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Science and the Signs of the Times:
Redefining Science and Enriching Humanity

S. Stephen Jayard
Jnana-Deepa Vidyapeeth,
Pune 411014

Abstract: Science, a powerful and influential enterprise, affecting even our thinking, cannot be ignored. Its recent inventions and interventions touch the very core of our human identity and dignity. However, the realization of various limits in science, too deep to be solved, show us that we are forced to move beyond 'scientism' and revise the very 'notion' of science. This paper seeks to discuss the need of looking at science from the perspectives of faith, rationality and wisdom. The natural limits in our reasoning capacity and the inability to have access to reality other than our human ways, lead us to see how ***faith*** matters in science. The very notion of ***rationality*** emerges from the scientific society as there is no one absolute standard framework of rationality to be imposed upon science from somewhere external to it. Since mere logic and reason will not take science too far in the service of humanity, we need ***wisdom*** to produce safe and holistic science.

Key words: Faith, Revision of Rationality, Need for Wisdom, Holistic Science

Introduction

Science, a powerful and influential enterprise as it is, cannot be taken lightly. It affects, especially in our modern times, not only the way we *live*, but also the way we *think*. Given the importance and the influence of science in our lives, several disciplines have come up in the twentieth century to investigate the nature and the claims of science. Disciplines like, History of Science, Sociology of Science, Philosophy of Science, Psychology of Science and so on bring science under sincere scrutiny. While science studies nature, these re-

cent disciplines study science itself. For instance, Philosophy of Science, though it has been there for long, has recently emerged as a distinct and powerful enterprise, to address important questions regarding the nature, aims, method(s) of science; it takes up the fundamental claims of science, like objectivity, rationality and progressiveness, head on. All these disciplines need not be taken as attempts to damage the venerable image of science, nor to belittle its wonderful feats; they are, rather, to bring us to our awareness the need and responsibility to deal with science, in such a manner, that science gets a human face, that science may work towards the enlightenment of humanity and the enrichment of nature at large.

This paper seeks to discuss the need and the relevance of looking at science from the perspectives of faith, rationality and wisdom. The natural limits in our reasoning capacity and the inability to have access to reality other than our human ways, lead us to see how ***faith*** matters in science; for instance, if scientists don't have the fundamental faith in the meaning / purpose in the universe, they will not be ready to invest their time and energy in exploring it. Further, the very notion of ***rationality*** that emerges from the scientific community is internal to it as there is no one, absolute standard framework of rationality to be imposed upon science from somewhere external to it. It is the consensus of the scientific community, for instance, which decides about the existence of a particle in nuclear physics. Once it is made clear that mere logic and reason will not take science too far to be of any use to humanity, then it would not take too long for us to see the need of ***wisdom*** to produce safe science, and more importantly, to use it holistically. The paper ends with concluding remarks, highlighting how the 'revised' science would enrich humanity.

Part I

Faith in Science

It is not uncommon to hear that: "I don't *believe* in anything because I think only science is truly successful and necessary for humanity" – such declarations underline the assumption that faith or

beliefs don't play any role in science, as science is based on rational methods and logical conclusions. According to Webster's New World College Dictionary, 4th edition, faith is defined as "unquestioning belief that does not require proof or evidence and unquestioning belief in God or religious tenets, etc." and it further explains that "faith implies complete unquestioning acceptance of something even in the absence of proof, especially of something not supported by reason". When one analyzes the actual practices of science and scientists, one realizes that not only such faith but also convictions, assumptions, postulates, beliefs, values, inspirations, intuitions and so on, are not strange to science. There are scientists who see faith as something crucial and values, like truth and beauty, as something essential to science. The religious assumption that God created the universe and the scientists' assumption that there was something here that's just always been the same – both assumptions are not radically different.[1] Science seeks to understand structure and the operations of the universe, while religion seeks to understand the purpose of the universe; but both, science and religion, require the human mind and evidence. Therefore, that an element of belief is very essential in the world of science too cannot be denied. As Van Fraassan puts it, in *The Scientific Image*, "Science aims to give us theories which are empirically adequate; and acceptance of a theory involves belief that it is empirically adequate".[2]

Science is not a body of provable truths; it is not the case that scientists arrive at demonstrable truths by mere logical reasoning and mathematical calculation. For, "virtually all of science is an exercise in believing where we cannot prove".[3] The History of science is full of evidence that discoveries and inventions don't occur following some strict rules. A scientist first visualizes what he or she wants to arrive at; even a long struggle may not prove useful; but sometimes it may dawn in his / her mind as a flash and this would inspire to solve the issue, even before some necessary rules are invoked, in a hitherto unimaginable manner. For instance, "when Democritus said that everything consists of atoms, he certainly had not the slightest confirmation for his theory. Nevertheless, it was a stroke of genius, a profound insight, because two thousand years later his vision was confirmed".[4] Thus, it is made clear that an element of faith,

intuition and creative imagination are very much part and parcel of science.

Meaning of the Universe – a Faith Declaration!

It is quite normal to see a picture of the mechanical and random universe to be dominating the world of natural sciences. This leads to a world of meaninglessness in the whole of human existence and that of the universe. Several scientists and philosophers have come to the unfortunate conclusion that the universe is fundamentally devoid of any meaning and purpose;[5] that the universe would one day be extinct is a gloomy and brute fact, about which we cannot do anything. As per the recent report in *The Times of India*,[6] our Earth is said to be facing a serious problem; it can sustain life only for 1.8 billion years as it will become very hot and the oceans will evaporate; one way to escape the extinction is to migrate to Mars. But, even then, the Sun's life span is about only another six billion years and after that the solar family will be wiped out. With such revelations, scientists get dismayed. They are disillusioned that scientific methodologies are not capable of showing the purpose or the meaning of the universe. So scientists, like other creatures in the universe, are forced to surrender themselves to the fate of a pointless universe, which is ultimately cold and lonely.

Nevertheless, several other scientists and thinkers show that the universe is purposeful, good, beautiful and worthy of our serious investigations, going along with the declaration in the Book of Genesis: "God looked at everything God had made, and found it very good (*Genesis* 1:31). Pat Byrne argues that the gloomy picture of the universe is unwarranted, by undertaking a case-study regarding geomagnetism – a study that goes on for more than a century, but still a number of questions remain unanswered. Unless scientists are convinced of the worth of their scientific investigations they will not be ready to invest their time and energy in them; unless they are convinced of the meaning and value of their researches they will not be ready to undertake challenging, risking and even life-threatening activities. It is a sort of *faith* that they have in the meaningfulness of their efforts, which propels them to work further and such inspiration to slog cannot be justified by the empirical world around us.

From their strenuous efforts we learn, among many other insights, that they are convinced of the *fundamental intelligibility* of the universe: "Intelligibility is what we come to know when we have insights that answer our questions. Intelligibility is what makes sense of the puzzling observations and questions that we pursue. By their ongoing questioning, therefore, scientists are seeking the intelligibility of the natural universe. In this way they are already engaging in a certain kind of *faith experience*".[7] To struggle to obtain intelligibility is equated with a faith experience, because this intelligibility cannot be proved or touched or seen by empirical methods! Many geniuses indeed marvel at the intelligibility (comprehensibility) of the universe and Einstein meaningfully wonders: "The most incomprehensible thing about the universe is that it is comprehensible!"[8] Scientific laws can only describe the situations but cannot go deeper to answer the questions about why only those situations, and not different ones, exist. Certain fundamental questions about the natural laws or the functions of the universe don't come under the purview of science. Scientific inquiry cannot answer them, though they are very much related to the scientific inquiry. Byrne, going along with Bernard Lonergan, is convinced that questions like, "Why are these forms of the laws that characterize our universe? ... Why do the events of our natural universe follow these laws rather than some others?... Why are those conditions under which the laws have to operate, rather than some others?" – are implicitly questions about God.[9]

Moreover, even "faith" in the religious sense as related to the experiences of divinity is not something strange to the contemporary world of science. The better and deeper awareness of the complicated structure of the universe, whose complex nature exceeds even our imagination, paves the way for some religious experiences, in and through the exploration of this amazing universe. The same convictions are shared by physicists like Werner Heisenberg, Arthur Eddington and many other quantum physicists.[10] The words of Einstein bear a strong witness to this faith: "The cosmic religious experience is the strongest and the noblest driving force behind scientific research",[11] without which no committed investigation would ever take off.

Part II

Redefining Rationality

As any human enterprise, science does have a history – a history of not only successes and achievements, but also struggles all along. In science, we find a steady and gradual growth in its every domain, even in the very conceptions of its nature and its methods. With the emergence of modern philosophy and modern science, in the 17th century, and discoveries in the further centuries, the mechanical conceptions of the universe and the traditional methods of science were questioned. There are experiences and facts of life that lie beyond the purview of science and this realization was a great thrust to move beyond science for a holistic understanding of human life. For instance, now we are given to understand that subjective dimensions play an important role in science. Science has so far been thought to bė a totally objective, rational and progressive enterprise, leaving no room for elements of social or personal factors. The dichotomy between subject and object has been stressed so much that the role of subject (or agent) in the process of investigation was totally forgotten. Reflections in the recent Philosophy of Science reveal that the subject assumes great importance in several aspects, like value-judgment, creative imagination and production of language. Insistence on subjectivity does not mean that science loses its objectivity. For, 'subjective' does not mean going by one's likes and dislikes. Value-judgments are based upon valid reasons but they remain human judgments. This awareness was the first step in releasing science from the tentacles of a one-dimensional idea of science as products of pure reason and logic and towards taking the non-rational factors seriously and helping science to be holistic and integrated. One is led to realize that humans need more than science and its rationality, for instance wisdom, for a meaningful life. In fact, it is this wisdom that enables us to put the scientific knowledge into right use. Thus, the rational conceptions of rationality had to be modified in order to accommodate many others aspects of the actual science and human existence, which were usually kept out of science and rationality.

The rationalist model of science has been severely criticized during the second half of the 20th century. Rationality was equated with scientificity and irrationality with the unscientific. But Putnam argues that it is not proper to take science to be co-extensive with rationality. According to him, there are at least three important areas of our human lives, where science has nothing to say; it cannot even affirm that those facts exist: a) the domain of objective values; b) the domain of freedom; and c) the domain of rationality itself.[12]

As I have explained elsewhere,[13] scientific changes and theory choice in science cannot be fully explained in terms of logic and reason, as there are many social, psychological and non-rational elements at work. *A rationalist model has to tackle the following hurdles*:[14] a) the issue of incommensurability, which claims that with major theory changes, the meanings of the terms in those theories radically change; b) the goal of science has to be explicated; c) they have to show that the principles of comparison are in fact a means to arrive at that goal; d) they have to show that adhering to these principles ensures progress in future and also in the past; and e) they have to show that the actual history fits with this model and that the social and psychological factors have only a minimal role in the course of science. All these hurdles are not going to be easily overcome and thus we are forced to look for a more adequate notion of rationality.

To show that there is a need to revise the understanding of rationality in science, for our present considerations I limit the discussion only to the modern methodologies of natural sciences. In modern times, Inductivism and Hypothesism are the prominent methodologies. For inductivism, to do science is to observe and to generalize, while Hypothesism aims to generate hypotheses and to explain those hypotheses in terms of unobservables. Both methods involve some elements which have been traditionally ignored in the conception of rationality of science; for example: 'intuition':[15] the inductive method has the intuition (inductive faith) that our beliefs about the world come from observation and interaction with the world; it believes that the future resembles the past, and the known is helpful in understanding the unknown; whereas, the method of hypothesism relies on intuition and creative imagination in formulating the hypothesis about the world and it has faith in the unobservables. In fact, in a

way, these unobservables are more "real" than the observables because even the observables are explained in terms of the unobservables; for instance, the table I see in front of me is explained in terms of billions of atoms and sub-atomic elements some of which are obviously unobservable! So, in both methods we have 'faith' involved. Inductivism does not explain what counts as observation, and it assumes that observations are theory-free. But now we know that there is no observation that is theory-free.[16] On the other hand, the method of hypothesism, though it rightly begins with hypotheses (not with observations as inductivism does), it is not able to explain the origins of those hypotheses. Both these methods rely on several background beliefs, which cannot be scientifically proved. Those background beliefs are needed *not only for* i) determining the instances, ii) choosing the relevant instances and iii) dividing instances into circumstances, *but also for* a) the formulation of problems, b) deciding upon the research strategies to find solutions, c) to fix up the criteria to choose from the possible solutions, d) to form the goals of science and e) to create regulations for directing the researches.

Thus we understand that the methodologies in science, and thereby, the notion of rationality in science, are not that simple and straightforward as they are assumed to be. Given such issues there are several philosophers who have attempted to revise the notion of rationality in science. For instance, Peter Winch[17] searches for *social rationality*; Stephen Nathenson[18] looks for an *ideal type of rationality in terms of reasonableness*; Heidegger looks for *an authentic reason*, as reason is the most authentic form of Being, and for him the misunderstanding of science and technology is basically the result of our misunderstanding of Reason; Habermas[19] insists on constructing *practical rationality*, and Tran Van Doan[20] invites us to *return to Confucius' notion of reasonableness.* Similarly, Feyerabend warns us to be cautious of science, so much so, that he demands the *liberating of society from science.* I have elsewhere briefly evaluated a few traditional notions of rationality. Due to their shortcomings I have also attempted to capture the notion of rationality in terms of reasonableness.[21] As Stephen Toulmin points out the one-sided emphasis placed on formal deductive techniques by the 17th

century natural philosophers, the ideas of 'rationality' and 'reasonableness' closely related in antiquity, were unfortunately separated.[22] Now it is the time that we brought them together to improve upon science and thereby to enrich humanity.

Part III

Inaccuracies and Impossibilities in Science

In spite of its amazing achievements, science still encounters its own limits and limitations. In many fields, accuracy in measurement is restricted. Uncertainties and inaccuracies are intertwined in the very existence of science. There is a limit in the speed with which we can share information, in the accuracy of measuring time, in having hyper sensitive technologies to avoid uncertainties.[23]

1. Abundance of Assumptions and Axioms

The National Science Teachers' Association (NSTA) describes science as follows: "Science is a method of explaining the natural world. It assumes that the universe operates according to regularities and that through systematic investigation we can understand these regularities... Because science is limited to explain the natural world by means of natural processes, it cannot use supernatural causation in its explanation. Similarly, science is precluded from making statements about supernatural forces because they are outside its provenance".[24] Regularities in nature are taken for granted. But without such an assumption science cannot proceed any further. Similarly, it is not easily explainable why we all have bias towards simple solutions. Further, science has many axioms, which are assumed to be unwritten laws, without which it cannot function. For instance:

a) Measurability of all things: All things are measurable and those things that can't be exactly measured, like emotions, aesthetic sense, love, etc., lie outside the field of science. However a closer look at the claim would reveal that even objects can never be absolutely measured. For instance, if this table is measured to be 100 cm long with a help of a ruler, a physicist with her better instruments would

find it to be 100.124 cm; and if a still more sophisticated instrument it may be 100.12457 cm. But at the quantum level it will be much more challenging to measure it as one cannot locate where electrons are exactly. So the exact length of the table will never be known.

b) Reliability of Logic and Mathematics: It is assumed that logic and mathematics work out correctly to give us accuracy. Mathematics is said to be the queen of sciences. It even constitutes sciences and without its help many concepts in the contemporary science cannot be understood. However, all is not rosy with mathematics too. For instance, there are irrational numbers, which can't be expressed in writing as they have infinite digits, without any pattern of repetition of the digits. (e.g. the square root 2, and the value of π = 3.14159... it will go on and on, without any repeatability of the digits). It shows innate inability.

c) Reliability of Experiments and Observations: Experiments are usually taken as the final word. But any experiment answers only a specific question. What is that specific question is decided by the practical and theoretical situation. The relevance and interpretation of experimental results always depend on the theoretical context and the creative imagination of the scientists involved. There is no pure observation as observations are always made with certain questions in mind and all the theories that are used to make the instruments of observation have to be assumed to be true. Further, there are several non-scientific elements involved in scientific experiments. We need to take them into account in order to trust or doubt the results of an experiment. For instance: i) Faith in a scientist's experimental capabilities and honesty, based on a previous working partnership; ii) Personality, the value-system and intelligence of the scientists involved; iii) A scientist's reputation gained in running a huge lab; iv) Whether or not the scientist worked in industry or academia; v) A scientist's previous history of failures; vi) 'Inside Information'; vii) Scientists' style and presentation of results; viii) Scientists' 'psychological approach' to experiment; ix) The size and prestige of the scientist's university of origin; x) The scientist's degree of integration into various scientific networks; and xi) The scientist's nationality. [25] Therefore, "The recognition that rational thought cannot be the final arbiter of truth and that some mechanisms that are external

to the working of our minds are essential in the pursuit of new knowledge, is fundamental to modern experimental science".[26]

2. Limitless Limits

Several authors explore the limits of science; like Hempel points out: a) the inability to justify inductive reasoning; and b) Science being an empirical enterprise always "seeks knowledge that reaches far beyond the supporting evidence... (so) the ideal of empirical knowledge with certainty is logically self-contradictory".[27] Hempel speaks about *the incompleteness of explanation* in science; for science explains anything in terms of something else. "A scientific explanation is thus always incomplete in the sense that the explanatory facts it adduces are left unexplained and thus ununderstood. It may even seem that, as a consequence, an explanation in science never does more than reduce the problem of explaining one fact to the problem of explaining several others".[28] But this is a problem for metaphysics or religion also. Hempel would concede that all such fundamental impossibilities, which are problematic for all, may not be limitations of science, but only 'limits' of science.

a) Limits in our Reasoning

We have many pitfalls in our reasoning; there are several natural tendencies in us, which either often deter us from seeing reality as it is, or often create an imaginable picture of reality. For instance, a tendency to underestimate the probability of coincidence, a lack of appreciation for randomness, a tendency to jump to conclusions, a tendency to perceive order in random arrangements, a tendency to detect spurious correlations, a propensity to ignore unfavourable evidence, and a constructive and selective memory – all these do hamper the so-called objective and rational approach to reality.[29] We tend to assign causal relationships to random events and we analyze and approach the world with the strong assumption that we are the 'main player' in the whole chain of events. Several domains of our life are dominated by irrational and illogical elements: playing lottery cannot be justified by any rational argument, but still millions undertake that; while we are on the phone, we laugh, frown, smile and

make various facial expressions though we know that the hearer cannot see that; we become victims of 'inattentional blindness' when focus on one particular thing blinds us to novel facts and ideas, as we filter through our baggage of past learning, etc. Taking a rationalistic approach as the only source of life and knowledge would sadly prove that we are, in fact, irrational. As Jaffe puts it, "Despite the mountain of evidence regarding the limits of the human mind, most humans believe that rational thinking, using only the powers of our mind, is sufficient to untangle any complexity in our surrounding reality. A strong belief in the absolute power of our rationality is irrational."[30]

b) Ontological Limits

Predictability gives science its special character; science has acquired its enormous power and influence in every field, and it has been held in high esteem precisely because of its ability to predict events in nature, which in turn enables science to control nature. However in the past few decades science is increasingly realizing the limitations of predicting even probabilities, especially in the world of sub-atomic entities. This inability is not due to our technical inefficiency, but due to the very nature of observed things and the relationship between the observer and the observed. As Popper puts it succinctly, "Every physical measurement involves an exchange of energy between the object measured and the measuring apparatus (which might be the observer himself). It is thus impossible to infer from the result of the measurement the precise state of an atomic object immediately after it has been measured. Therefore the measurement cannot serve as basis of predictions".[31] With all these revelations, it seems to be safe to conclude that we have theories "that predict that they can't predict".[32]

It is true, as Hempel points out that all these limits may not be limitations of science as such, but I believe, they point out to some other deeper lesson: that is, the powers of human cognition are not limitless. It seems that humans cannot see themselves as the masters of shaping their own destiny. It may be seen as a limit of human existence as a whole, as most of the Existential Philosophers have pointed out. Some of them, like Sartre and Nietzsche, have ended up

with a pessimistic outlook towards the world, while some others, like Gabriel Marcel, have taken the fact of limits as something adding interest to the very human existence, opening up avenues of transcendence. After all we cannot even know whether we know everything.

Concluding Remarks

After reflecting upon the actual practices of science and scientists, one may be convinced of many things and learn many lessons from it; one of the fundamental lessons is that we realize that science is not enough, not only to make our existence meaningful and worthwhile but also for science itself. Isolated from human context, stripped of its human face and social characteristics, science loses itself. For science "is an activity of persons, involving unspecifiable powers of creative imagination. Science by itself is not enough even to describe the pursuit of science itself".[33]

The limits, inaccuracies, impossibilities, uncertainties - that we encounter in science need not discourage us. We can still be optimistic; for they are not negative factors blocking our growth and our realization of our potentialities. In fact, they can become a positive source of our further development. For "there is more to impossibility than first meets the eye. Its role in our understanding of things is far from negative. Indeed...we will gradually come to appreciate that the things that cannot be known, that cannot be done, and cannot be seen, define our Universe more clearly, more completely, and more sharply than those that can"[34].

Wise Science... Wise Humanity!

There are various sorts of limits and natural restrictions in our explorations of nature. But those limits make our science a humble and wise undertaking that boldly and realistically acknowledges that it does not know everything. We may not be sufficiently wise to clearly define what wisdom is, but we are certainly wise enough to know that we need to be wise. The inability to define 'scientifically' what wisdom is, must not deter us from deliberating on it; it must not be an excuse to science to do whatever it wants! Better to be wise than other-wise. Otherwise science would become a monster,

too big to be contained. Science, which aims at, not just enhancing life, but retrieving the glorious pre-fallen state of our human existence, will annihilate the very life that it is expected to enrich. Just because we can do something, does it authorize us doing it? Polkinghorne cautions that the technological imperative (we can do something) must be tempered with the moral imperative (should we do it?). Compared to ignorance, science as a body of knowledge may help us to take a better decision, but "to make a right decision wisdom must be added to knowledge".[35] There are intrinsically undesirable knowledge: e.g. to the know the genetic causes (if there are!) that produced differences of average physical strength or average mental ability – this knowledge would lead to unfair stereotyping; so better not to know them at all! Science is not just to accumulate information; all such wealth of information must turn into useful knowledge. But again knowledge must turn out to be wisdom, without which one may not know how to use that knowledge efficiently and effectively. As Francis Bacon insisted, science must take us back to the glorious life of pre-fallen stage described in the Book of Genesis. Humanity struggles to live a life of worth but in the bargain it loses life itself. That is why, T. S. Eliot rightly wonders: "Where is knowledge that is lost in information? Where is wisdom that is lost in knowledge? and Where is life that is lost in living?"

Wisdom will enable us to acquire intellectual humility and honesty. Newton becomes a great model for us in this regard when he said that the world might call him a great genius but as far as he was concerned he was only like a little boy on the sea-shore, playing with pebbles, whilst the great ocean of truth lay all undiscovered before him. Wisdom will evoke the child-like wonder in us which is necessary to pursue further investigations, in spite of struggles and failures. It teaches us to learn to live with unsolved mysteries by science and many elements that don't make any sense or fills us with awe and wonder, like that we can account only 4 % of the universe, and the remaining is in the form of dark energy/matter.[36]

Limited Science... Limitless Life!

It is our existential experience that there is a gap between what we want to be and what we actually end up being; we make use of

science and technology, and we rely on people for their love and affection, and in spite of all these, there seems to be a sort of unfulfillment and a sort of vacuum. All the efforts to fight for the sense of fullness have not been a total success and land us in frustration. "We are left with the choice: either to fight for the Impossible and Unlimited; or to submit to it. The people who fight against the fragility of humanity end up in frustration. The people who surrender to it develop an interior modification that enables them to lead their fragile existence meaningfully. That interior modification is "spirituality".[37]. All the domains of our life cannot be explained by science; there are issues and questions which cannot be touched upon by science. Even if they are explained by science those need not necessarily psychologically satisfy us and remove all our anxieties; they will not account for our need for love and affection, the passion for success and many other human needs and wants.

Cottingham gives a perceptive plan for a meaningful life: Because we are limited, finite and fragile, there is a sort of innate deep yearning for meaning and fulfillment in life, deep longing for the Impossible and Unlimited in life, and this is what is meant by religion in the postmodern times.[38] He invites us to come to terms with the limits; we need to realize that life is meaningful in spite of all its shortcomings, limits and limitations. The limits reveal that we are not unlimited and at the same time that life is worthwhile as we have the inner desire and longing to overcome those limits; and that makes life interesting and challenging. We need to develop a way of life, which admits traditions of worship, in total submission to God, not dominated by power of wealth and reason; our life has been mechanized by technology; has led us to individuality; we need to regain communal and collective consciousness. Pierre Hadot makes a meaningful suggestion: Spiritual exercises and experiences help one to accept our limitedness humbly; we need to renounce false values, while undertaking fervent prayer, meditation, a moderate life-style and the simple happiness of every practice of justice and truth.[39]

Finally, in his recent letter, former Pope Benedict XVI has clarified to Piergiorgio Odifreddi, a popular Italian atheist professor, who wrote a strong criticism against Benedict XVI's writings, on a certain fundamental issue that is very relevant to our discussion here:

namely, the professor has replaced God with 'nature', but he has not defined what this nature is; 'religion of faith' has been replaced by the 'religion of mathematics'. But this religion cannot touch upon the three basic elements of human existence – freedom, love and evil, which are so inevitable in our lives that they cannot be ignored. If any religion keeps silence on these issues as if they do not exist, that religion loses any worth.[40] Taking a cue from the former Pope, I would like to conclude that a revised understanding of science would certainly not allow religion to be replaced with science and it will take freedom, love and evil for serious reflection which would certainly enrich humanity.

Notes

1. For example, see: Charles Townes, "Testing Faith and Wrestling with Mystery", in *Faith in Science – Scientists Search for Truth*, ed. by Mark Richardson and Gordy Slack (London & New York: Routledge, 2001), pp. 170-86.
2. Van Fraassan, *The Scientific Image* (Oxford: Clarendon Press, 1980), p. 12.
3. Philip Kitcher ,"Believing Where We Cannot Prove", in E.D. Klemke et al., (eds.), *Introductory Readings in the Philosophy of Science*, (New York: Prometheus Books, 1998), p. 78.
4. Rudolf Carnap, "The Nature of Theories," in Klemeke, E. D., et al., (eds.), *Introductory Readings in the Philosophy of Science* (New York: Prometheus Books, 1998), p. 330.
5. For example, Bertrand Russell is convinced that science offers a purposeless and meaningless universe, that is condemned to extinction, sooner or later, though he tries to find an humanistic answer to this challenge (See his work: *Mysticism and Logic, and Other Essays* (London: Longmans, Green and Co., 1918). Similarly, Jacques Monad projects human beings as the ones who don't know their destiny in the vast Universe, where they are left alone (See his work: *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology* (New York: Knopf, 1971). Max Weber and Richard Dawkins are also convinced that the Universe is brutally pointless. See: Max Weber, "Science as a Vocation", in Hand H. Gerth and C. Wright Mills (eds.), *From Max Weber: Essays*

in Sociology (NY: Oxford University Press, 1946), 138-9; and Richard Dawkins, *The Selfish Gene* (New York: Oxford University Press, 30th anniversary edition, 2006).

6. *The Times of India*, Goa edition, 20 Sep, 2013, p.11.

7. Patrick Byrne, "Is the Universe on Our Side? Scientific Understanding and Religious Faith", in *The Lonergan Review*, III, 1, Nov 2011, 140-161, p. 149. Emphasis mine.8 http://www.phnet.fi/public/mamaal/einstein.htm (Accessed on 17 May, 2013)

9. Patrick Byrne, 2011, 140-161, p.156.

10 For an elaboration on the issue of the philosophical and religious leanings of quantum physicists see my paper: Stephen Jayard, "Mysticism and Quantum Physicists – Friends or Foes?," in *Omega – Indian Journal of Science and Religion*, Vol. 3, No.2, 2004. pp. 89 – 106.

11. David E. Rowe and Robert Schulman, *Einstein and Politics: His Private Thoughts and Public Stands on Nationalism War and Peace*, (New Jersey: Princeton University Press, 2007), p. 234.

12. Hilary Putnam, "The Place of Facts in a World of Facts," in Douglas Huff and Omer Prewett (eds.), *The Nature of the Physical Universe* (New York: A Wiley-Inter-science Publication, 1979), 113-140.

13. "Are Values Valuable in Science? – A Kuhnian Perspective", in *Omega – Indian Journal of Science and Religion*, Vol 9, No 1, 2010, pp. 7-24. See also: Basu, Prajit K., "Theory-ladenness of evidence: A Case Study from History of Chemistry", Studies in History and Philosophy of Science, 34(2003), 351 – 368; and Brewer, William F., and Bruce L. Lambert, "The Theory-Ladenness of Observation and the Theory-Ladenness of the Rest of the Scientific Process," in *Philosophy of Science* 68, no. 3 (2001).

14. Newton-Smith, W. H., *The Rationality of Science* (London & New York: Routledge, 1996), 267. First print 1981.

15. I have elaborated elsewhere the role and relevance of 'intuition' in science and the implications of taking it seriously in science and life. See: Stephen Jayard, "The Role of Intuition in Science", in (ed.), *Together Towards Tomorrow – Interfacing Science and Religion in India* (Pune: Association of Science, Society and Religion, 2006), Kuruvilla Pandikattu (ed.), 2006, 145-170.

16. I have argued elsewhere to show that all our observations are theory-laden. (See: Stephen Jayard, "Observations on Observation in Philosophy of Science", in *Omega – Indian Journal of Science and Religion*, Vol.6, No.2, 2007, 65-84.

17. Peter Winch, *Ethics and Action* (London: Routledge & Kegan Paul, 1972).

18. Stephen Nathanson. *The Ideal of Rationality – A Defence, within Reason* (Chicago and La Salle, Illinois: Open Court, 1994).

19 Jurgen Habermas, *Theory and Practice*, Trans. John Viertel (London: Heinemann, 1971). Of course, Habermas is better known for Communicative reason which is more comprehensive than practical rationality.

20. Tran Van Doan, *Reason, Rationality and Reasonableness*, Vietnamese Philosophical Series, I, Cultural Heritage and Contemporary Change, Series I, Culture and Values; Vol 25, Series IIID, South East Asia, Vol. I, General Editor, George F. McLean, 2001.

21. I have considered some traditional notions of rationality; namely, rationality as logical consistency, as justification, as scientificity, as goal-orientedness, as the fundamental assumption of being humans, as deducibility, rationality in terms of true / false beliefs, and rationality provided by autonomous (a priori) principles – and construed rationality in science in terms of reasonableness. I see the role of reasonableness, in science, at three levels, though they cannot be categorized in water-tight compartments, nor are they exhaustive: *Reasonableness at the Personal Level of the Scientists* – Imagination, the Agent, Judgment and Intuition; *Reasonableness in Scientific Methodology* - Rejection of Zero-tolerance, An Enriched Notion of Objectivity, The Need of Skeptical Attitude, and The Need for Common Sense; and *Reasonableness in Scientific Practice* – Embracing Pragmatism and the Consensus of the Scientific Community. See: Stephen Jayard, *Towards a Theory of Rationality in Science – A Plea for Reasonableness*, New Delhi: Global Vision Publishing House, 2012.

22. Stephen Toulmin, *Return to Reason* (Cambridge, MA: Harvard University Press, 2001), p. 204.

23. John D. Barrow, 2005, p.154

24. C. John Collins, *Science and Faith – Friends or Foes?* (Illinois: Crossway Books, 2003), p. 40

25. Harry Collins and Trevor Pinch, *The Golem at Large: What You Should know about Technology* (Cambridge: Cambridge University Press, 1998), p.101.

26. Klaus Jaffe, *What is Science? – An Interdisciplinary View* (NY: University Press of America, 2010), p. 31

27. C. G. Hempel, *The Philosophy of Carl G. Hempel – Studies in Science, Explanation and Rationality*, (Oxford: Oxford University Press, 2001), p. 331.

28. C. G. Hempel, 2001, p. 335.

29. Klaus Jaffe, 2010, pp. 69, 70

30. Klaus Jaffe, 2010, p. 30; emphasis mine.

31. Karl Popper, *The Logic of Scientific Discovery* (London: Routledge, 2002), p. 212.

32. John D. Barrow, *Impossibility – The Limits of Science and the Science of Limits* (London: Vintage, 2005), p.26

33. John Polkinghorne, *Beyond Science – The Wider Human Context* (Cambridge: Cambridge University Press, 1998), p. 2

34. John D. Barrow, 2005, p. ix

35. John Polkinghorne, *Science and Theology – An Introduction* (Minneapolis: Fortress Press, 1998), p. 130.

36. John Malone, in his *Unsolved Mysteries of Science*, (Canada: John Wiley & Sons, Inc., 2001), explains twenty one mysteries that are, or even cannot be, solved. Further, that there are several facts from the fields of Biology to Cosmology, from Psychology to Physics, that cannot be adequately explained even by eminent scientists is a claim made by Michael Brooks, *13 Things that Don't Make Sense* (London: Vintage, 2009).

37. Joe Arun, SJ, "The Post-modern God – ways of Being Religious in the Postmodern World", in *Vidyajyoti – Journal of Theological Reflection*, Vol. 73 (2009), 564-580, 571.

38. John Cottingham, *On the Meaning of Life* (London and New York: Routledge, 2003).

39. Pierre Hadot, *Philosophy as a Way of Life* (Oxford: Blackwell, 1995), p.103.

40. For more details: http://www.news.com.au/world-news/pope-benedict-breaks-his-silence-to-engage-atheist-mathematician-piergiorgio-odifreddi/story-fndir2ev-1226726585334. Accessed on 8 Oct, 3013.