Scientific and Spiritual Dimensions of Climate Change

Unit 2 Science and Religion

(longer version)

Section 1: Science

The faculty of intellectual investigation into the secrets of creation... is the most praiseworthy power of man, for through its employment and exercise the betterment of the human race is accomplished, the development of the virtues of mankind is made possible...

Through intellectual and intelligent inquiry science is the discoverer of all things. It unites present and past, reveals the history of bygone nations and events, and confers upon man today the essence of all human knowledge and attainment throughout the ages. By intellectual processes and logical deductions of reason this superpower in man can penetrate the mysteries of the future and anticipate its happenings.¹

Science is the first emanation from God toward man. All created beings embody the potentiality of material perfection, but the power of intellectual investigation and scientific acquisition is a higher virtue specialized to man alone. Other beings and organisms are deprived of this potentiality and attainment. God has created or deposited this love of reality in man. The development and progress of a nation is according to the measure and degree of that nation's scientific attainments. Through this means, its greatness is continually increased and day by day the welfare and prosperity of its people are assured.²

God has conferred upon and added to man a distinctive power the faculty of intellectual investigation into the secrets of creation -the greatest virtue of which is scientific enlightenment. This endowment is the most praiseworthy power of man, for through its employment and exercise the betterment of the human race is accomplished, the development of the virtues of mankind is made possible...³

'Abdu'l-Baha

What is science?

Our whole civilization, life as we know it, is built on scientific and technological advances. Science comes from the Latin word *scientia* which means "knowledge". Science is a specific process of learning to understand the reality of the universe. It is both an individual and a collective process that is progressing over time.

Science is a method of investigating reality that minimizes the influence of bias or prejudice.

Depending on the discipline of the science, the scientific method encompasses various steps and procedures. One process is critically important, namely the execution of experimental tests. These experiments must be well documented and other scientists must be able to repeat these experiments to check their validity. This replicability of experiments is critical to the scientific method.

A <u>scientific theory</u> or law represents a hypothesis, which has been confirmed through repeated experiments. Accepted scientific theories and laws become part of our understanding of the universe and the basis for exploring less well-understood areas of knowledge.

As used in science, the word "theory" is in contrast to its common, everyday use: For example, when one says "it's only a theory" it implies that something is unproven or speculative. However, nobody would choose to ignore a scientific theory or law of nature such as gravity and step off from a high cliff because "gravity is only a theory".

A scientific theory is a well-confirmed explanation of some aspect of nature, made in a way consistent with accepted scientific knowledge and methods.

Models

Models are often used when experiments are not possible or would be unethical. An example of the former would be when the scientist is trying to predict the potential consequences of a conceivable set of future conditions not possible to create in the present—this is often the case in climatology (climate science). The latter is illustrated by the clearly unethical nature of infecting a human with a disease in order to study it.

Mathematical, usually computerized, models simulate natural systems or phenomena as a way to better understand how the world works.

Climate models are mathematical representations of the interactions between the atmosphere, oceans, land surface, ice, and the sun. This is clearly a very complex task, so models are built to estimate trends rather than events. For example, a climate model can tell you it will be cold in winter, but it can't tell you what the temperature will be on a specific day – that would be weather forecasting. Climate trends are weather, averaged out over time - usually 30 years. Trends are important because they eliminate - or "smooth out" - single events that may be extreme, but quite rare.

Climate models have to be tested to find out if they work. We can't wait for 30 years to see if a model is any good or not. Therefore, models are tested against the past, against what we know happened. If a model can correctly predict trends from a starting point somewhere in the past, we could expect it to predict with reasonable certainty what might happen in the future.

Where models have been running for sufficient time, they have also been proven to make accurate predictions. For example, the eruption of Mt. Pinatubo allowed modelers to test the accuracy of models by feeding in the data about the eruption. The models successfully predicted the climatic response after the eruption. Models also correctly predicted other effects subsequently confirmed by observation, including greater warming in the Arctic and over land, greater warming at night, and stratospheric cooling.⁴

Studying climate change is not just an academic exercise, useful in furthering our knowledge of some interesting aspect of the world. Climate science is investigating phenomena that have the potential to threaten human civilization and life on Earth as it has existed for hundreds of thousands, if not millions, of years. Climate scientists are using their findings to project the potential results of human activities today along various possible future paths, also called **scenarios**. Different amounts of future greenhouse gas emissions create different scenarios that would result in different impacts on the climate. These models can show us to what extent it is necessary or prudent to change our ways.

Climate science relies on models only when researching what may happen in the future. Much of climate science either analyzes geological measurements when researching the climate of the past, or collects current data in nature such as measuring the concentrations of greenhouse gases in the atmosphere, chemically analyzing them to figure out their origin, measuring the temperature of air and oceans, measuring the size and volumes of glaciers, tracking animals and documenting their changing behavior, etc. These measurements of the past and present can also be used to show trends that will impact our future. However, climate models provide more reliable projections as they are able to include increasingly more data from the very complex climate system.

Publication and Peer Review

It used to be that knowledge from observation of the world was passed on orally from one person and generation to the next. Today, the system of scientific communication has been greatly formalized and the publication of a peer-reviewed report or paper is expected. Even the style and content of such papers is more or less formalized, with each including an abstract (brief summary), opening statement on the background of the research and the hypothesis to be tested, a detailed description of the methods, material, and context of the work done (in order to allow replication and verification), a presentation of the results, and a discussion of conclusions along with, perhaps, pointing out implications or further work that needs to be done. The paper concludes with a listing of the literature cited as relevant to the work done.

Peer Review is an integral and expected part of the process of publishing the results of a scientific study in a reputable scientific journal. It means that the prospective publishers put a paper presented to them for publication out for pre-publication review by independent scientists (often two or three, who usually remain anonymous), who have expertise in the author's field of research. The purpose of the process is to check that the methodology, analysis, and results are reasonable and properly conducted and presented according to accepted standards. After the peer review, the paper may be accepted and published as is, sent back to the author for revision before publication based on reviewers'

comments, or simply rejected as incomplete, unreasonable, or otherwise inadequate to publish based on the reviewers' comments.

Uncertainty and Scientific Consensus⁵

There is always some degree of *uncertainty* in science. Scientific results are subject to revision in the future as new experiments are done and as knowledge is applied in the "real world" and the results are reviewed in the light of that experience.

Scientific Consensus is the collective judgment of the community of scientists in a particular field of study; it implies general agreement, not necessarily unanimity. Differences of opinion on some detailed aspects of a subject are always present in a scientific community even if there is consensus about the general subject. However, communicating that consensus to those outside the field can be difficult. The usual discussions surrounding the always present uncertainty can seem like a lack of consensus to outsiders, indicating greater disagreement and uncertainty than actually exists. Conveying scientific consensus can prove difficult because of differences between the level of understanding about an issue by scientists, politicians, and the lay-public.

The term "Settled Science" is sometimes used where the opinion of a vast majority of scientists knowledgeable in a field are in agreement that there is no reasonable doubt about a certain scientific result or conclusion that would justify any significant expenditure of energy or money at the current time trying to disprove a particular consensus opinion or change their direction of study. Global warming caused by anthropogenic greenhouse gases is considered "settled science" by the vast majority of climate scientists, even though there are still many questions to be answered about the specific details of future climate impacts and their implications for human society.

The Intergovernmental Panel on Climate Change

Climate Change Science encompasses many different disciplines of science: Climatology, Geology, Physics, Chemistry, Oceanography, Biology, and many more. In each discipline, scientists are researching many different aspects of climate science. In Biology, for example, some scientists study the effects of higher CO₂ concentrations on leaves and animals, some study tree rings, some research the changing migration times and routes of birds, some investigate the many changes in ocean life, etc. This scientific research is being conducted in all the countries of the world. The amount of knowledge about the many aspects of climate change is huge. Nobody is able to know it all.

That's why the *Intergovernmental Panel on Climate Change* (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP); both organizations of the United Nations. The purpose of the IPCC is to gather all the research results from all disciplines from all over the world and then to evaluate the risk of climate change caused by human activity. This gathering of facts is a necessary prerequisite for making decisions about taking actions to mitigate climate change and to adapt to the changing conditions. That knowledge is indispensable for any government policy.

This course is based on the scientific findings of the Intergovernmental Panel on Climate Change.

The IPCC is not a political organization. It consists of scientists from all around the world who are volunteering their time.

The Limits of Science

Although scientists must adhere to certain ethical principles such as truthfulness and fairness, science does not provide an ethical framework that could guide us in the responsible use of the products of scientific research. Therefore, the ethical values derived from religion are crucial in the implementation of any technology.

The science of climate change can explain and describe what is happening to the planet, for example, why glaciers are melting so fast, why sea levels have been rising, and why extreme weather conditions like heat waves, droughts, floods, and stronger storms have been increasing. Science and technology can also propose solutions to mitigate or adapt to climate change. However, the choice of solutions involves value judgments that are beyond the realm of science. Religion can provide the value system necessary for making decisions including climate-change policy.

The Position of Baha'i Institutions on Science and Climate Science

In its 29 Nov. 2017 letter commenting on climate change, the Universal House of Justice wrote:

Among the Bahá'í teachings are those concerning the importance of science. "Great indeed is the claim of scientists ... on the peoples of the world," Bahá'u'lláh observed. 'Abdu'l-Bahá wrote that the "sciences of today are bridges to reality" and repeatedly emphasized that "religion must be in conformity with science and reason." Significantly, on an occasion when a scientific question was asked of Shoghi Effendi, he responded in a letter written on his behalf that "we are a religion and not qualified to pass on scientific matters." And in reply to scientific issues raised on a number of occasions, he consistently advised Bahá'ís that such matters would need to be investigated by scientists.

Scientific inquiry into the question of human contributions to global warming has gradually unfolded over a century of investigation and, more recently, with intense scrutiny. While there will naturally be differences of view among individual scientists, there does exist at present a striking degree of agreement among experts in relevant fields about the cause and impact of climate change.⁶

Section 2: Religion

Religion serves the individual by providing enlightenment and spiritual guidance. At the same time, it helps society by providing an ethical framework:

God's purpose in sending His Prophets unto men is twofold. The first is to liberate the children of men from the darkness of ignorance, and guide them to the light of true understanding. The second is to ensure the peace and tranquillity of mankind, and provide all the means by which they can be established.⁷

Religion is the greatest of all means for the establishment of order in the world and for the peaceful contentment of all that dwell therein.⁸

Bahá'u'lláh explains that society is negatively affected when people turn away from religion or when religion becomes corrupted:

...Religion is a radiant light and an impregnable stronghold for the protection and welfare of the peoples of the world. ... Should the lamp of religion be obscured, chaos and confusion will ensue, and the lights of fairness and justice, of tranquillity and peace cease to shine...⁹

The following paragraph further elaborates what happens when people turn away from religion: "The perversion of human nature, the degradation of human conduct, the corruption and dissolution of human institutions, reveal themselves, under such circumstances, in their worst and most revolting aspects. Human character is debased, confidence is shaken, the nerves of discipline are relaxed, the voice of human conscience is stilled, the sense of decency and shame is obscured, conceptions of duty, of solidarity, of reciprocity and loyalty are distorted, and the very feeling of peacefulness, of joy and of hope is gradually extinguished."¹⁰ Written by Shoghi Effendi in 1936, we can experience the truth of these words in all aspects of our society today.

You may be surprised about the positive portrayal of religion in the above paragraphs as you may be a realistic observer of today's world. The Baha'i teachings explain that religions are going through cycles. At the beginning they are full of spiritual light and enkindle increasing numbers of people. A new culture, a new civilization develops. After a while, human made dogma and rituals begin to cloud its light. Corruption and power-seeking individuals engulf its institutions. Then it is time for a new divine revelation and the beginning of a new cycle.

Today we need this divine and transformative power of religion more than ever as we are facing planetary crises that are unprecedented in human history. Religion as renewed in the Bahá'í Faith provides a clear framework of ethics that can guide us in our actions to address these crises.

Although we must actively pursue religious knowledge, religion is not solely the product of human striving after truth, but is a Revelation given to us through God's love. It is "the fruit of the creative Word of God which, with divine power, transforms human thought and action."¹¹

"Religion exerts a profound influence on all societies and many of the world's peoples. Throughout history, it has proven to be the primary force for social progress, motivating individuals to develop spiritual qualities, and empowering them to sacrifice for their fellow human-beings and to contribute to the betterment of their communities."¹²

Section 3: The Relationship of Science and Religion

The Universal House of Justice states that we should view "science and religion as *two independent yet complementary systems of knowledge* that propel human progress."¹³

The principle of the harmony of science and religion means...that everything in this creation, all aspects of human life and knowledge, should be studied in the light of [religious] revelation as well as in that of purely rational investigation [i.e., science].¹⁴

The Universal House of Justice

Science and religion are tools to investigate reality from two different angles. Each discipline asks a fundamentally different question. Science asks: "*How* does the universe work?" Religion asks: "*Why* is there a universe and what is its purpose, and what is our purpose of existence as human beings?"

If science and religion ask fundamentally different questions and are complementary, how are they each to be used when we examine an issue of social concern?

The role of science is the assessment of facts and their potential physical and social consequences. After scientists provide citizens, politicians, and other stakeholders with the facts and consequences of concern, all stakeholders must use ethical values to make policy decisions about any actions to be taken that may affect society. Values and ethics are the domain of religion.

In the case of climate change, science can explain the causes of global warming and project with various amounts of certainty the impacts of the resulting changes in climate. It is then up to the public and to politicians to consider these facts, to apply values, and then to act accordingly.

In its statement One Planet One Habitation – a Baha'i Perspective on Recasting Humanity's Relationship with the Natural World, the Baha'i International Community elaborates on science and religion as complementary systems of knowledge and practice:

In working to build a more sustainable world, humanity has at its disposal two mutually reinforcing systems of knowledge and practice: science and religion.

Scientific inquiry has been a vital instrument in seeking to understand physical reality and in forging innovative solutions based on a search for truth and a commitment to learning. When combined with values such as freedom from prejudice and bias it has enabled humanity to separate fact from conjecture. Scientific capabilities—of observing, measuring, rigorously testing ideas—have allowed us to construct a coherent understanding of the laws and processes governing physical reality, as well as to gain insights into human conduct and the working of society. Far from being the province of researchers and academics alone, the methodologies of scientific inquiry are tools that any individual or community can employ.

For its part, religion provides a framework by which high ideals can be applied to individual lives and to the life of society, for the betterment of all. The spiritual principles animating the world's enduring religions have aided individuals and entire populations to grapple with questions of meaning, purpose, and the nature of the good life and the good society. When true to these ideals, religion has provided a bulwark against ideologies of materialism that would reduce human beings to mere resources to be exploited or consumers to be satiated. At its highest, religion has not only raised the call to virtues such as integrity, good character, high resolve, cooperation, and sacrificial endeavor, but drawn growing numbers together around such principles, unifying disparate elements, and giving rise to cohesive communities working to manifest high ideals in practice.

Taken together, science and religion provide fundamental organizing principles by which lasting progress can be made. When both the material and spiritual dimensions of humanity are kept in mind, and due attention is given to both scientific and spiritual knowledge, the tendency to reduce human progress to the consumption of goods, services, and technological packages is avoided. Both science and religion are essential to the liberation of individuals and communities from the traps of ignorance and passivity. Both are vital to the advancement of civilization.¹⁵

Section 4. Misuse of Religion and Science

Any agency whatever, though it be the instrument of mankind's greatest good, is capable of misuse. ¹⁶

`Abdu'l-Bahá

When talking about **religion** we should be aware that abuse and perversion of religion have often caused intolerance, fanaticism, oppression, and even war. This is, of course, in stark contradiction to the original teachings of all the world's religions. The Bahá'í Faith, for example, admonishes that "religion should unite all hearts and cause wars and disputes to vanish from the face of the earth, give birth to spirituality, and bring life and light to each heart. If religion becomes a cause of dislike, hatred and division, it were better to be without it, and to withdraw from such a religion would be a truly religious act."¹⁷

Or as stated by Bahá'u'lláh, *"In matters of religion every form of fanaticism, hatred, dissension and strife is strictly forbidden."* ¹⁸

At the heart of the Christian Faith is love. It is a love not limited to our own family, nation or coreligionists. It embraces everyone, even our enemies: "But I say unto

you which hear, love your enemies, do good to them which hate you, bless them that curse you, and pray for them which despitefully use you."¹⁹ Jesus

The Bahá'í Faith teaches that all religions have the same divine origin and that we should *"consort with the followers of all religions in a spirit of friendliness and fellowship."*²⁰

Most important for avoiding religious fanaticism is the use of reason and science.

Science can also be abused. The most widespread abuse of science and technology is their use without spiritual or ethical consideration. Such abuse frequently results in human rights violations and/or environmental problems and degradation. For example, if a company manufactures and sells sterile seeds, the farmers become dependent on that company to buy seeds every year. If bioengineered seeds are sold, they can contaminate many native species of crop plants, which may result in the eventual loss of all these important food plants. Large-scale hydropower projects require the building of huge dams and the flooding of agricultural lands, forests, and villages, which causes the displacement of thousands of people. A very obvious example is the manufacturing of bombs and other weapons. The sale of weapons benefits some people economically, but harms innumerable other human beings who will be killed or wounded by these weapons. Today, even the sale and advertisement of medicines is geared towards the profit making of the pharmaceutical industry and not for the well-being of a sick person. There may well be scientists with much integrity and ethical values at work doing research on a specific medicine. However, the way much of this research is controlled and exploited by the pharmaceutical industry frequently lacks an ethical framework.

Deliberate **misrepresentation of science** by economic interests and political interference is another form of abuse. A case in point is the systematic disinformation campaign by the climate change skeptics. They are not following responsible scientific criticism, but through various tactics endeavor to shed doubts on climate science.

Section 5: Independent Investigation of Truth

...Man must independently investigate reality, for the disagreements and dissensions which afflict and affect humanity primarily proceed from imitations of ancestral beliefs...²¹

`Abdu'l-Bahá

Every human being has the responsibility to investigate reality and search for the truth, both in the realms of physical as well as spiritual reality. The principle of the independent investigation of truth has applications in everyday life. When we watch the news on TV, hear something on the radio, are told something on social media, or read an article in a newspaper we can think about whether this is really true, just partially true or even wrong. When we hear or read about an issue, we should view it in a critical light and relate it to what we have already learned from sources we trust.

You have probably seen in the media the controversy over different views about the science of climate change. The media often give equal time to scientific information and the views of climate skeptics. While for many social issues it is beneficial to hear different opinions, in the case of climate change this is not the case, as it is a matter of science education. Different human opinions don't affect the laws of physics and chemistry. It is a huge problem that the general population is not well- and even mis-informed about climate change, for the consensus of a large portion of the population is needed to support meaningful actions that could help mitigate it and avert a catastrophe. In a democracy, citizens must be informed enough that they feel comfortable making value judgments and choosing policies based on scientists' assessed risks and benefits.

Bahá'u'lláh admonished the writers of newspapers "to be purged from the promptings of evil passions and desires and to be attired with the raiment of justice and equity. They should inquire into situations as much as possible and ascertain the facts, then set them down in writing. ... Fair speech and truthfulness, by reason of their lofty rank and position, are regarded as a sun shining above the horizon of knowledge."²²

Next time you read a newspaper, go on the internet, or see news and advertisements on social media or TV, think about what you consider as credible information.

Given the spiritual principles of the independent investigation of truth and consultation, should this course give only one view of climate change science if there are other opinions? Why are these other views not given equal value?

The warming of our planet Earth is a fact and not an opinion. That's the consensus of an overwhelming majority of scientists everywhere. The report by the Working Group 1 of the Intergovernmental Panel on Climate Change states: "Warming of the climate system is unequivocal." "It is virtually certain that globally the troposphere has warmed since the mid-20th century." The IPCC indicates the probability of "virtually certain" as 99–100%.²³

The report also says that "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century." "Extremely likely" is defined as 95 – 100%. "The evidence for this has grown, thanks to more and better observations, an improved understanding of the climate system response and improved climate models," explains a recent IPCC press release.

Most leading religious institutions have called for action on climate change as a moral responsibility including the institutions of the Bahá'í Faith.

Therefore, in this course we do *not* debate whether climate change is happening or not. The purpose of the course is to give a very basic introduction to the science of climate change. Based on that knowledge, we will apply spiritual principles and ethical standards as found in the scriptures of the world's religions. After establishing that foundation, we will be ready for a consultation about what we could do as individuals and religious communities to contribute to the mitigation of climate change.

Section 6: Science and Religion in this Course

Religion and science are the two wings upon which man's intelligence can soar into the heights, with which the human soul can progress. It is not possible to fly with one wing alone! Should a man try to fly with the wing of religion alone, he would quickly fall into the quagmire of superstition, whilst on the other hand, with the wing of science alone he would also make no progress, but fall into the despairing slough of materialism.²⁴

`Abdu'l-Bahá

This course is based on both science and religion. Whenever the perspective of religion is used, quotations from religious scriptures are presented because they provide the ethical foundation. Moreover, the Word of God has the power to change human hearts. Similarly, when the perspective of science is used, scientific facts and direct statements from scientists are presented with supporting citations to a scientific source. Scientific details, numbers, and graphs don't need to be memorized; they are included to provide depth to our understanding and to illustrate the scope of the problems discussed.

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