpublished work, "A Short Scheme of the True Religion", in Theological Manuscripts, p.48-49. Also reproduced in Brewster, Memoirs, Vol. II, pp.347-348.

[38]See Newton's second letter to Bentley. In similar vein he writes: "The hypotheses of matters being at first evenly spread through the heavens is, in my opinion, inconsistent with the hypothesis of innate gravity, without supernatural power to reconcile them; and therefore it infers a Deity". See his fourth letter in Sermons, p.215.

One cannot say from the above passage that Newton is referring to an active God who is continuosly creating. The transition from the view of God as creating and destroying continuosly to that of a clock-maker can be seen in Newton's argument concerning gravity whereby he believes that gravity also has somekind of natural power. It is not the case that all natural power rests upon God alone. "Gravity", says Newton, "may put the planets into motion, but without the divine power it could never put them into such a circulating motion as they have about the sun". "Therefore", Newton concludes, "I am compelled to ascribe the frame of this system to an Intelligent Agent".[39] One can say from this passage that Newton indeed paved the way for a mechanical world view which later dominates the Newtonians.

In his scriptural arguments, which are not well elaborated, Newton quotes the Ten Commandments, Genesis 7 and 8, Proverbs 8:25, Job 15:7 and Psalm 90:2.[40] It is only when he attempts to construct the early act of God creating the earth whereby God creates nature out of chaos that he refers to Moses' knowledge. States Newton: "A sea I believe was then formed, as Moses expresses, but not like the sea, but with an even bottom without any precipices or steep descents".[41]

---

[39]See Newton's second letter to Bentley. In his fourth reply to the latter, he says: "The diurnal rotations of the planets could not be derived from gravity, but required a divine arm to impress them". See his Opera Omnia, IV, pp.432-442; Sermons, p.215.

[40]See his letter to Thomas Burnet reproduced in Brewster, Memoirs, Vol. II, pp. 99-100, 447-54.

[41]See ibid., p. 448.

The foregoing discussions shows that Newton believes in the divine creation of nature. God creates nature in the beginning. As to whether nature is created ex nihilo or not, Newton asserts: "Creation in scripture signifies formation out of something: as where God created man out of dust or the earth. Gen. 2.7".[42]

In Newton's cosmology, nature as a work of God has several characteristics besides 'harmony' and 'beauty' that I have mentioned earlier. One of those is uniformity; that there are standard features for each species of God's creation which differentiate them from others. Newton cites the case of bird, beast and men to support his claim:

> Can it be by accident that all birds, beasts and men have their right side and left side alike shaped (except in their bowels); and just two eyes and no more, on either side of the face; and just two ears on either side [of] the head; and a nose with two holes; and either two forelegs or two wings or two arms on the shoulders, and two legs on the hips, and no more? Whence arise this uniformity in all their outward shapes but from the counsel and contrivance of an Author?[43]

In addition to the uniformity of nature, Newton believes that there is nothing in nature that is an 'excess'. It is in this sense that nature is simple, that "Nature does nothing in vain", and that "Nature is pleased with simplicity and affects not the pomp of superfluous causes".[44] It is due to the simplicity of nature that

---

[42]See Newton's statement reproduced in D. Castillejo, Expanding Force, op. cit., p.59.

[43]See Newton, "A Short Scheme of the True Religion," reproduced in Brewster, Memoirs..., Vol. II, pp. 347-348.

[44]See Principia, Motte-Cajori, p.398.

according to Newton, "we are to admit no more causes of natural things than such as are true and sufficient to explain their appearances".[45] An example that he gives is the sun. In response to the question of "Why there is one body in our system qualified to give light and heat to all the rest", he says: "I know no reason but because one was sufficient to warm and enlighten all the rest".[46]

In order to elaborate his concept of simplicity further, he says that since nature is simple, "We are certainly not to relinquish the evidence of experiments for the sake of dreams and vain fictions of our own devising".[47] Therefore Newton's concept of simplicity does not mean that the structure of the universe is not complex because a conglomerate of simples is certainly a complicated object. What he means is that we should not make our examination of nature unnecessarily difficult by employing extra-sensible stories of our own.[48]

Newton maintains that the understanding of simplicity and the unveiling of truth about nature are deeply connected. There is an organic synthesis between truth and simplicity. "Truth", he

---

[45]See his "Rule I" in ibid., p.398.

[46]See his first letter to Richard Bentley in Sermons, p.204.

[47] Ibid.

[48]It is important to distinguish between stories from the scripture and stories of our own in analysing Newton's concept of simplicity because it is very clear that Newton employed the former in his scientific explanation as we have demonstrated earlier. Therefore what he was referring to when he used the phrase "dreams and vain fictions" in my opinion, was man made and not 'revealed' (from his perspective, that is) extra-sensible explanation.

declares, "is ever to be found in simplicity, and not in the multiplicity and confusion of things".[49]

The content of a simple, harmonious, orderly, and beautiful nature is far from homogenous. In fact, Newton's nature is definitely not a material plenum. There are levels of beings, spiritual and material, each having particular responsibilities given by God. Says Newton:

> As all regions below are replenished with living creatures, (not only the Earth with Beasts, and Sea with Fishes and the Air with Fowls and Insects, but also standing waters, vinegar, the bodies and blood of Animals and other juices with innumerable living creatures too small to be seen without the help of magnifying Glasses) so may the heavens above be replenished with beings whose nature we do not understand. He that shall well consider the strange and wonderful nature of life and frame of Animals, will think nothing beyond the possibility of nature, nothing too hard for the the omnipotent power of God. And as the planets remain in their orbs, so may any other bodies subsist at any distance from the earth, and much more may beings, who have a sufficient power of self motion, move whether they will, place themselves where they will and continue in any regions of the heavens whatever, there to enjoy the society of one another, and by their messenger or Angels to rule the earth and converse with the remotest regions. Thus may the whole heavens or anypart thereof whatever be the habitation of the Blessed, and at the same time the earth be subject to their dominion.[50]

According to Newton, one of the responsibilities given by God to some of these invisible and intelligent beings is to manage the motions of heavenly bodies. Conduitt reported that in one of his conversations with Newton, the latter "seemed to doubt whether

---

[49]See Yahuda MS. 1.1. (Manuel, Religion, op. cit., (Appendix A), p.120.)

[50]See Yahuda MS. 9.2., fol. 140r. cf. Manuel, Religion..., p.102.

there were not intelligent beings superior to us who superintend these revolutions of the heavenly bodies by the direction of the supreme being."[51] Elsewhere, Newton writes:

> God made and governs the world invisibly....For in God's house (which is the universe) are many mansions, and he governs them by agents which can pass through the heavens from one mansion to another. For if all places to which we have access are filled with living creatures, why should all these immense spaces of the heavens above the clouds be incapable of inhabitants?[52]

Apart from the fact that Newton believes in the existence of angels and other invisible beings, interestingly Newton did not embrace the view that Nature is governed by God through a process which he called 'emanation'. He argues that this view originates from the heathens and by the term 'heathens', he refers to those people other than Christians which include Jews and Mahometans (Muslims). Newton gives a historical account pertaining to the development of the theory of emanation. Thus:

> From this opinion came the metaphysical philosophy of the heathens about the origin of the world, the generation and nature of the Gods & the transmigration of Souls. And this doctrine of Daemons was as old as the Idolatory of the heathens. For their Idolatory was grounded upon it. And therefore Moses to prevent the spreading of this sort of Philosophy among the Israelites wrote the history of the creation of the world in a very different manner from the Cosmogenies of the heathens, attributing the production of all things to the immediate will of the supreme God. Yet the Israelites by conversing with the heathens frequently lapsed into the worship of their Gods & by consequence received their theology, until they were captivated for these transgressions.

---

[51]See Conduitt letter reproduced in Castillejo, Expanding Force, p.96.

[52]See the manuscript reproduced in Brewster, Memoirs, Vol. II, p.354.

> And afterwards by conversing with the Chaldeans, Egyptians and Greeks they imbibed their Metaphysical Theology as is manifest by the Cabala of the Jews which consists chiefly in describing how the first Being, whom they called Aen-Soph the infinite emitted ten gradual subordinate emanations which they called Sephiroths or Splendours, the first immediately from himself, the second from the first, the third from the first or second & so on. And these ten emanations they name after God's attributes and powers, calling the first Kether the Crown, the second Cochmah Wisdom, the third Binah Prudence, the fourth Gedulah magnificence, the fifth Geburah strength, the sixth Tipherah Beauty....[53]

In his discussion on the theory of emanation related to the creation of Nature, he also claims that the theory is very closely allied to the view that the cosmos is divided into three worlds; the world of separate intelligence, the world of Angels and the corporeal world.

> And after these ten which they call 'mundus azaluthicus' the emanative world, they make three lower worlds which they call Briah the throne or glory, & the world of separate intelligences, Jezirah the world of Angels, & Asiah the corporeal world, that is the world in which we live. And they say that the influence and power of the first cause which they call Aen-Soph & the Aensophic world reaches through all things below them & that by means of the superior powers the Azaluthic kingdom formed the world of Briah, the Briathic Kingdom formed the world of Jezirah & the Jezirathic kingdom formed the lowest world Asiah: & that the souls of men from above revolve & pass into several bodies & after death return to the internal light of the Shekinah.[54]

Newton rejects the theory of emanation[55] and the theory of the

---

[53]See Yahuda MS. 15, p.137. cf., Castillejo, Expanding Force, p.66.

[54] Ibid.

[55]It is pertinent to note here that there are likewise theories of emanation in the Islamic cosmological view. Perhaps the most widely received is that of al-Farabi. Unlike the theory of emanation which is the result of the deification of dead Kings (as understood by Newton), al-Fārābī's theory of emanation is based on

three worlds in the creation of nature because he maintains that both theories are products of heathens worshipping their Kings, idolizing them after their death. Newton explains in detail, canvassing the history of creation adopted by various nations and races while paying particular attention to the Jews[56].

> This opinion seems to have had its rise from the worshipping and deifying of dead kings & exalting them in the opinion of the people till they made them the highest celestial Gods & took the oldest for the supreme God or for a God descended immediately from him & his successors for a series of Gods descended successively from the oldest, & making this race of Gods as ancient as the world. For the Chaldeans placed a race of ten succesive Gods reigning from the beginning of the world to the time of the flood, aś is recited in the fragment of Berosus preserved by Eusebius. The Egyptians represented God's creation of the world by a spider's weaving a web out of her own bowels & began their history with a race of Gods & heroes the last of which was Orus. The Phoenicians began their history with the creation of the world & a race of above ten succesive pairs of Gods as is recited by Sanchoniatho. And from Egypt & Phoenicia came the like Theology into Greece as you may see in Hesiod's Theogony. And the Jews by conversing with the heathens fell into Idolatory before the captivity, so conversing with the Chaldeans in the time of the Babylonian Captivity they seem to have learnt the theology of those nations & refined it. For they derived their mystical Cabbala

---

the idea of the hierarchy of beings "in terms of a hiearchy of intelligences and souls and their effusion or emanation (fayd) from God", and concerning God who is the First Cause, "we can have only the principles of our knowledge of it and not the principles of its being". See O. Bakar, Classification of Knowledge in Islam: A Study in Islamic Philosophies of Science, Foreword by Seyyed Hossein Nasr (Kuala Lumpur, 1992), p. 95 and 97 respectively. Thus the Islamic theory of emanation differs from that understood by Newton.

[56]In the time of Newton, there was the zeal to proselytise the heathens by the 'Christian Virtuoso', especially the Jews and others. For an example, Robert Boyle who was a close friend of Newton left this will upon his death: "To settle an annual salary for some divine or preaching minister, who shall be enjoined to perform the offices following: 1. To preach eight Sermons in a year, for proving the Christian religion against notorious infidels, viz., Atheists, Deists, Pagans, Jews, and Mahometans". See Sermons, pp. xv-xvi.

> by tradition from the days of Ezra & supposed that it came to Ezra from Moses & this Kabbala consists chiefly in describing how the first cause whom they call Aen-Soph the infinite emitted gradually ten subordinate emanations which they call Sephiroths; formed the lowest world Asiah. Each of the ten Sephiroths they called Adam a man & the first of them they called Adam Kadmon the first man & make him the son of God as Adam is called in Scripture. Which confirms the opinion that the ten Sephiroths were originally ten men deified, namely the ten antediluvian patriarchs mentioned by Manetho the first of which was called Alorus by the Chaldeans & Adam by the Jews.[57]

From the above passage we can also derive that Newton's cosmological view is certainly influenced by his belief that truth lies in Christianity since he rejects their explanations about the creation of nature chiefly because the theories originate from the heathens. Embracing their theories of emanation is synonymous with deifying their dead Kings and will results in "worshipping the creation instead of the creator".[58]

God creates the world and governs it in his own way. "God made the world and governs it invisibly, and hath commanded us to love, honour and worship him and no other God but him, and to do it without making any image of him",[59] says Newton, and that "We can know him only by his most wise and excellent contrivances and final causes".[60]

---

[57]See Yahuda, MS 15. p.137. cf. Castillejo, Expanding Force, p.67.

[58]See Theological Manuscripts, p.50.

[59]See ibid., p.54.

[60]See Principia, Motte Cajori, pp. 545-56 and Principia, Koyre'& Cohen, pp. 762-63.

4.3 Newton's God

So far we have elaborated Newton's perspective concerning the link between nature and God. Since God plays such a dominant and pervasive role in his conception of nature, Newton's conception of God certainly warrants further examination. Does his God have particular Names and Attributes? Is his God transcendent? Is his God "God-of-the-Gaps," so to speak?

Concerning Newton's theology, he has been described as "a Judaic monotheist of the school of Maimonides",[61] an Arian who "sometimes expressed himself like a Socinian",[62] a Unitarian, anti-trinitarian,[63] and that his religion was a historical and scriptural".[64] What is common under these themes is that his belief was considered heretical in his time and certainly in so far as theology (as opposed to religion) is concerned, Newton's

---

[61]See J.M Keynes, "Newton, the Man," The Royal Society Newton Tercentenary Celebrations. cf. Theological Manuscripts, p.13.

[62]See Theological Manuscripts, p.14.

[63]See his "A Short Scheme of the True Religion" in Theological Manuscripts, pp.49-51. According to one biographer, Newton's letter "exposing as false the Trinitarian proof-texts in John and Timothy had been transmitted through Locke to Le Clerc for anonymous publication in Holland, but then had been withdrawn in panic". See Manuel, Religion, p. 12. See also G.S. Brett, "Newton's Place in the History of Religious Thought", in Sir Isaac Newton: A Bicentennary Evaluation of His Work, (Baltimore, 1928), pp.260-268 and Newton's "Paradoxical Questions Concerning the Morals and Actions of Athanius and his Followers," in Theological Manuscripts, pp.61-118.

[64]See Manuel, Religion, p.3. See also ibid., Isaac Newton, Historian, (Cambridge, Mass., 1963), pp.8-9.

belief did not conform to the Christian tenets of his days.[65] If his peculiar belief were to be made public during his lifetime, it would at least have cost him his career.[66]

By and large, Newton's concept of the Names and Attributes of God is summarized in the General Scholium.[67] According to him, God "governs all things, not as the soul of the world, but as Lord over all".[68]He is "eternal, infinite, absolutely perfect",[69] and that He is "omnipotent and omniscient".[70] Newton believes that not only God governs all things but He also "knows all things that are or can be done". Newton adds further that God "is not eternity and infinity, but eternal and infinite; He is not duration of space, but He endures and is present".[71]

Furthermore Newton claims that there are Aspects of God which are absolutely unknowable. Says Newton:

---

[65]I have in mind the tenets advocated by the Council of Nice whereby the Trinity was made (and still is) the foundation of Christianity.

[66]William Whiston's career was a case in point. Although appointed by Newton as his successor to the Lucasian chair, Whiston was expelled from the post in 1711, a consequencs of the Toleration Act of 1688, because his Arian belief was made public. See The History of Science Society, Sir Isaac Newton: A Bicentenary Evaluation of His Works, op. cit., pp. 260-261.

[67]See Principia, Motte-Cajori, pp. 544-46. See also his "A Short Scheme of the True Religion", in Brewster, Memoirs..., Vol.II, pp. 347-8.

[68]See Principia, Motte Cajori, p.544.

[69]Ibid.

[70] Ibid., p.545.

[71] Ibid.

> Whence also he is all similar, all eye, all ear, all brain, all arm, all power to percieve, to understand and to act; but in a manner not at all human, in a manner not at all corporeal, in a manner utterly unknown to us. As a blind man has no idea of colors, so we have no idea of the manner by which the all wise God perceives and understands all things.[72]

With regard to the Essence of God, Newton states that "He is utterly void of all body and bodily figure, and can therefore neither be seen nor touched". Consequently God should never "be worshipped under the representation of any corporeal thing", because "we have ideas of his attributes, but what the real substance of anything is we know not".[73]

Elaborating further on our knowledge on the Essence of God, he draws an analogy with the manner of our perception.

> In bodies we see only their fingers and colors, we hear only the sounds, we touch only their outward surfaces, we smell only the smells and taste the savors, but their inward substances are not to be known either by our senses or by any reflex act of our minds; much less, then, have we any idea of the substance of God.[74]

If the Essence of God is unknowable, how then do we as human beings know and consequently worship God? In response to this question, Newton states:

> We know him only by his most wise and excellent contrivances of things and final causes; we admire him for his perfections, but we reverence and adore him on account of his dominion, for

---

[72] Ibid.

[73] Ibid., pp. 545-6.

[74] See ibid., p.546.

we adore him as his servant.[75]

Newton is clear that 'anthromorphic phrases' about God are nothing more than metaphor. He understands that the total dependence of the world on God is beyond literal description although perceiving the dependence lies within the realm of human knowledge. The activity of the omnipotent Creator has no human counterpart. Therefore 'anthromorphic phrases' about God should not be taken literally in the sense used to describe human behaviour.

> But, by way of allegory, God is said to see, to speak, to laugh, to love, to hate, to desire, to give, to receive, to rejoice, to be angry, to fight, to frame, to work, to build; for all our notions of God are taken from the ways of mankind by a certain similitude, which, though not perfect, has some likeness, however.[76]

In addition to his comments above, he emphasizes that God "is omnipresent not virtually only but also substantially; for virtue cannot subsist without substance", and that "the Supreme God exists necessarily, and by the same necessity he exists always and everywhere".[77] Thus we say that Newton's God is not 'distant' but transcendent and immanent.

In Newton's cosmology, unlike al-Bīrūnī's, God creates the universe but He does not manage it continuously; he only intervenes occasionally. There is the 'mechanical aspect' of nature. Thus Newton uses phrases such as "Nature does nothing in vain",[78]"Nature

---

[75] Ibid.

[76] Ibid.

[77] Ibid., p.545.

[78] See ibid., p. 398. cf. Opticks, p.369.

is very consonant and conformable to herself",[79]nature "performing all the great motions of the heavenly bodies by the attraction of gravity",[80] that is, nature has the disposition to act independently. For example his discussion on ether leads him to write:

> Perhaps the whole frame of nature may be nothing but various contextures of some certain etherial spirits or vapors, condensed as it were by precipitation, much after the manner that vapors are condensed into water or exhalations into grosser substances, though not so easily condensable; and after condensation wrought into various forms, at first by the immediate hand of the Creator, and ever since by the power of nature, which,by virtue of the command "increase and multiply", became a complete imitator of the copy set her by the protoplast.[81]

In a similar vein, Newton uses phrases like "the power of gravity" or the "power of magnetism"[82]. In presenting a 'partly mechanical world', Newton is tredding the foot-steps of Galileo[83] in paving the way for a purely mechanical world which later dominates the West.

---

[79]Opticks, p.376 and p.397.

[80] Ibid., p.397.

[81]See Newton's "An Hypothesis Explaining the Properties of Light Discoursed of in My Several Papers", in a letter to Oldenberg, January 25, 1675/6. Communicated to the Royal Society, 9th December 1675. Quoted in Brewster, Memoirs..., Vol. I, p.392.

[82]See Corollary V to Proposition VI in Principia, Motte-Cajori, Bk. III.

[83]Says Galileo,"The Holy Ghost teaches how to go to heaven, not how the heavens go."See his 'Letter to the Grand Duchess Christina' in Stillman Drake, Discoveries and Opinions, (New York, 1957), p. 186.

4.4 On Scientific Problems.

In this section, we will discuss the orientation of scientific problems and Newton's approach in solving them with respect to his philosophy of nature.

"The whole burden of philosophy", says Newton, "seems to consist in this: from the phenomena of motions to investigate the forces of nature, and then from these forces to demonstrate the other phenomena".[84] Accordingly scientific problems, from Newton's view, are problems in natural philosophy about phenomena.

Through out Newton's scientific endeavour, it appears that these scientific problems[85] share some common and interesting traits. The most important of them all is that Newton's scientific problems are problems which are shadowed by arguments about God.

In more specific terms, scientific problems according to Newton are problems concerning nature belonging to that part of theology which is demonstrable. We will treat the demonstrable aspect of the problems later. First we will examine the manner in which Newton's scientific problems are also problems of theology.

That God is central in his natural philosophy is clear. His discussion about God's Names and Attributes leads him to conclude: "And thus much concerning God, to discourse of whom from the appearances of things does certainly belong to natural

---

[84]See Newton's preface to the first edition of the Principia, 8th May 1686. Principia, Motte-Cajori, pp. xvii-xviii.

[85]We have in mind problems treated in the Principia, Opticks and in his practice of alchemy. For a sample of Newton's work on alchemy, see Castillejo, Expanding Force, pp. 17-29.

philosophy".[86] To give another example, he writes the following passage in his study of optics:

> And these things being rightly dispatch'd, does it not appear from Phenomena that there is a Being, incorporeal, living, intelligent, omnipresent...And through every true Step made in this Philosophy brings us not immediately to the Knowledge of the first Cause, yet it brings us nearer to it, and on that account is to be highly valued.[87]

As a matter of fact, God is so crucial to his philosophy of science that he declares "When I wrote my treatise about our system (that is the Principia,) I had an eye upon such principles as might work with considering men for the belief of a deity".[88] He even told Conduitt that the Principia was written "to enforce and demonstrate the power and superintendency of a supreme being".[89] If his scientific enterprise is overshadowed with discussions about God to the extent that theology and his 'natural philosophy' are amalgamated together, what more of his scientific problems!

His fervent belief in the connection between God and problems can also be seen in his view about problems and their solutions. God is simple for He is the One. Accordingly, problems and the manner of solving them should potray simplicity. Says Newton:

---

[86]See his General Scholium in Principia, Motte-Cajori, p.546.

[87]See Opticks, p.370.

[88]See the first paragraph in his first letter to Richard Bentley in Opera Omnia IV, p.429. cf. Sermons, p.203.

[89]Keynes MS.130 (6), University of Cambridge, King's College Library. See also Manuel, A Portrait, p.417.

> As the world, which to the naked eye exhibits the greatest variety of objects, appears very simple in its internal constitution when surveyed by a philosophic understanding, and so much the simpler by how much the better it is understood, so it is in these visions. It is the perfection of God's works that they are all done with the greatest simplicity. He is the God of order and not of confusion. And therefore as they that would understand the frame of the world must endeavour to reduce their knowledge to all possible simplicity, so it must be in seeking to understand these visions.[90]

The above passage is taken from his inquiry into prophetic visions. What we want to emphasize from the passage is the similarity of finding the solutions to problems. Solutions to problems should be based on the scientist's belief in the attributes of God (God of order and not of confusion). The scientist should assume that the problem need to be tackle in an orderly fashion in order to arrive at the simplest solution.

In view of these passages, we claim that Newton construes scientific problems as problems that have solutions which would enhance the scientist's knowledge of the Deity.

The second aspect of Newton's scientific problems is that they are naturally demonstrable. That they are so is because Newton's scientific problems involves 'phenomena'. In order to give an example of what is meant by the phrase 'naturally demonstrable' and 'phenomena', we will present his discussion on gravity which occurs in the Principia, and which leads to his well known slogan, "Hypothesis non-fingo".

Newton writes that he has explicated "the phenomena of the heavens and of our sea by the power of gravity", but he admits that

---

[90]See Yahuda MS. 1.1. See also Appendix A in Manuel, Religion..., p.120.

he has not yet "assigned the cause of this power". Newton argues that gravity:

> must proceed from a cause that penetrates to the very centers of the sun and planets, without suffering the least dimunition of its force; that operates not according to the quantity of surfaces of the particles upon which it acts (as mechanical causes do), but according to the quantity of the solid matter which they contain, and propagates its virtue on all sides to immense distances, decreasing always in the duplicate proportion of the distances.[91]

He goes on to concede that he could not thus far "deduce the cause of those properties of gravity from phenomena". This phrase occurs immediately preceeding his famous remarks, "Hypothesis non fingo". Newton continues: "whatever is not deduced from phenomena is to be called an hypothesis", and these hypotheses, "whether metaphysical or physical, whether of occult qualities or mechanical, have no place in experimental philosophy". Just exactly what are 'phenomena' to Newton and how are 'phenomena' related to the thesis that his scientific problems are naturally demonstrable?

According to Newton, phenomena are not made up from the world of brute facts. It is not merely data resulting from sense

---

[91]Principia, Motte-Cajori, p.547. Principia, Koyre-Cohen, p.764. The nature of Newton's hypotheses are the subject of several studies. See for examples Alexander Koyre's articles; "Concept and Experience in Newton's Scientific Thought" whereby he argues that what is meant by "Hypotheses non-fingo" is "I feign no hypotheses" and his other article, "Newton's 'Regulae Philosophandi'". Both articles appear in Newtonian Studies, (Cambridge, Mass., 1965) pp. 25-52 and pp. 261-272 respectively. See also I.B. Cohen's "Preface" in Isaac Newton, Opticks, op.cit, pp.ix-lviii; "Hypothesis in Newton's Philosophy," Physis, 8(1966), pp.163-184. Cf. Marie Boas and Rupert Hall, "Newton's Mechanical Principles", Journal of the History of Ideas, 20(1959), pp. 167-78. In light of these studies, "Hypotheses non fingo" should not be perceived as descriptive of Newton's work.

observations such as the rising and setting of the sun. Rather 'phenomena' to Newton results from observing the sensibles while analysing and thinking about nature and God. (The existence of God is deduced from phenomena as Newton has shown and thus this hypothesis, if we want to call it an hypothesis, certainly belongs to his experimental philosophy). As a matter of fact, the various planets and the Sun which Newton mentions in order to support his arguments about the Deity[92] constitutes the materials for Phenomenon I to VI of his Principia[93].

We can likewise find the word 'phenomena' in his "Rules of reasoning in Philosophy". Newton states:

> In experimental philosophy we are to look upon propositions inferred by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.[94]

That the above passage is to underscore the importance of problems based on phenomena can be discerned from its draft which is one of Newton's unpublished statement.

> In experimental philosophy one is not to argue from hypotheses against propositions drawn by induction from phenomena. For if arguments from hypotheses are admitted against inductions,

---

[92]See for example, Newton's first letter to Bentley dated 10th December 1692 in Isaac Newton Papers & Letters on Natural Philosophy, edited by I.B. Cohen, op. cit., pp.286-87. Cf. Sermons, pp.203-207.

[93]See Principia, Motte-Cajori, pp.401-406.

[94]See Newton's Rule IV in Principia, Koyre'-Cohen, p.555 and Principia, Motte Cajori, p.400.

> then the arguments of inductions on which all experimental philosophy is founded could always be overthrown by contrary hypotheses. If a certain proposition drawn by induction is not yet sufficiently precise, it must be corrected not by hypotheses but by the phenomena of nature more fully and more accurately observed.[95]

Since phenomena involves that part of nature which is demonstrable[96], meaning that they must be supported by empirical evidence (thus the term "experimental philosophy"), scientific problems which are founded on phenomena must likewise be demonstrable too. Specifically, they should have empirical import. Scientific problems are problems solved "not by deducing it [in arriving at the answer] only from a confutation of contrary suppositions, but by deriving it from experiments concluding positively and directly".[97] Thus Newton argues:

> For the best and safest method of philosophizing seems to be, first to inquire diligently into the properties of things, and

---

[95]This statement is translated by Alexandre Koyre in his "Newton's 'Regulae Philosophandi'", Newtonian Studies, p.269. The Latin text is given on the same page.

[96]There are six phenomena stated in Newton's Book III: The System of the World. For the purpose of illustration, three of them are as follows:

Phenomenon I. That the circumjovial planets, by radii drawn to Jupiter's centre, describe areas proportional to the times of descriptions; and that their periodic times, the fixed stars being at rest, are as the 3/2th power of their distances from its centre.

Phenomenon III. That the five primary planets, Mercury, Venus, Mars, Jupiter, and Saturn, with their several orbits, encompass the sun.

Phenomenon VI. That the moon, by a radius drawn to the earth's centre, describes an area proportional to the time of description.

See Principia, Motte-Cajori, pp.401-405.

[97]See Newton's letter to Oldenberg, July 1672 in Opera Omnia IV, pp. 320-21.

> establishing those properties by experiments and then to proceed more slowly to hypotheses for the explanation of them. For hypotheses should be subservient only in explaining the properties of things, but not assumed in determining them; unless so far as they may furnish experiments.[98]

Newton's belief that scientific problems qua scientific problems must involve experiments has made him to remark that "the Greeks, a people more addicted to the study of philology than to Nature, derived their first, as well as soundest, notions of philosophy (by observing the heaven)".[99] Surely Newton knew about the Greek contributions to the development of science. What I want is to direct the readers' attention to the significance of experiments to Newton. According to Newton, inspite of the Greek well known involvement in the flowering of science, their awareness of the importance of experiments is still insufficient.

Now that we have established his conception of scientific problems particularly on the manner which they are related to arguments about God and the characteristic that they must be naturally demonstrable, we will delve deeper into his approach in solving them. we want to know whether Newton has a methodology of

---

[98]See Newton's "Answer to the Second Letter of Pardies," in Isaac Newton's Papers & Letters on Natural Philosophy, op. cit., p.106.; from the Philosophical Transactions (7)(1672).

[99]See passages from Newton's The Chronology of Ancient Kingdom Amended (Castillejo, Expanding Force, p.86). Cf. to the thrust of Cotes preface to the second edition of the Principia: "He who is presumptuous enough to think that he can find the true principles of physics and the laws of natural things by the force alone of his own mind ...must [either] suppose that the world exist by necessity and by the same necessity follows the laws proposed". See Principia, Motte-Cajori, p.xxxii.

scientific research. If indeed he has, we will examine the relationship between his methodology and his philosophy of nature.

4.5 Some Philosophical Aspects of Newton's Methodology of Problem Solving

That he had a methodology we are certain. Some of the words he used such as 'induction' and 'inferred' point to a methodology. For examples, he states: "...we are to look upon propositions inferred by general induction from phenomena",[100] and "In this philosophy particular propositions are inferred from the phenomena, and afterwards rendered general by induction",[101] And elsewhere Newton again expounds on this theme:

> This Analysis consists in making Experiments and Observations, and in drawing general Conclusions from them by Induction, and admitting of no objections against the conclusions...And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of, and may be looked upon as so much the stronger, by how much the Induction is more general.[102]

Although Newton uses the word "induction" quite conspicuously, it is incorrect for us to classify Newton's methodology as basically that of induction[103] because he also uses the word "deduction". To cite some examples, in the concluding General

---

[100]See Principia, Motte-Cajori, p.400

[101] Ibid., p.547.

[102]See Opticks, pp.404-05.

[103]See R. Palter, "Newton and the Inductive Method," Texas Quarterly, (10)(1967), pp.161-73.

Scholium of his Principia, Newton writes: "whatever is not deduced from the phenomena is to be called an hypothesis",[104] and elsewhere in his other work: "... the main Business of natural Philosophy is to argue from Phenomena without feigning Hypotheses, and to deduce Causes from Effects...".[105] In fact, in his letter to Oldenberg of 6th July 1672, he claims that "the proper Method for inquiring after the properties of things is, to deduce them from Experiments".[106] Therefore it is clear that in his methodology of scientific research, he uses both induction and deduction extensively.

What is the strongest connection between his scientific methodology of solving problems and his philosophy of science? We will argue that the connection is the particular role of hypotheses as envisaged by him.

Just like Galileo and Descartes who used hypotheses in their scientific inquiries, so did Newton.[107] By and large, the latter used the word "hypotheses" in order to "signify only such a Proposition as is not a Phenomenon nor deduced from any Phenomena

---

[104]See Principia, Motte-Cajori, p.547.

[105]See Opticks, Query 28 (which is Query 20 in the Latin edition of 1706.)

[106]See Opera Omnia, Vol. IV, pp. 320-321.

[107]The argument that Newton basically uses hypotheses only after conducting experiments, echoing his "Hypothesis non-fingo", has been shown not to be correct upon deeper studies of his works. See footnote 90 of this chapter.

but assumed or supposed without any experimental proof".[108] The following quotation is an example:

HYPOTHESIS I

> That the centre of the system of the world is immovable. This is acknowledged by all, while some contend that the earth, others that the sun, is fixed in that centre. Let us see what may from hence follow.[109]

The great difference between Newton and other scientists in using hypotheses is that the former used the word "hypotheses" pejoratively. Hypotheses to Newton "should be subservient only in explaining the properties of things, but not assumed in determining them; unless so far as they may furnish experiments".[110] And elsewhere he boldly states: "Hypotheses, whether metaphysical or physical, whether of occult qualities or mechanical, have no place in experimental philosophy".[111] As a matter of fact, in the first part of his Opticks he clearly shows his peculiar attitude to hypotheses. "My Design in this Book is not to explain the Properties of Light by Hypotheses, but to propose and prove them by Reasons and Experiments",[112] says Newton.

---

[108]See Newton's letter to Roger Cotes, 28th March 1713 in Correspondence, Vol. V, p.397.

[109]See Principia, Motte-Cajori, p.419, Koyre'-Cohen, p.586.

[110]See Papers and Letters. Cf. Correspondence, Vol. I, p.164.

[111]See Principia, Motte-Cajori, p.547.

[112]See Opticks, Part I.

We submit that the main reason he exhibits such a cautious approach to hypotheses is because of his historical finding on the 'abuse' of hypotheses, so to speak. This so-called 'abuse' of hypotheses is diametrically opposed to his intense belief in the dominant role of God. Newton's conception of the historical development of hypotheses can be ascertained from a draft of his works which in the polished form, is presented as Query 28 in his Opticks. Thus:

> Later Philosophers banish the Consideration of such a Cause out of natural Philosophy, feigning Hypotheses for explaining all things mechanically, and referring other Causes to Metaphysics: Whereas the main Business of natural Philosophy is to argue from Phenomena without feigning Hypotheses, and to deduce Causes from Effects, till we come to the very first Cause.[113]

And in the draft for the above passage, Newton unequivocally qualifies what he means by "a Cause" and what the usage of hypotheses has done to it:

> Later Philosophers banish the consideration of the supreme cause out of natural Philosophy framing Hypotheses for explaining all things without it & referring it to Metaphysicks [that is to abstract reasoning without the help of Phaenomena or reasoning in the dark]: whereas the main business of natural Philosophy is to argue from effects to causes 'till we come to ye very first cause.[114]

Here we have a natural philosopher who believes that it's not possible to do natural philosophy without God, who spent more time

---

[113] Ibid., p.369.

[114] University Library, Cambridge; MS Add. 3970.

in studying the scriptures than in writing the Principia[115], who was an active participant in ensuring the success of Boyle's lecture[116], who was prepared not to take orders from the Catholic church [117] and who wrote passionately about Him, and yet, the usage of hypotheses will do nothing save banishing Him from natural philosophy. Certainly he would take proper measures to avoid this intellectual idolatory from happening. Thus his unique attitude to Hypotheses.[118]

So far we have sketched some aspects of Newton's methodology of solving scientific problems. It consists basically of experiments and observation, hypotheses, induction and deduction[119] of phenomena.

Of interest is that Newton always mentions experiments and observations together. That relationship does not always hold with induction or deduction. In addition to the above passages quoted, the affinity between observations and experiments is also stated in

---

[115] D. Gjertsen. The Classics of Science, (New York, 1984), wherein the author argues that Newton was more interested in religion and history than in science. See pp. 191-92.

[116] For example, Newton gave as much help as possible to Bentley who was chosen as the first lecturer.

[117]See Manuel, A Portrait...., pp.100-103, about Newton's refusal to be ordained. See also Theological Manuscripts, p.13 about Archbishop Tenison's offer that Newton rejected.

[118]That Laplace relegates the active role of God to that of a hypothesis (which he does not need: 'Je n'avais pas besoin de cette hypothe'se-la') is an example of the 'abuse' of hypotheses from Newton's point of view.

[119]They are not necessarily in this order because it has been shown that he did use hypotheses not conforming to the spirit of "Hypotheses non-fingo." See footnote 90.

the following passage:

> Natural philosophy consists in discovering the frame and operations of nature, and reducing them, as far as may be, to general rules or laws; establishing these rules by observations and experiments...[120]

and likewise in Cote's preface to the second edition of the Principia:

> Without all doubt this world...could arise from nothing but the perfectly free will of God...From this fountain...the laws of nature have flowed, in which there appear many traces indeed of the most wise contrivance, but not the least shadow of necessity. These therefore we must not seek from uncertain conjectures, but learn them from observations and experiments.[121]

Since the crucial link between the scientist and his experiment is observation, we will examine Newton's position on observation. In particular, we want to know whether he believes that observation is objective or subjective, in order for us to have a clearer insight into his conception of scientific problems.

Observations involve vision and Newton makes several statements pertinent to this issue in his Opticks. He believes that 'seeing', is a complicated process. According to him;

> ....When a man views any object...the light which comes from the several points of the object is refracted by the transparent skins and humors of the eye (that is, by the outward coat ...called the tunica cornea, and by the crystalline humor...which is beyond the pupil...) as to converge and meet again in so many points in the bottom of the

---

[120]See Newton's "Scheme for Establishing the Royal Society," quoted in Brewster, Memoirs..., Vol. I, p. 102.

[121]See Principia, Motte-Cajori, p.xxxii.

> eye, and there to paint the picture of the object upon the skin (called the tunica retina) with which the bottom of the eye is covered...and these pictures, propagated by motion along the fibers of the optic nerves in the brain, are the cause of vision. For accordingly, as these pictures are perfect or imperfect, the object is seen perfectly or imperfectly...[122]

The interesting thing is that Newton believes what is seen is what is. In other words, the observation of the scientist is objective. Says Newton:

> If when we look but with one eye it be asked why objects appear thus and thus situated one to another, the answer would be because they are really so situated among themselves and make their colored pictures in the retina so situated one to another as they are.[123]

Although the brain plays an integral part in the process, but it is not the brain that sees; rather it is the soul.

> In like manner when we look with two eyes distorted so as to see the same object double, if it be asked why those objects appear in this or that situation and distance one from another, the answer should be because through the two eyes are transmitted into the sensorium two motional pictures by whose situation and distance then from one another the soul judges she sees two things so situate and distant.[124]

We will delve deeper into his concept of the sensorium in the next chapter but it is important at this stage to present Newton's acknowledgment of the significance of the soul with regard to

---

[122]See Opticks, p.12.

[123]See his letter to William Briggs, quoted in Edleston, Correspondence of Sir Isaac Newton and Professor Cotes, (London,1850), p.269.

[124]Ibid.

observation (in the process of problem solving). It points to the importance of the spiritual aspect in his conception of scientific problems. Thus any analysis on his scientific enterprise should not only deal with the material world. In more specific terms, to analyse his concept of understanding scientific problems merely on the basis of the function of the brain and consequently neglecting the function of the soul is certainly not conforming to his scientific credo.

Since the soul can attain objectivity in the process of observation, the knowledge thus acquired can be actual knowledge about the properties of things. But the problem to Newton is that we do not know when we arrive at true knowledge because there is always the possibility of not being able to prove it with an experiment yet.[125] Interestingly, this aspect points also to his inclination of the mechanical view of the world in evaluating truths. Stressing the importance of experiment, Newton writes:

> Moreover, that the divided but contiguous particles of bodies may be separated from one another is a matter of observation; and, in the particles that remain undivided, our minds are able to distinguish yet lesser parts, as is mathematically demonstrated. But whether the parts so distinguished and not yet divided may, by the powers of Nature, be actually divided and separated from one another we cannot certainly determine. Yet had we the proof of but one experiment that any undivided

---

[125]Instruments are indispensible in devising experiments. That Newton knew experiments are dependent upon the availability of instruments is clear from his effort in inventing the refracting telescope. About this "philosophical discovery", to use his phrase, he writes: "Thus Sir, I have given you a short account of this small instrument, which though in itself contemptible, may yet be looked upon as an epitome of what may be done according to this way", See Newton's letter reproduced in L.T.More, Isaac Newton: A Biography. op. cit., p.68.

> particle, in breaking a hard and solid body, suffered a division, we might by virtue of this rule conclude that the undivided as well as the divided particles may be divided and actually separated to infinity.[126]

Although experiments are indeed crucial in his methodology, Newton believes that conclusions drawn from them are not infallible. In writing the Principia, Newton's awareness of the limitation of his methodology leads him to say that "I hope the principles here laid down will afford some light either to this or some truer method of philosophy".[127] As a matter of fact, Newton shows the manner wherein his discoveries can be shown to be incorrect:

> ... showing the insufficiency of experiments to determine these queries, or prove any other parts of my theory, by assigning the flaws and defects in my conclusions drawn from them; or of producing other experiments which directly contradict me, if any such may seem to occur. For if the experiments which I urge be defective, it cannot be difficult to show the defects.[128]

In addition to the above passage, Newton also states that "if at any time afterward (after the discovery) any exception shall occur from experiments, it may begin to be pronounced with such exceptions as occur".[129] Therefore Newton concedes that there is always the possibility that knowledge derived from his scientific methodology can turn out to be inaccurate or incorrect. Although

---

[126]See his "Rules of Reasoning in Philosophy," in Principia, Motte-Cajori, p.399.

[127] Ibid., p.xviii.

[128]See his letter to Oldenburg, July 1672. Opera Omnia IV, pp.320-321.

[129]See Opticks, p.404.

the possibillity is so remote as to seem practically impossible at the time of discovery, there is still the possibility nevertheless.

Cognizant of the uncertainty of scientific knowledge at the level of experimentation, he adopts a cautious attitude with regard to using the Scripture in scientific research, paving the way for a secularized view. Newton declares:

> That religion and Philosophy are to be preserved distinct. We are not to introduce divine revelations into Philosophy nor philosophical opinions [not truth derived from philosophy!] into religion.[130]

Furthermore, Newton employs the modus tollen form of arguments in his approach of problem solving. His discussion on infinities leads him to say:

> The falseness of the conclusion shows an error in the premises, and the error lies in the position that all infinities are equal...[131]

Supposing that Newton is using a divine revelation as a premise for a scientific problem which he is tackling and his conclusion is somehow shown to be false, accordingly the premise, which is the divine revelation, is false too!

There is, however, a caveat. Although Newton unequivocally states that divine revelation should not be incorporated into scientific works, it does not imply that science should be totally

---

[130]See Theological Manuscripts, p.58. Therefore Newton's statement should not be interpreted either as a consequence of a 'positivist' position. Rather, it is because of his intense passion for safeguarding his scriptural belief.

[131]See his second letter to Bentley in Sermons, p.209.

void of the Transcendent. His works that we have examined thus far certainly include some discussions about God. What Newton is against is not some discourses on God's Names and Attributes in the practice of science. It is the application of verses from the Scriptures given by scientists to support their answers to scientific problems.[132]

Newton believes that Moses possessed the answers to some of the scientific problems and the Scripture provides 'notional explanations' about these problems. Newton's position on the synthesis between scriptural explanation and scientific problems leads him to adopt the opinion that "the Bible is written in the language of everyman" and thus found justification in the Scriptural explanation concerning the creation of the world, (not to mention other problems), that the world is created in six days, without the scripture giving indepth elaboration concerning the nature of the six days. In Newton's opinion;

> To describe them distinctly as they were in themselves would have made the narration tedious and confused, amused the vulgar, and become a philosopher more than a prophet. He [Moses] mentions them, therefore, only so far as the vulgar had a notion of them, that is, as they were phenomena in the firmament, and describes their making only so far and

[132]It has been suggested that there are two basic reactions concerning the relationship between science and religion. The first is to keep them apart and the second is to conjoin them, yielding an organic synthesis whereby religion and science are amalgamated into a single worldview. See Manuel, Religion...., p.27-28. In my opinion, (contra Manuel), Newton never belongs to the first. His natural philosophy is always bounded by his 'scriptural religion'. His natural philosophy is a consequence of his religious belief and not an opposition to it.

at such a time as they were made such phenomena.[133]

Newton draws a distinction between the audience of the philosopher and that of the prophet. The reason that Moses did not relate the answer more rigorously as derived from the quotation above, is because Moses "is a philosopher more than a prophet".[134] Therefore Moses had "to adapt a description of the creation as handsomely as he could to the sense and the capacity of the vulgar".[135] A prophet faces a larger and more heterogenous social group and intellectual community than a philosopher.

> Thus when he [Moses] speaks of two great lights, I suppose he means their apparent, not real, greatness. So when he tells us God placed these lights in the firmament, he speaks I suppose of their apparent, not real, place, his business being, not to correct the vulgar notions in matters philosophical... If it be said that the expression of making and setting two great lights in the firmament is more poetical then natural, so also are some other expressions of Moses, as when he tells the windows or floodgates of heavens were opened, (Gen. vii.,) and afterward stopped again, (Gen. viii,) and yet the things signified by such figurative expressions

---

[133]See Newton's letter to Thomas Burnet, quoted in Brewster, Memoirs, Vol.II, pp.452-53.

[134]Some interpret this phrase to show that Newton differentiates between methodology used in science and that in the scripture. On the other hand, I maintain that what Newton did was to draw distinction between the kind of audiences and not so much on the methodological aspect because from the above quotation, both philosopher and prophet solve the same problem based on the same phenomena but relaying the answer differently. The distinction is not so much in the methodological aspect.

[135]See Brewster, Memoirs..., p.450. Newton gives another example of an explanation for the common people. Says Newton: "And if at any time I speak of light and rays as colored or endued with colors, I would be understood to speak, not philosophically and properly, but grossly and accordingly to such conceptions as vulgar people in seeing all these experiments would be apt to frame". See Opticks, pp. 108-109.

are not ideall or moral, but true. For Moses, accomodating his words to the gross conceptions of the vulgar, describes things much after the manner as one of the vulgar would have been inclined to do had he lived and seen the whole series of what Moses describes.[136]

4.5 Conclusion

According to Newton, the study of nature, religion and science, are interconnected. All of them are grounded upon the belief in the existence of God. But compared to al-Bīrūnī's view, the role of God and religion in science is limited. There is a sharp distinction between the natural and the supernatural in Newton's view. Natural causes such as gravity has natural power which is independent from the supernatural.

Religion and science, however, have some similarities. What mainly differentiates religion and science, or a prophet and a philosopher, if we must make the distinction, is partly the manner in explaining problems as explicated in the foregoing discussions.

In Newton's scientific enterprise, he believes that harmony is found not only in nature but also in the relation between nature, religion and science. In as much as he tries to harmonize between all of them, one can feel the tension in Newton's position. It is not surprising that in his assiduous effort to integrate them, he ends up with a suggestion of differentiating between religion and philosophy.

---

[136]See his letter to Thomas Burnet, quoted by Brewster in his Memoirs..., Vol. II, pp.450 and 453.