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in Mehdi Golshani, ed., *Can Science Dispense with Religion?* 3rd ed. (Tehran, Iran: Institute for Humanities and Cultural Studies (IHCS), 2004), pages 315-326. Reprinted in 2020.

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1. What is your definition of science and of religion?

Science and religion share the conviction that the world is intelligible, but they define their quests differently. In the cleanest cases, we can say that science operates with the presumption that there are *causes* to things, religion with the presumption that there are *meanings* to things. Meanings and causes have in common a concept of order, but the type of order differs.

Typically in natural science *cause* is inferred from outward, empirically observable constant conjunctions, attended by an elusive notion of necessary production of consequent results by the preceding spatiotemporal events. Where causes are known, prediction is possible, and an effect is commonly thought explained if its causes are known, especially if it is subsumed under a covering law, that law giving a certain logic to the process.

Meaning is the perceived significance of something, typically with accompanying inwardness or subjective experience. Where meanings are methodically detected out of a covering model, which is thought to represent an ultimate structure in reality, one has some sort of religion or one of its metaphysical cousins. Science holds that causality runs deep in the nature of things; religion holds that what is highest in value runs deepest in the nature of things. It is often said that science answers *how* questions and religion answers *why* questions; but these words, while suggestive, are not reliable indicators of syntax and the kind of explanation sought.

Social scientists and psychologists are disagreed as to whether their sciences are ever sciences of meanings, and the puzzle as to how far human subjects can be causally understood has left the human sciences unsettled. The social sciences do not prescribe what meanings scientists themselves ought to have. Whenever one undertakes this latter task, one has passed over into the province of religion and its cognate fields – ethics, comparative religion, the humanities, philosophy.

2. Do you see any conflict between your definitions of these two concepts?

The search for causes does not *ipso facto* compete with the search for meanings, though discoveries and convictions in the one domain may and often does revise what we think in the other. Scientists have found many causal connections, while religious persons have discovered much of significance. These dispositions to interpret things causally and also meaningfully are built into the deep structures of the mind, and we have to some degree an innate psychological drive to find things intelligible.

There is vast diversity in religions, great diversity even within monotheisms; the sciences have a great diversity, from nuclear physics to sociology, which is almost equal to that in theism. Within such pluralism, some conflicts are to be expected between some forms of science and some forms of religion. Still, and despite the pluralism, these two great epistemic lines in the West are cousins, at once kindred and independent.

In a generalized way, science mixes observation, theory, and inference, but these ingredients with their blending are quite complex and differ with the sciences. As a first schematic, often called the hypothetico-deductive method, a scientist attempts to operate out of theory in an if then mode "over" the facts. A theory (the hypothesis) is generated out of the facts, followed by deduction back down to further empirical level expectations, those then being related back to observations to confirm or disconfirm the theory, more or less, and to generate revised theory. Such a theory comes to have a developmental history.

Such facts quickly become theory laden. The scientist comes up with models and abstractions, such as lines of force in an electromagnetic field, concepts that come by mulling over the data, but in which the scientist also contributes creative hypotheses. With success, these interpretive frameworks can become increasingly dominant, what philosophy of science calls paradigms. Paradigms are governing models that, in some fairly broad range of experience, set the context of explanation and intelligibility.

Religion too methodically mixes experience, theory, and inference. There are many disanalogies, often one finds notions of revelation and inspiration, and hence of normative authority, that cannot be easily reconciled with the procedures of science. Creeds are not so provisional as scientific theories sometimes are, but more like settled

operational assumptions (which scientific theories also can become). And there are many noncognitive elements in religion not present in science.

Nevertheless, in a general way religious convictions develop in the face of certain experiences judged to be of ultimate importance, as of suffering or of joy, of sin and salvation, of the holy and the moral. On reflection by theologians, there arise cognitive, theoretical notions suggesting certain universal spiritual laws or generalizations, leading to a positing of, and encounter with, an underlying ultimate reality in and beyond the world that is sufficient to account for such experiences. The later religious experience provides a testing of dogmas, confirming or disconfirming them. The history of religion is strewn with abandoned beliefs, largely overcome by more commanding creeds or made implausible by new ranges of experience. The basic idea of a controlling patterned seeing does seem to characterize the history of science and religion alike.

Scientists increasingly realize that theory, models, data, and description are more entwined than once supposed. This, together with discoveries in physics and shifting scientific theories over time, has softened the realism in science in favor of more historical and culture-bound accounts. Critics of science, especially the postmodernists, press these claims about the social construction of science and theology further than many scientists wish; and theologians are of mixed opinions whether to welcome these developments. Theology is evidently a cultural, historical activity; yet it too, like science, seems to make more universal and trans-cultural claims.

We cannot think without paradigms, and yet we hope to submit to the facts, do this what it may to our models. Just this willingness to set the compulsion of the truth above a compelling paradigm prevents the latter from becoming an ideology; it enables our paradigms, self-serving as they are, to be self-correcting. Honesty, truth, commitment, selflessness, and humility in the scientist facilitate the inception and teaching of science. Only devotion to truth can accomplish this; and so a willingness not only to give of oneself but to give up one's preconceptions and illusions for the sake of the truth – a determination to hear the whole truth and nothing but the truth, come what may, cost what it may – is as characteristic of good theology as it is of good science. The reforming spirit in theology is just this insistence that a person must not get in the way of the truth, must not bias it, but hear it sensitively and entirely.

3. Where do you think there may be a conflict between these two?

The conflicts between scientific and religious interpretations arise because the boundary between causality and meaning is semipermeable. The causal paradigm favors a computational logic, whether inductive or deductive, while the meaning paradigm involves an intelligibility that is more holistic. Causes go into linear networks, which often permit a quantifying theoretical overlay measuring with numbers. Even nonmetric science is prone to analysis, involving, for instance, taxonomic serial catalogs and phylogenetic chains, bringing a particular occurrence or individual under a covering law or type. Science needs repeatability and parallelism.

Religious meanings are not integrative in this scalar way. When set in their gestalt, the particulars give rise to meaning. In detecting more sophisticated patterns, as with recognizing faces, there is a subtle interplay of textural features by which the whole is constituted. This sort of logic can be present in science but it looms much larger as one approaches the perception of meanings. One must join earlier and later significances in ways more qualitative than quantitative, more dramatic than linear. The sense of scenic scope is more crucial than that of incremental detail, hence the non-metric character of religion. Religion is historical and this may involve unique particulars, such as for Christians the life and death of Jesus, or for Muslims the giving of the Qur'an.

The relations between physics and theology are surprisingly cordial at present; the relations between biology and theology are more difficult. Astrophysics and nuclear physics, combining quantum mechanics and relativity theory, are describing a universe "fine-tuned" for life, while evolutionary and molecular biology seem to be discovering that the history of life is a random walk with much struggle and chance.

Molecular biology, discovering DNA, has decoded the "secret of life" (once ascribed to the Spirit of God). Evolutionary history has located the secret of life in natural selection operating over incremental variations across enormous time spans, with the fittest selected to survive. The process is prolific, but evolutionary history can seem tinkering and make-shift at the same time that, within structural constraints and mutations available, it optimizes adapted fit.

Natural selection is thought to be blind, both in the genetic variations bubbling up without regard to the needs of the organism,

some few of which by chance are beneficial, and also in the evolutionary selective forces, which select for survival, without regard to advance. Evolutionary science often carries an implicit or explicit understanding of who and what humans are, one which may not be coherent with the human self-understandings that come with religious education. Humans may well need religious teachings for their salvation, perhaps even to be humane in their cultures, for religion can enlighten and elevate the human nature that has evolved biologically.

Though dominant throughout biology, evolutionary theory has proved quite problematic itself (independently of any theological agenda). There are disagreements involving the relative degrees of order and contingency, repeatability, predictability, the role of sexuality, competition and symbiosis, the evolutionary origins of mind, especially the human mind, differences between nature and culture. Darwinian natural history reveals an ambiguity in life, often problematic. Life is a ceaseless struggle; new life is generated by blasting the old. Darwinians may focus on the survival of the fittest, accentuating the competition in life, "nature red in tooth and claw". Darwin as well portrays connectedness in life, common ancestry, survival of the best adapted, life support in ecosystems, life persisting in the midst of its perpetual perishing, life generated and regenerated in spectacular biodiversity and complexity, with exuberance displayed over three and a half billion years, an "abundance of life".

Such a view of life echoes ancient religious motifs: Life is a table prepared in the midst of enemies, green pastures in the valley of the shadow of death. An evolutionary theism emphasizes the continuing vital creative processes over time, the ascent of life from the simple to the complex, the increase of information, the effective and efficient results of genetic creativity and natural selection, producing a quasi-design, the production of more out of less over long millennia, with the increasing sophistication of molecular structures. A plausible account is that creaturely autonomy and self-creativity is combined with the divine will for life.

4. What have been the grounds for the development of conflict between these two?

The warfare between science and theology is often a struggle to clarify to what extent causal explanations are compatible with or antagonistic to meaning explanations. Particular disputes may result in adjusted claims about the territory occupied by each account. While no one

denies that each field commands some territory of its own and that there is partial complementarity, are they always commensurable? Some kinds of causal accounts, for example, the competitive survival of the fittest, do seem to inhibit some kinds of meaning accounts, such as that every species was divinely designed at an initial, sudden creation. Some causal explanations show some meaning explanations to be inaccurate, inadequate, or irrelevant. Science, by redescribing nature, places constraints on what concepts of God are credible, even though science by this redescription prescribes nothing about God's existence. It sets limits within which meaning accounts can work.

Does the presence of sacred meanings in the world require any tearing in the weft of causes and effects, any perforation of the natural by a supernatural order? Does the meaning account sometimes constrain the causal, as when the experience of autonomy and moral responsibility seems to demand that persons be something more than effects predetermined by antecedent causes and stimuli? Experience that is counted puzzling under the causal framework may prove intelligible under the meaning framework.

Religion asks about good and evil, about guilt and redemption, about love, justice, and holiness, about the values of the subject in its objective world, and it judges these to be the ultimate or deepest ranges of experience, beside which the empirical explanations of the sciences are penultimate or even superficial. In the natural processes that the physical and biological sciences investigate, most of these issues do not ordinarily appear. So far as they do, as for instance when an evolutionist asks whether the elimination of the less fit is bad, the question cannot be solved with those tools with which the scientist does her empirical work.

On any occasions where prescriptions are offered, some values must be superadded to empirical data, and science has moved over to the participatory level of religion. Reformatory elements begin to appear, and in religion reformation of the person is a primary goal. To what world view does it seem most worthwhile and reasonable to give my allegiance? Here science has a way of truth; religion is a way of truth. In science, one knows "about" the object; religion removes that "about" to know with more intimacy. Here the judge must be up to what she judges; that is, the character conditions are more demanding. Moral experience is required in the counselor, a sense of justice of the judge. Spiritual qualification is required of the theologian, involving talent at levels not demanded of the physicist qua physicist. Only the pure in heart can see God.

Every discipline requires its relevant sensitivity; and learning and thinking in the biophysical and social sciences, so far as they operate empirically, are simpler morally, aesthetically, and spiritually, however complex a causal logic may be used, than these are in religion. Proportionately as truths become more significant, combining cosmic with personal importance, they require more sensitivity for their reception. One cannot verify merely by painstaking observation or imaginative construction what has been discovered and confirmed by passion, sacrifice, faith, and suffering. This relative restriction of science to empirical levels and to descriptive, technical logic partly explains why, among those competent to judge, there can be broader intersubjective agreement in science than in religion. Sometimes it even seems that the elusiveness of an answer is in proportion to the importance of the question!

5. What has been the role of religion in the development of science in the West?

The Hebrews disenchanted the universe on the basis of monotheism long before science appeared, a conviction that carried forward to Christianity and to Islam. The belief that the world was the good creation of a rational, just, and loving God subsequently made science possible. Here also the Greeks helped. Their gods became incredible, even before the monotheist expansions, and the Greek bent toward rational analysis complemented the Hebrew beliefs in their one God creating a good world.

Would-be scientists have to get rational theory and empirical observation in the right mix, and Judeo-Christian-Islamic monotheism introduced the proper amount of each. The natural world, rational by virtue of the Creator who made it, is also contingent. The world order is by free creation, not by necessity. Humans must discover the laws of the cosmos by consulting it. On the one hand, humans cannot know how the world works a priori (rationalism, mathematics); on the other hand, mere a posteriori observational data (empiricism) is also insufficient. A monotheist cosmology orients thinkers to a moderate realism, and science results.

These monotheist origins of science must be faced by the many scientists who think of themselves as secular, or those who think of science and religion as feuding camps, or unrelated disciplines. They also have to be faced in Asia, in Africa and elsewhere where science was so often stillborn. Science was the logical evolution of the

monotheist belief that the universe was the rational product of the Creator and that humans are destined to become the masters and possessors of nature – for however problematic the latter belief has become in an environmental age, it did serve to generate and legitimate the historical development of science.

Even after science was launched, it has not been easy to keep these ingredients properly blended. Too much empiricism has too little faith in the creative intellect; it passively accepts phenomena as given and fails actively to think that the scientist can re-think God's rational thoughts after him. Too much idealism loses its way in a priori system building; it fails regularly to consult the created world. Scientists display real creative genius when convinced of the intelligibility of a nature that can be contingently discovered, as for example in Newton in classical science, or in the twentieth century, by Albert Einstein.

6. Can we have a religious science?

This question admits no simple answer, for there are several questions embedded within it. As just argued, the science that we do have in the West comes trailing religious origins. On the other hand, there is no Christian physics, biology, or geology differing from Islamic or from secular physics, biology, or geology. And I postpone until the next the question whether contemporary science and scientists will be operating out of metaphysical frameworks that have religious implications. Christian, or Muslim, or secular value commitments may drive differing research agendas in the sciences. Whether, for example, scientists devote their limited time, energy, and resources to producing weapons, or to medicine, or to research toward a sustainable world, will depend on their deepest value commitments.

Interpreted another way, this question could also ask whether theology is a science, a religious science. The answer most synthetically speaking is *yes*, but more analytically speaking is *no*. Theology, like science, is, as claimed above, broadly a systematic attempt at understanding and so might be called a science. Nevertheless, more specifically, as also claimed above, science focuses on causal understandings while theology focuses on meanings; on balance, it is best not to try to claim theology as a science. This is also true of other humanities, such as history, literature, or politics. The better course is to realize the incompleteness of science, to which I next turn.

7. Can science dispense with religion?

Particular sciences in their search for causes do not need religious claims about meanings. But the larger metaphysical frameworks within which scientists operate, will raise religious questions. Science can dispense with religion, but scientists cannot – or at least not without something in the room of religion to make their lives, and their careers in the sciences, worthwhile. Scientists need meaning in life as much as anybody else; they too must choose between good and evil.

One distinctive characteristic of human life is its broken-ness, and here the religions classically offer "salvation", or "the good life". "I have set before you, life and death, blessing and curse; therefore choose life" (Deuteronomy, 30:19). Jesus says: "I am the way, the truth, and the life". The metaphor may be of new life; one is born again, or regenerated. This reforming of life appears to many philosophers, ethicists, and theologians to be the area in which the sciences have so little purchase – the *ought to be* – however much physics has found the ultimate constituents of matter and the origins of the cosmos. Biology has decoded what *is* describing the metabolisms and evolution of life, or perhaps (in a currently fashionable metaphor) found "selfish genes" that dispose our behavior. But to reason from what *is* as a result of evolution to what *ought to be* is to commit the naturalistic fallacy.

Now the theologians, especially after having heard from physicists that the universe is "fine-tuned" for life, will resist the claims that biology explains religion, finding the secret of life in genes or in natural section, or finding that religion is (nothing but) some mythical belief system that favors survival. Theologians turn the tables. Rather, religion is needed to explain biology, that is, the prolific genesis of life on Earth, documented in natural history, generates religious responses. The prolific Earthen fertility, or generative capacity, in which we find ourselves immersed, is what most needs to be explained. We humans alone confront the ethical duty of appropriate respect for such life, including our own human life. Nothing in biology settles questions about the meaning of life.

8. Can one separate the domains of activity of science and religion completely?

Classical theism, though once medieval, has nowhere become modern without dramatic revisions. Science is not, as is sometimes thought,

merely instrumental to value, for intrinsic science does redescribe the world for us. The descriptions here cannot be ignored, for such discoveries as the age and extent of the universe, the evolution of life and its biochemical nature, the human neurophysiological structures, or the electronic character of matter have forced theology to reform earlier accounts of meanings. Persons always shape their values in some correspondence with what they believe the world to be actually like.

But these descriptions never constitute prescriptions, however much they may force a reconstituting of them. In this sense, religion is fully operational, completely functional in joining theory with practice, as science is not. Religion has its own value setup, which permits the translation of principles into conduct, while any scientific system is parasitic on some value system before it can become operational in life. Religion, however, is not so operational that it can ignore what science reveals about the character of the world and of life.

An older form of this claim is that science seeks knowledge, but the spiritual quest is for wisdom. Knowledge and wisdom are neither coextensive nor mutually exclusive, but they overlap. In part, but only in part, a person remains naive and unwise until she has integrated the best available knowledge from the current sciences into her worldview. Still, such knowledge is not sufficient for wisdom, for no accumulation of causal explanations can ever produce the significance of a thing. The latter comes at another level of insight. In this sense, science *explains* but religion *reveals*; science *informs*, but religion *reforms*.

Meanings are always self-implicating. Values are by definition those things that make a difference. This might be thought to bias a person's capacities for logic in religion. One cannot think clearly about what one is wrapped up in. But the other side of this is that one will not think at all about that for which one does not care, or rightly think about that for which one does not rightly care. This caring becomes more self-reforming as the inquiry passes from the scientific to the religious. The task of religion is to examine that self in its relationships with the world, unmasking illusions and false cares, reforming it from self-centeredness, centering it on that which is of ultimate worth.

Religion shares with science then a concern for objective rationality, only it knows far better than science that the path to true objectivity lies through subjective reformation. Religion is the science of the spirit, where a rationality suited for objects is inadequate. Here reflective scientists will not say that they come to nature without assumptions, despising theologians as being overcome with them. But

they will see that, so far as their selection employs empirical causation as their fishing net, they have a different set of assumptions; and they may even wonder whether just these assumptions might prevent them from receiving the data of religion in an undistorted form.

Theologians will claim that, with due admiration for its successes, science leaves the ultimate value questions still urgent and unresolved. Indeed, there is no scientific guidance of life; despite the evident progress in the sciences in today's world, the value questions remain as acute and painful as ever.