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Creativity, Society and Science

As the twenty-first century approaches we begin to see a flurry of exercises in futurology. From the lay person to the expert (in whatever field!) there is interest and anxiety to peer into the crystal ball to see what lies ahead. Not that anything dramatic is expected to happen at the midnight hour on December 31st of the year 2000 A.D. just because it happens to mark the last moment of the present century!

Indeed, as mathematicians will point out, a century stands out in our reckoning simply because we use the decimal system. With a system of eight digits, 100 would mean sixty four while in a system of twelve it would be as much as one hundred and forty four! It is the same decimal system that prompts us to attach special significance to the so called silver, golden and diamond jubilees.

Nevertheless, like all such 'special' occasions, the passing of a century makes us introspective. Have we, as the current representatives of the human race, achieved enough to be proud of? Can the price paid for those achievements be justified? Have we made existence easier or more difficult for our successors? What benefits of our experience can we pass on to the generations that will follow ours?

A cynic might say that these exercises in anticipation are only of academic value. Like most new year resolutions, these pearls of wisdom are scattered and soon lost. In any case, if our experience of the twentieth century is any guide, the accelerated growth of science and technology makes any estimates of the future quickly out of date. Who, at the close of the nineteenth century, would have allowed for nuclear bombs, space travel, communications technology, heart transplants or the green revolution?

But, a sincere exercise in estimating the future, however faulty it may eventually turn out to be, is better than no exercise at all. Such attempts help us outline action plans which are of short term value and which can, hopefully, be corrected as new inputs are received. Human societies, nations in particular, should undertake such exercises from time

to time, and not only at the turns of centuries. My ideas presented in this article are in the Indian context.

The intellectual capability of a human society is reflected in its *creativity*. As a Sanskrit *shloka* describes:

साहित्य संगीत कला विहीनः साक्षात्पशुः पुच्छविषाणहीनः ।

—a person who is without literature, music and the arts is but a beast, only shorn of horn and tail. Here the emphasis is on creation as well as appreciation of the liberal arts. In the past, human cultures have been judged by these criteria.

However, whether it is the Kanchipuram temples or the Taj Mahal, Kalidasa or Tansen, the hallmark has always been 'creativity'. These examples of creativity arose in response to some driving urge, either individual or societal. Their excellence is seen in the way they have withstood the march of time.

Added somewhat belatedly to this list of manifestations of creativity, in the Indian context, were science and technology. In this day and age a nation cannot aspire to greatness if it cannot promote originality in science and innovativeness in technology. I give two historical examples to illustrate how we, Indians, have been found wanting on these counts in the past.

In his celebrated work the *Aryabhatiya*, fifth century astronomer Aryabhata writes:

अनुलोमगतिर्नीस्थः पश्यत्यचलं विलोमगं यद्वत् ।
अचलानि भानि तद्वत् समपश्चिमगानि लंकायाम् ।।

Translated literally it means that just as the rider on a boat observes the stationary objects on the land moving in a backward direction so do the stationary stars appear to move westwards on the sky.

To us today this statement conveys the fact that viewed from a spinning Earth the stars appear to move along westward trajectories: a fact that is well known and accepted. Yet in Aryabhata's time this was a revolutionary concept. For, the dogma, originating (most probably) with the Greeks, that the Earth is fixed and the celestial sphere revolves round it, had been prevalent in India too.

How should society react when a well known and well respected scholar makes a statement contrary to the accepted notion? Before coming to this question let us look at what happened several centuries later in Europe, when another scholar made a revolutionary statement.

It was Nicolaus Copernicus who, in the early sixteenth century, went even farther than Aryabhata in challenging the Greek dogma. Not only did he have the Earth spinning round a North-South axis, he also had it going round the Sun.

In this case society reacted strongly. The challenge to the geocentric theory was seen as a challenge to the foundations of religion. And so, the Copernican ideas were pronounced heretical and their author had to face hostile criticism throughout the rest of his life. His strong supporters likewise faced religious sanctions, the most famous of them being Galileo. Galileo who faced inquisition for propagating Copernican ideas. Yet, eventually the factual nature of the Copernican heliocentric theory became established and accepted.

We thus have a situation in which a new idea met with strong resistance, but it won through because of the tenacity of its proponents who were convinced of its factual nature.

In contrast what do we find in Aryabhata's case? His own followers and subsequent generations of astronomers either ignored his revolutionary idea or tried to re-interpret his *shloka* differently to rob it of its actual meaning. The flexibility of the Sanskrit language allows one that liberty! The upshot of it all was that a new idea (which happened to be correct) failed to gain the hearing it deserved.

Sir Hermann Bondi has rated the success of a new idea in science as follows: 100 per cent if it is readily accepted, 50 per cent if it evokes strong opposition and zero per cent if it is ignored. On this rating Copernicus scores 50 and Aryabhata zero! This is a reflection not on these scientists but on the societies they lived in.

My second example comes from the comments of Abdus Salam, a Nobel Laureate in physics. Salam points out that the Taj Mahal in Agra and the St. Paul's Cathedral in London were constructed approximately in the same period, the seventeenth century. Both are considered supreme examples of architecture and reflect the maturity of contemporary art in India and England. Both countries enjoyed strong and stable dynastic rule. If at all, the Mughal empire might be considered as having a greater all round influence than the English rulers of those days enjoyed.

Yet, there was one difference. England, in the seventeenth century, produced an Isaac Newton who laid the foundations of modern science. In India there was no scientist. Indeed, the appearance of a scientist like Newton on the English scene was not entirely an accident. Science had taken root in that country. The Royal Society under the patronage of the ruling monarch already represented the best in contemporary science in England.

Support for science as a creative activity dates back to the renaissance period of Italy when some enlightened aristocrats acted as patrons to gifted scientists. By contrast, we find no example in Indian history of royal patronage for science and the scientists. And so it was that the Mughal emperors who could build the Taj Mahal and could boast of patronage of the arts, music and literature apparently never thought of supporting scientific creativity.

It was this disregard for science and its technological outflow that finally tilted the balance. Although we like to argue that the tiny British nation could subjugate the Indian giant through a 'divide and conquer' tactic, that only accounts for part of the reason. No less important was the fact that an inferior technology, facing an advanced one, stood very little chance of survival.

Why did creativity in science and technology flourish in Europe and not in India? Was it that the problems of survival in the more difficult climate of Europe forced the inhabitants to seek new ways to improve their living standards? Did our philosophy of bearing all adversities with no complaint (and looking towards a better deal in the next birth) make us contented with our lot? These questions probably have no simple answers but they should nevertheless be raised and discussed by scientists and historians.

Meanwhile, with these two examples in mind: let us now turn to the future. Today, whether we like it or not, science and technology are very relevant to our welfare and future development.

Alvin Toffler in his book *Future Shock* has graphically shown how the run-away growth of Science and Technology has led human societies to a state of bewilderment. Ray Bradbury once said that the life of a person born around the First World War was realisation of what was earlier regarded as science fiction. The inventions that we enjoy and dread today all came in increasingly rapid succession and there seems to be no end to the sequence in the foreseeable future. Social reaction to these inputs has not been a coherent one. Consider the following quotation:

After a long period today we witness hatred, unholiness and dishonesty rampant in the world. Devotion has disappeared. Simplicity and straightforwardness are being ridiculed while justice remains only in the name. Confusion and lack of purpose are widespread; nothing appears to go according to plan.

The above extract which looks so appropriate to the present age in fact comes from a book entitled *Vicissitudes* written by Louis Le Roy in the year 1575! It was a time when science and its technological applications were just beginning. But the new culture of science generated a sense of social bewilderment just like the one we are facing now.

A rational response to these developments has to include two corrective measures. First, we as a nation must keep ourselves very much in the mainstream of science. It would be suicidal to isolate ourselves from it, as our history tells us. Second, we must learn to assimilate S&T, to face up to this impact.

Let us consider the latter issue first. It is true that the above description by Le Roy is very apt in the present circumstances. It is also possible to identify some of the evils of present day society with the rapid

changes brought about by the impact of S&T. In the advanced countries mechanisation has brought about increased efficiency. But it has also generated idleness: man has much more spare time now because machines do the work for him. Or, there is unemployment and hence frustration. Enforced idleness brings its own evils like alcoholism, drug addiction etc. In developing countries there has been rapid urbanisation with cities unable to cope with the flow of persons in search of work, with growing pollution and rising crime. The get-rich-quick ways offered by technology have bred corruption.

But this is where the second point matters. Human society needs to develop a maturity to be able to digest what S&T have to offer. This is where the liberal arts have a role to play. If a well-to-do human being finds more free time at his disposal, can he not spend it in pursuit of literature, music, painting or architecture? The human brain is at its best when it is creative, and next best when it can appreciate creative work by others. Why should it not produce conditions that lead to another renaissance? With its rich heritage of accumulated wisdom from many religions and philosophies India is much better placed to combat the evil effects of S&T, than the nations of the West.

With this optimistic view we should look at the first point. We have to resist the temptation to turn round and go back to the simpler life of the past. The very facility of communications in the modern world forbids a country to isolate itself and go its own way, especially in the reverse direction. We have to accept S&T in spite of the above drawbacks.

This is where creativity in S&T counts. We cannot afford to simply buy scientific knowledge and technological know-how from other nations: we have to produce our own, adapted to our needs. Instead of rejecting mechanisation because it takes away jobs, we have to create new jobs by exploring new and appropriate technologies.

An example will illustrate the point. A few years ago, a foreign country wished to enter into collaboration with India in a joint venture for producing small aircrafts. We did not take a positive decision. Now we are having to buy the same aircraft from the same country at the cost of precious foreign exchange.

Creating something new is not easy. There are birth pangs and the new-born does not look attractive at first. But with patience, the ugly duckling can become a majestic swan. It is always tempting to buy the ready-made products manufactured abroad. In the short term this appears to meet our need: in the long term it leads to an economic dependence which in turn may lead effectively to a colonial status.

Have we learnt this lesson from history? At a superficial level, we have. A look at the investment made by the nation in science and technology seems to suggest that we, as a nation, understand and appreciate the vital role of science and technology in our future welfare.

Since achieving independence we have seen proliferation in the number of universities, research institutes, R&D laboratories as well as an impressive increase in the money available for S&T projects. However, one is still compelled to ask the question: "Are we being creative enough?"

For, money and facilities apart, creativity ultimately requires a human brain. What good are the resources if there is no motivated human being drawing on them? It is the real shortage of such motivated persons that seems most alarming to me today.

Under typical circumstances a nation looking for brainpower for its S&T projects would expect to find it amongst its university graduates. Howsoever one may castigate the British Raj, the fact remains that the country did succeed in getting good scholars and researchers from the few universities in the first four decades of this century. The universities succeeded because they had at least a few inspiring and dedicated teachers. Sadly, that situation does not obtain today, in general. The reasons are many: let me advance those I consider most important.

First, since independence, the creation of research institutes and R&D laboratories has effectively denigrated the universities to a second class citizenship. The autonomy, working conditions and flexibility enjoyed by the former have been noticeably absent in the university framework. This has resulted in brain-power shifting away from the universities to locations where it is isolated from the bulk of the undergraduate population of this country.

This is not to say that there is no brain-power in the universities today. Excellent researchers and dedicated teachers are still to be found there, but their numbers are steadily diminishing. The academic atmosphere conducive to their work has been steadily eroded over the years. For, the universities have been saddled with constitutions that deny them the true autonomy that is needed for achieving academic excellence.

Autonomy, of course, comes with responsibility for maintaining standards. It demands a will to resist political pressures and a dedication to values that place academic excellence above power and authority. In our ancient tradition, the *rishis* conducted their schools in forests away from the distraction of urban life. They did not go to royal courts except to remind the reigning monarchs of their duty to protect the educational environment from outside interference. It was the monarch who visited a *rishi* for some particular favour or advice. Today, the flow is in the reverse direction: we see the academics visiting seats of authority in search of power and status.

It is usually argued that highly intelligent students reject careers in S&T in favour of more lucrative professions like accountancy, engineering and medicine. I do not think money is the only deciding factor. Dignity of profession, the joy of creativity and a relatively more relaxed way of life are attractions of an academic career that make up for the adverse

income differentials. This is why in the advanced countries, despite similar differentials, motivated students still opt for academic careers.

Moreover, in view of the balancing role played by the humanities—the liberal arts—it is essential to ensure that while we try to improve the life of the scientist and the technologist we also create conditions where these subjects also flourish. A Rabindra Nath Tagore is as important for our society as a C.V. Raman.

The key to a successful entry into the twenty-first century, therefore, lies in creating conditions which will bring out creativity in S&T as well as in the arts. The first step in that direction has to be through sincere attempts to revitalise our universities, to restore to them the dignity and stature that they so badly need.