Darshana Jolts

Concluding Thoughts

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All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man's life, lifting it from the sphere of mere physical existence and leading the individual towards freedom.

– Albert Einstein

Introduction

We function in a framework of worldviews that is not always explicitly articulated. Our worldviews have two dimensions. One is related to our cultural connections. This includes such matters as values, beliefs, ethics, etc. The other relates to our understanding and interpretation of natural phenomena. The totality of this second dimension may be called science. It is very difficult to keep the two in separate water-tight compartments.

The two dimensions often intermingle without our realizing it. This is why in all ancient cultures, and in the minds of many even in our own times, science and religion are inseparable. Religion is a part of culture, and culture is an important element in our lives. It not only enriches our aesthetic experiences, but also establishes our affiliation to a group of people sharing similar worldviews. This affiliation is emotionally satisfying – it gives us a sense of security, as also an experience of pride. Cultural belonging is fulfilling to our inner self. But sometimes it can also blind us in our efforts to recognize and appreciate objective reality[1].

In the articles of this series we have seen some important examples of how our views of natural phenomena and their explanation have been affected as a result of developments in science in the past few centuries. Many changes in our views of the world came about as a result of adopting means and methodologies that are drastically different from the ones that were present in any culture or civilization in the world in eras preceding the rise and blossoming of what we call modern science. Notwithstanding some striking and superficial similarities between the results of current science and some ancient worldviews, the language and methods of modern science are drastically different from those of ancient science. Moreover these are constantly evolving, very changing now and then. Seeking support for old worldviews on the basis of

[1] V V Raman, *Truth and Tension in Science and Religion*, Beech River Books, 2009.

current scientific results may not be helpful in the long run when these very results would probably be discarded by scientists of future generations.

The cultural factors forming our worldviews influence our visions of modern science in ways that are neither warranted nor accurate. Trying to do science with a conscious cultural anchor may not be helpful in scientific creativity. Though culturally inspired scientific claims may not be productive, culturally colored views on science are powerful because they are psychologically satisfying and emotionally fulfilling. This is one reason why they have been growing in strength of late.

During the past few decades there have been drastic shake-ups in the global arena in the planes of politics, religion, conflicts, economics, and cultural confrontations. One consequence of these is that objective appraisals and calm considerations of data, whether in science or in history, are being replaced by whatever is emotionally more satisfying: Cultural pride and soothing claims combined with anger and hate for the other have become the dominant forces even in the context of science and history. It is true that there are valid grounds, if not rational justification, for these trends.

Constraints Facing Ancient Investigators

There is no question that ancient investigators in India had keen minds and original insights[2]. The ancient world, especially in India, China, and Greece, had made some extraordinarily significant discoveries in mathematics and astronomy, in alchemy and speculative atomic theory. These were nontrivial achievements, and they deserve credit and respect[3]. They certainly had the potential for developing into the full-fledged science of later centuries. However, their science, like that of ancient Greece or China – was in many important respects very different from how scientists arrive at results in our own times. It is equally true that in ancient India, aside from magnificent poetry, literature, music and art, there also arose profound philosophical reflections and metaphysical worldviews of great relevance to the human condition. It is important to value their relevance even in an age of science[4].

Realizing that all heavy bodies fall is not the same as formulating the law of gravitation. The theory of gravitation has a mathematical aspect and an explanatory capacity. Recognizing that the earth is spinning is not the same as the heliocentric model of the solar system. The idea of a cosmic egg (*brahmánda*) is not the same as that in the big bang model of current cosmology.

[2] V V Raman, *Glimpses of Indian Scientists*, Samvad India Foundation, 2006.

[3] V V Raman, *Glimpses of Ancient Science and Scientists*, Xlibris, 2000.

[4] V V Raman, *Indic Visions in an Age of Science*, Metanexus Publ., New York, 2001.

Nor does the Heisenberg principle prove that consciousness is primary in the physical world. Such identifications may be reassuring, but they can also be quite misleading.

The fact is, people prior to the seventeenth century lacked measuring devices to observe distant objects and very minute entities. The telescope and the microscope revealed aspects of the world that were utterly unimaginable to the ancients. It must not be forgotten that without probing instruments which extend the scope and enhance the sensitivity of our biologically evolved doors of perception it is just impossible to become aware of countless features of the world which are and have always been there beyond our grasp. One cannot realistically expect a person without the auditory system to know about music or one without eyes to know about colors. The ancients did not have the instruments which served as more powerful eyes and ears for scientists of later centuries. Nor did they have measuring devices, like the thermometer and the barometer, to make precise measurements. There can be no physics without quantities to be measured and devices to measure.

Nor did the ancients have a uniformly defined system of units, except for the most basic quantities of mass, length, and time. Many new physical quantities had to be defined before significant progress could be made in science. Since the rise of modern science a hundred new physical quantities have been introduced in the study of the physical world.

Much of the physics starting from the seventeenth century became more and more sophisticated because of significant advances in mathematics. There was considerable breakthrough in arithmetic, algebra, geometry, and trigonometry in pre-seventeenth century mathematics in India, Greece, and China, and even deep insights into the foundations of the calculus. But these were seldom developed in relation to the physical world, nor applied in the study of natural phenomena in fruitful ways.

The idea of physical laws being writ in large and small crypts was another major *darshana* jolt that modern science gave to human efforts to decipher the mysteries of the physical universe. The mutually fruitful interactions between the study of natural phenomena and their formulation in mathematical terms led to countless new branches of mathematics, such as vector and tensor analyses, differential equations, group theory and much more.

The ancients did not have the means to publish their results and transmit them to other inquirers, so as to elicit comments and criticisms, and also to inspire others to continue the search. A prerequisite for modern science is cross-fertilization of ideas from the minds of many peopl . The paradigm in the ancient world was respect for authority and reverence for sacred texts. Criticizing a book or a person held in high esteem or challenging the content of a sacred work was not favorably looked upon in the ancient world. These attitudes are appropriate in the

religious context. Intelligent criticism is more important than infallible books for the furtherance of science. Copernicus and Newton, Galileo and Lavoisier were all great, but their words are not regarded as final on any scientific issue. Experts may still hold sway in the continuance of particular theories, but younger scientists gradually improve upon, modify, or replace their ideas altogether. This is how science progresses.

Darshana Jolts in Other Fields

In this series we have focused mainly on the physical aspects of natural phenomena. We have talked about leptons and hadrons as well as stars and galaxies, and much in between. We have seen how our ideas of matter and energy, of heat and light, of sound and waves have all been affected in dramatic ways as a result of the science of the past few centuries. Many of these are part of general knowledge today, taught even in high schools. But they are all quite recent in the long stretch of human history.

But we did not touch upon fields like chemistry and biology, mathematics and geophysics. In each one of these also there have been important *darshana* jolts. Thus our ideas of atoms and molecules and their interactions are dramatically different from ancient views of indestructible ultimate entities associated with matter and mind. Modern chemistry is radically different from medieval alchemy whose goal was to transmute lead into silver, copper into gold, and find the elixir of immortality. In ancient science, there was no inkling of hydrogen or oxygen or H_2O for a water molecule in ancient science, or of NaCl for a molecule of common salt, let alone of carbohydrates, the benzene ring, or polymers.

Or again, our knowledge of the interior of the earth, of atmospheric conditions, or the several layers of the atmosphere, the causes of weather patterns and hurricanes and earthquakes, the depths of oceans and the currents in them, the maps of countries and continents, and a thousand other things we know about the earth today are all significant *darshana* jolts that have occurred in recent centuries. The ancients did know about the sphericity of the earth, and even its spinning, But of gravity varying with latitudes or the inching of tectonic plates causing earthquakes they knew nothing.

Or again, consider ways in which our understanding of life has changed in the past few centuries. The circulation of blood through veins and arteries to and from the heart was uncovered only in the sixteenth century, and its role in conveying oxygen came to be known much later. The invention of the microscope made us aware of the existence of countless microorganisms, and it took more than a century to realize the role of bacteria and viruses in diseases and in the sustenance of the biosphere. The ancients had their systems of taxonomy which were quite insightful. But modern biology has come up with a more exhaustive system.

That plants can be male and female was not a common idea in the ancient world. Recognition that the ultimate units of life are cells was another major *darshana* jolt. Delving deeper into the constitution of biological cells deep down to the DNA is part of twentieth century science.

The origin of life is still a mystery. From scientific perspectives, complex (biochemical) molecules could be formed under appropriate conditions. One theory is that a billion years ago the salts in the sea, provoked by sunlight and lightning and other stimulants chanced to combine to form self-replicating molecules which became the basic biochemical molecules. There is no guarantee that this is how it happened, but the idea is in the format of a scientific effort to explain phenomena.

Or again, we have come to understand that organisms thus formed evolved to more and more complex beings through the process of natural selection. This leads to the idea of biological evolution. This is an altogether new idea in the history of thought. Revising all ancient views, it says that every living creature, including humans, gradually evolved over eons, not formed as a whole and left lose on the planet, as traditional religions contend. As in other contexts relating to ultimate questions, this created a major rift between the world of science and that of religion which continues to create disharmony between these two finest expressions of the human spirit.

Another implication of this view, regarded by some as not very flattering to human beings, is that we are by no means special in the world of creatures. If human beings are unique in some ways, so is every other creature, from ants to zebra, in its own particular way. Birds can fly, fish can live in water, and squirrels can climb trees in a jiffy, none of which humans can do. This understanding enables us to appreciate and honor life in all forms, relieving us of the arrogance of superiority in the ecosystem wherein we are occupying our little niche. All this may not be incompatible with the idea that the world was created in this way by an omniscient God. But that idea, however elevating a thought and uplifting to the spirit, is not indispensable in accounting for the details of observed nature.

This reminds us of the *darshana* jolts in our understanding of the universe as a whole. Before the rise of modern science the great civilizations of the world did not have any idea of the existence of trans-saturnine planets, satellites other than our moon, double stars, and galaxies, let alone pulsars and quasars or the notion of the birth and death of stars. If these are not mind-expanding achievements of the modern scientific quest, nothing else is.

Framework of Knowledge

Another major *darshana* jolt we have received from modern science is the recognition that reliable knowledge about the phenomenal world should come from careful observations,

experimentations, verifiability and falsifiability of hypotheses, rather than from sources regarded as sacred or authoritative. This is an important development in human efforts to understand the world. One huge advantage of this paradigm is that it opens up the possibility of changing current knowledge on the basis of future breakthroughs and insights. It respects the authority of those who have studied a subject thoroughly and have themselves made significant contributions to it, but attaches no infallibility to any book or individual. This leaves open the possibility that in decades and centuries to come our understandings of natural phenomena could be slightly or drastically different from what they are today: an openness that is not part of many religious frameworks.

Associated with this is the idea that no one person knows or can know everything about everything, that respect for tradition is not the same as accepting everything that our ancestors had said, much less twisting ancient insights to make them seem the same as more recent scientific discoveries. In modern scientifically enlightened world, untenable positions or views contrary to received knowledge may at worst be ignored by the experts, but the proponents of new ideas will never be chased out of town or penalized in other ways. Fundamental scientific research often involves the overthrow of previously held ideas. As Max Planck quipped, "A scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it." Religious truths, on the other hand, tend to take on greater value and stability after the originators have passed away.

Unfortunately there is a tendency among some Indian commentators to describe the protagonists of modern scientific knowledge as victims of Western indoctrination. This has the effect of silencing many independent thinkers from speaking out their minds on these issues. In the modern scientific framework everyone is given a fair hearing and every idea is entitled to receive due consideration in the framework of scientific methodology.

Universality of Scientific Knowledge

The rise of modern science has resulted in the unplanned formation of an international fraternity of scientists consisting of students and specialists in every branch of serious science whose primary interest is continuing the tradition of exploring every aspect of the world in order to understand it and explain it. In the context of their scientific endeavors the working scientists in any field do not consider themselves to be representatives of any particular cultural, religious, or national group. They work as members of a transnational and transcultural body. In high energy experiments at some centers like CERN, scientists from many different countries work together as a team. The task or joy of claiming credit for this nation or that race may still

interest people as cultural beings, and this is only natural. But, in principle though not always in practice, such considerations are not what motivate working scientists.

This aspect of science cannot be stressed enough in the Non-Western world. Because of several historical factors modern science emerged in the West-European cultural matrix. During the period of blossoming of that science with an abundance of harvests of positive results, some European nations were also colonizing, exploiting, and oppressing the Non-West. Because of this side of history many thinkers in the Non-West are unable to dissociate modern science from Western imperialism. This has sometimes resulted in blatant rejection of modern science and also in some awkward claims for Non-Western science.

The sooner one gets out of this mind-set the better it will be for the cause of science in the Non-Western world. This has already happened in some scientifically productive Non-Western countries like China and Japan. It started in India too and began to take root in the first half of the twentieth century which produced scientists like J C Bose, P C Ray, S N Bose, M N Saha, C V Raman, Srinivasa Ramanujan, and more. But in the last quarter of the twentieth century some ethnocentric voices, inspired by Western postmodernism, began to talk about ancient Hindu science as if it was something special and superior to other sciences, and to argue that some of the modern scientific discoveries like quantum mechanics and quarks were already known to our ancestors. Fortunately, serious scientists in India pay little attention to such claims.

We have already benefited enormously from the technology that has ensued from modern science. But the populace continues to take astrology, horoscopes, and numerology seriously. This is because though we have a good many bright students of science and sophisticated practicing scientists, people at large have not been as much enriched by the science-respecting worldviews that have expanded the minds and enhanced the visions of humanity. This will happen when we consciously understand the relevance and significance of the *darshana* jolts that have shaped the modern world, and their historical roots.

Ultimate Questions

It is not uncommon to read in the writings of traditionalists from all religious frameworks, whether Christian, Hindu, Muslim, or Buddhists, that with all its achievements science has not been able to explain what consciousness is, what the goal of life should be, or why we are here at all. These are valid comments on science, but are not as valid as criticisms of science. As to consciousness, the matter was taken up for systematic scientific study only a few decades ago. There have been tentative scientific explanations for the emergence of consciousness, but none

quite satisfactory. It may be many decades before a full accounting of this most marvelous of all phenomena in the universe is fully understood, if at all, in scientific terms. But it must be remembered that metaphysical descriptions of consciousness, though meaningful, fulfilling, and deeply insightful, are not exactly explanations. As to the goal of life, this is a cultural issue. It is not the business of science to tell us what our purpose in life should be. Science only describes and attempts to explain; it does not prescribe or formulate injunctions for human behavior. As to the why of existence, this is a puzzle that has tormented reflecting human minds since time immemorial. It has been there since the dawn of human consciousness. While there are many different answers to this question given by the great religions of the world there is not a single one that is universally accepted or acceptable. The *raison d'être* for the existence of the universe or of the human spirit in it is among the grand mysteries confronting us. Experiencing that mystery is what spirituality is all about. Answers to that mystery constitute various religious doctrines.

The goal of this series was to remind ourselves that the *darshana* jolts from modern science are quite recent in human history. They opened our eyes and minds to a thousand facets of the physical and biological worlds of which the ancients hardly knew anything. There will continue to be *darshana* jolts for as long as civilization and the spirit of inquiry lasts, and the freedom to inquire is fostered, unfettered by the weight of the past. Perhaps some day, some of the young readers of these essays will cause further *darshana* jolts in our grasp of the phenomenal world.

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