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RESEARCH ARTICLE

## Scientific Temper: An Arena of Contestation in a Globalized World

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### ABSTRACT

There are three conditions that guide this conversation. Firstly, this paper is not an effort to provide a solution to the questions and concerns that have been repeatedly raised by the community of scholars who have worked in the area of Public Understanding of Science (PUS) over the past 30 years. The paper tries to argue that all science communication activities should aim at developing a 'scientifically tempered society'. Secondly, this paper is a continuation of the keynote address presented at the International Conference on Science Communication, Nancy, France, 2012 (Raza, 2012), and two editorials published in the Journal of Scientific Temper. Thirdly, the paper draws heavily on the Indian experience and history; therefore, any generalization requires careful scrutiny to ensure local applicability.

**KEYWORDS:** Scientific Revolution, Secular Values, Extra-Science, Contestation

### Introduction

#### Ideological Basis of Scientific Revolution

All revolutions have a past, present and, if successful, have a future too. Such was the case with the scientific revolution too. The recent work in the history of the European Enlightenment tells us it was not a one-off event (O'Brien, 2013). David C Lindberg acknowledges that 'the rationalism of the Greeks was one of the greatest achievements of antiquity' and he asserts that 'with the living traditions' (after Christianity spread to Europe) 'philosophy was becoming progressively more like religion, based on inspired authorities, with mystical illumination and

personal salvation' (Lindberg, 1986). He further notes that the ideals of rationality and objectivity through the ages to a limited extent continue to be 'available and influential'.

Science in this regard became perceived as the 'handmaiden of theology' and its role was limited to the 'interpretation of Holy Scripture' (Grant, 1986). The fortification around scientific investigation started to develop cracks by the 12th century. Grant (1986: 52) argues that 'Thus were the seeds of science–theology confrontation planted, the bitter fruits of which would grow to mature in the thirteenth century following upon the introduction of Aristotle's scientific works, which formed the crucial core of the new Greco-Arab science that entered the Western Europe'.

The 'confrontation planted' was not a sufficient condition for the scientific revolution to take place in Europe. During the previous century two competing theories gained acceptance among scholars (Lindberg, 2007). Firstly, it was suggested that the application of mathematics to 'natural philosophy' cleared the deck. 'A revolution in science resulted, therefore, when Copernicus, Galileo and other early modern scholars united the two enterprises, thereby creating genuine mathematical physics and setting science (or the physical sciences at least) on the road to modernity.' (Lindberg, 2007:360). The other group of scholars proposed that the application of the method of science and experimentation eventually resulted in a paradigm shift in favour of the sciences (Lindberg, 2007:362). Even if we assume that there was disconnect between natural philosophy and mathematics (which, evidence shows, is obviously erroneous) in Europe, the first hypothesis could easily be rejected. Evidence shows that in India, China and Arabia, mathematics was always an integral part of scientific investigations. The second theory cannot be accepted because philosophers through the ages systematically performed controlled experiments often using instruments, but could not produce a scientific revolution (Sarma and Shukla, 2000).

Lindberg shows that the revolutionary catalytic agent in the sixteenth and seventeenth century was metaphysical and cosmological rather than methodological (Lindberg, 2007:364). It was the advocates of a 'mechanistic universe of lifeless, indivisible atoms moving in an infinite void', that struck the final

blow. In the fearsome clash of ideas, ‘the organic universe of medieval metaphysics and cosmology had been routed by the lifeless machinery of the atomists’ (Lindberg, 2007:365).

The old ideologies, though over a long period of time, lost the battle for control and dominance and the institutional structures based on these ideologies crumbled. There was no prime cause required to understand nature, any more. As the power of the prime mover, the God, weakened, the authority of the church and royalty was also challenged. Though this argument cannot be applied uniformly to the entire Europe, it is safe to assume that the scientific revolution was an event on the trajectory of human civilization when old, outmoded ideas collided fiercely with the newly emerging paradigm of secular thought. This clash of paradigms did not take place in an ideological vacuum. The ‘ideologically rich historical foundation’ of a secular modern science inspired the masses as well as the emerging bourgeois class, who became its vanguard.

### **The Ideas Get Transformed**

The next centuries witnessed two important processes. Firstly, as the political power balance changed in Europe, the ideas of the Enlightenment went through a transformation in European societies. Secondly, these ideas travelled through cultural spaces across the globe, encountered varying consciousness levels and went through transformative phases before being absorbed within the various cultural thought-structures of societies.

For example, Grayling argues that in eighteenth-century France, aggressive anti-clericalism was a form of secularism (Grayling, 2008). As the ‘intrusive and oppressive priestcraft’ withered away from the west, both content and the form of secularism changed. It assumed a neutral meaning that is embedded in the ‘separation of church and state’ — a significantly less ‘hostile’ notion. As these secular ideas travelled to other parts of the world, the word ‘church’ was replaced by ‘religion’, especially when they encountered multi-religious societies. In the process the ‘hostility’ was further diluted.

The notion of ‘secularism’ transmuted in content and form in Europe over the past three centuries. However, it was always

closely linked to the idea of scientific enquiry, scientific method and scientific rationality. In India it went through a transformation when it encountered a social structure that was fractured along religious, caste, linguistic and regional identities. Secularism in the Indian context did not mean ‘separation of church and state’ rather, it was understood as ‘The State shall not discriminate against any citizen on grounds only of religion, race, caste, sex, place of birth or any of them’ (Article 15, Constitution of India). This understanding was arrived at over a period of more than a hundred and fifty years of political debate and freedom struggle.

### **Secular Values and Scientific Temper**

The debate on the importance of modern science, science education, science popularization and science-society relationships had started in India during the early 19th century (Venkateswaran, 2013), and gained momentum during its second half (Madras Presidency, 1866). Phrases like ‘Modern Knowledge’, ‘Scientific Method’, ‘Western Models of Investigation’, ‘Liberal and Enlightened System’ and ‘Scientific Spirit’ became part of the intellectual discourse (Mahanti, 2013). Though, initially, this debate was limited in its reach, by the turn of the century the emerging scientific community, social reformers, media, educationists and leaders of resistance movement had started using these terms frequently. Gradually, these ideas seeped through the osmotic membranes of caste, class and language, and became part of the cognitive structure of the people.

As the debate matured over the next fifty years, Pt. Jawaharlal Nehru, probably, realizing that the notion of secularism had been reduced to Hindu-Muslim Unity<sup>1</sup>, introduced the somewhat hazy idea of ‘scientific temper’ (Nehru, 1946). Over the next fifty years, in an independent India, some of the tenets of scientific temper have crystallized into a more focussed understanding of this term (SPR, 1958). Though it can be argued that the Indian populace of today is more scientifically

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<sup>1</sup> In order to rule the Indian subcontinent, the British master had actively incited large scale violence between Hindus and Muslims.

tempered compared to the days of the British Raj, building a scientifically tempered society still remains a distant dream (Nanda, 2013). The ‘cynical’ may argue that constructing an ideal scientifically tempered society is a utopian dream. The ‘romantics’ may reject the idea of constructing such a society altogether (Nandi, 1984). Others may continue to trace the roots of dynamic and robust democratic structures within a science-society relationship.

The term ‘scientific temper’ might be a fuzzy notion; it does not mean that, at any given point of time, the distinct features that characterize this term cannot be identified. Both science and society continually evolve and therefore the relationship between the two is dynamic, nonlinear, complex and ever changing vis-à-vis a social structure. Consequently, the contours of the science-society-linkage also change as it encounters different socio-cultural structures.

### **Science versus Extra-Science**

As opposed to a continuous progress within the scientific-knowledge-complex, in other structures of configuring the cosmos and its reality, the ultimate truth remains frozen in time. These structures of thought could collectively be termed as extra-scientific. Across cultures extra-scientific, perceptions about the ultimate truth may change radically, but within a specific thought structure, perceptions do not change with time<sup>2</sup>. The rigidity inherent in such thought structures, does not allow any radical change. This renders the propagation of extra-scientific messages easy; the repeatability ensures inelastic crystallization of perceptions within the thought structure of a common citizen. Extra-scientific ideas are transmitted through repeated messages, symbols, social conversation, literature, folklores and religious practices, from one generation to another.

The public understanding of science surveys carried out in India suggest that the migration of people from rural areas to

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<sup>2</sup> For example, the theory of creation in Semitic religions are very different from the theory in the Hindu religion or Buddhist cosmology.

urban centres causes a cognitive void (Raza *et al.*, 2005). In a rural cultural milieu, traditional belief systems, and in turn religious worldviews, are transmitted to new generations through strong interpersonal interaction (Raza and Singh, 2007). Due to changes in cultural settings, in urban areas the interpersonal communication between generations is reduced considerably and thus the process of transmission of traditional ideas gets disrupted. However, the robust interpersonal channel of the rural areas is replaced by even more efficacious electronic channels of communication, which thrive on repeatability of messages. This characteristic of the modern media makes it mellifluous to transmit extra-scientific messages<sup>3</sup>.

### **Ever Changing Scientific Information Causes Cognitive Dissonance**

Scientific information is often counter-intuitive and changes regularly, and at times, radically. In other words, it creates paradigm shifts (Kuhn, 1996) or, to borrow a phrase from dialectical materialism, goes through a phase transformation of 'quantitative to qualitative change'. When a change comes about in the scientific-knowledge-complex, it is not a function of variation in cultural spaces. Firstly, the shifts materialise on a timeline, and initially, dominate the spaces of consciousness that a scientific community holds. Usually, after the validation and broad acceptance of a new piece of information or a new scientific theory by the scientific community, the new ideas seep through the national, regional, cultural, linguistic and even religious boundaries and tend to occupy thought complexes of the non-expert populace over a period of long time. Conversely, in extra-science different religious-cultural spaces offer different 'truths' but within a group the ideas once accepted do not change with time. This difference makes the task of propagating scientific information, idea, laws and consciousness,

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<sup>3</sup> In India as well as in many other developing countries there is no science TV channel, but there are many religious channels. In India 10 religious channels operate on 24X7 basis. Many news or entertainment channels reserve time slots for transmission of religious discourse.

and thereby creating a scientifically tempered society, increasingly difficult.

At the micro level, I have argued elsewhere, the cognitive structure of a common citizen contains spaces which are secular, materialistic and scientifically shaped (Raza *et al.*, 2000). It also consists of extra-scientific ideas. These two diametrically opposite and contradictory spaces continue to co-exist peacefully. A common citizen invokes one or the other, depending upon the nature of the problem that s/he encounters during quotidian life through an assessment of what option will furnish her/him with the desired results. Science communicators strive to propagate secular facts and scientific tenets aimed at enlarging the scientific cognitive space and presume that it will reduce the extra-scientific space. Evidence, however, indicates an increase in scientific information does not necessarily result in reduction of extra-scientific beliefs (TOI, 2013).

The project of 'spreading scientific temper', which is a constitutional duty of the citizens in India, is a quite complex one. Spreading scientific awareness is only a precondition for the creation of a scientific temper. It follows that science popularization cannot be an end in itself. The multi-dimensionality and non-linearity of processes involved in science communication forbid a direct causal linkage. Let me borrow a notion from physics; there are always a few social and cultural dimensions which are 'curled up' and remain hidden from the observer's eyes, any small perturbation in those dimensions may cause a butterfly effect, and all prediction may prove to be wrong (Greene, 1999).

Carefully chalked out strategies for communicating science, may often not yield the desired results. For example, national surveys carried out in the western countries have repeatedly reported inconsequential increase in scientific literacy. The NSF and Euro-barometer reports published over the last 20 years show how worrisome the situation has remained. Scholars repeatedly question the indicators and methodologies followed by researchers who carry out these studies. However, the broad conclusions reflect the primary concern of science communicators that their efforts have not made any significant change.

### **Culture as the Arena of Contestation and Globalization**

Culture is the arena of contestation where ideas collide, transform, renegotiate and get assimilated to form new structures of thought. If we consider the two domains of culture, the scientific and extra-scientific, consistently negotiate and renegotiate with all other domains, the processes could be understood better. For example, statistical tools have influenced economics, politics, literature, judiciary, media, production processes and even religious discourse. The scientific idea that patterns exist in seemingly disordered processes was not accepted without contestation. The discovery of DNA has had profound impact on various sectors of human activity, ranging from archaeology to judiciary. Similarly, the idea of an intelligent being as creator of the cosmos, miracles or omnipresent-omnipotent God are powerful ideas that still influence both, human as well as human activities. Many more examples could be cited. This negotiation and re-negotiation between science and extra-science has become increasingly difficult to understand during the past few decades.

‘Globalization’ along with its baggage of finance capital and market economy has put most societies under tremendous torsional stress. It has exponentially increased the pace of cross-cultural mediation. The clash of ideas, which, during the last century, took place in real time and space, is now taking place in cyber space and is affecting societies profoundly. There is an upsurge in cross-country and cross-continental migrant labour. They act as carriers of their cultures and implant ideas, both scientific and extra-scientific, into the recipient culture. These processes have put traditional societies under great stress and even Europe for the first time after WWII is feeling the heat of ethnic friction. The recent attack on cartoonists in France is an example of this contestation taking the most violent form. Science communicators cannot afford to keep their eyes closed regarding these developments.

### **Conclusion**

Scientific temper refers to a broad set of values that are rooted in the European ideas of the ‘Enlightenment’. These values touch



areas of human cognition and actions beyond the boundaries of science and impinge upon the domain of extra-science. Therefore, when these values encounter different cultural groups or sub-groups on a time-cultural space map, it is important to trace the spaces occupied by extra-science. Subsequently, from the broad set of values, it becomes imperative to draw a list of elements that will assist in claiming larger spaces during the struggle for creating a scientifically tempered society.

The project of 'spreading scientific temper' demands continuous research that should probe social, cultural, religious, economic, political (the list by no means is exhaustive) realities that contribute to the propagation of scientific temper or impede it. There is a need to continually revisit the nebulous notion that scientific temper is.

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