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Popular Science

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Abstract— **Portmanteau words like 'infotainment' and 'edutainment' well reveal how great can be the value of media in spreading information and education. Science will not inspire, if not for media; it will become a pastime for bookworms merely. So, to liberate us from a 'frog-in-the-well' existence, we must communicate and we must know. I can see media as digging tunnels through innumerable wells and creating a network through which information can be exchanged and scientific knowledge shared- globalization and global villages can be viewed that way. Science can be used to enlighten the masses, not as staple of pedantic lectures but liberated of jargon and intellectual elitism. Science is firmly grounded in laws but still amazes. It also intimidates. Text book science certainly does. Not so with popular science. It is contemporary realization that science has to deal with literature; it cannot afford to lord over an isolated realm. It will have to get folk appeal- be butt of jokes and at the heart of humour. To be 'happening' and form an interesting part of 'noosphere' it has to even get parodied. It may also venture into speculation and evoke wonder rather than harp on realism all the time. Information has to be blended with entertainment to become palatable as infotainment. Science has to enter speculation and learn its lessons from science fiction to keep up its popularity and even relevance. Putting its finger on the nerve of contemporary populace, science has to be egalitarian, not elitist. At the same time, popular science has to be guarded from overt theatricality and sensationalism. So, the line dividing science fiction from futuristic writing has to be carefully drawn**

I. Introduction

Portmanteau words like 'infotainment' and 'edutainment' well reveal how great can be the value of media in spreading information and education. Science will not inspire, if not for media; it will become a pastime for bookworms merely. So, to liberate us from a 'frog-in-the-well' existence, we must communicate and we must know. I can see media as digging tunnels through innumerable wells and creating a network through which information can be exchanged and scientific knowledge shared- globalization and global villages can be viewed that way. Science can be used to enlighten the masses, not as staple of pedantic lectures but liberated of jargon and intellectual elitism. Science is firmly grounded in laws but still amazes. It also intimidates. Text book science certainly does. Not so with popular science. It is contemporary realization that science has to deal with literature; it cannot afford to lord over an isolated realm. It will have to get folk appeal- be butt of jokes and at the heart of humour. To be 'happening' and form an interesting part of 'noosphere' it has to even get parodied. It may also venture into speculation and evoke wonder rather than harp on realism all the time. Information has to be blended with entertainment to become palatable as infotainment. Science has to enter speculation and learn its lessons from science fiction to keep up its popularity and even relevance. Putting its finger on the nerve of contemporary populace, science has to be egalitarian, not elitist. At the same time, popular science has to be guarded from overt theatricality and sensationalism. So, the line dividing science fiction from futuristic writing has to be carefully drawn.

II. Learning from Literature

In his preface to Hyperspace Kaku recalls Nobel Prize winner Isidore I Rabi's stance who castigated physicists saying that 'science –fiction writers had done more to communicate the romance of science than all physicists combined"(xii).

So, science is also learning from literature. In fact, science has picked up more from literature than just the use of literary devices. Scientists are working and writing on themes suggested by most imaginative of authors.It has been understood that though science may lose popularity if it does not become more appealing or more practicable/applicable as technology, literature will remain relevant whatever be the drift of times. Pure science, therefore, garners support from literature in gaining popularity. For example, sitcoms that parody science or use jokes tapping on stereotypes of scientists and mathematicians ultimately inspire the audience to check the fundamental theories.

Modern science writing aims to make science accessible to the informed laymen, for example Richard Dawkins has compiled an anthology of scientific papers in The Oxford Book of Modern Science Writing (2008) with a title allusive of this orientation. Similarly Roger Penrose has written a much acclaimed book The Emperor's New Mind: Concerning Computers, Minds and the Laws of Physics (1989), another Oxford publication.

Many scientists give enigmatic titles to their essays, not only this they begin explicating on their theories through illustrations, evocative imagery, anecdotes and allegories and analogies. They may also allude to some mythological story rather than just citing terse precedents from the scientific world.

Media's role in spread of scientific awareness and temper cannot be gainsaid.It goes beyond literature to visual and performing arts. Where should one place MJ's moon-walk or music called metallica? One may also be reminded of cubist paintings and surrealistic art, and automatic writing. Does the allusion to science in these media make or mar its purpose? Media, for the purpose of the paper, is writing, performance or technological media-all.

III. METHODS

Science is adopting a multi-pronged strategy to gain media popularity.

First method involves demystification of traditional ideas and received wisdom or folklore or even nursery rhymes. Hoisting counterposts to check various statements by. For every answer that literature or scriptures offer from creation/genesis to rainbows and butterflies- science has an alternative answer emerging in rational and logical world. Parodies of nursery rhymes also highlight how our perspectives change with technological advancement. This one by Ian D Bush is shared by Kaku:

Twinkle, twinkle little star
I don't wonder what you are,
For by spectroscopic ken,
I know that you are hydrogen. (Hyperspace. 186)

Second strategy to make science appeal to the reader works by highlighting its own enigma, evoking mysteries and keeping questions open-ended as in discussions on nature of electrons, parallel universes, other dimensions and time travel. Offering itself as the window to the universe and laying out vistas to be explored. Even hypothesis have become as worthy of attention as thesis itself; sometimes demanding even more respect.

It was the poet who hitched his wagon to the moon first, scientists followed and then came the 'giant leap for the mankind'. Is it not true that Isaac Asimov envisaged the arrival of robots and laid down three laws of robotics fifty years before robots first appeared in reality in Japan? Robots were first talked about in a Czech play called RUR by KarelCapek (Rossum's Universal Robots) in 1920. Artificial Intelligence, Cybernetics and Genetic Engineering have also inspired sci-fi writing with human sojourns into Jurassic periods and conceptions of androids, humanoids, cyborgs, hybrids and clones. We have moved from textual robots to actual robots and from robot slaves of RUR to Asimov's intelligent robots materialized as Asimo, the real-world humanoid developed by Honda and displayed at Expo 2005. Sci-fi magazines have time-travel, space travel, wormholes, aliens and UFO s as patent objects but modern science writing too takes these as serious subjects. From Science Fiction, we move to the realm of Futuristic Writing. In his preface to Hyperspace, MichioKaku informs: 'Physicists at the California Institute of Technology, for example, have seriously proposed the possibility of building a time machine, consisting of a wormhole that connects the past with future. Time machines have now left the realm of speculation and fantasy and have become legitimate fields of scientific research"(x).

Science fiction and futuristic writing both emerge at the intersection of science and literature, but the first is fictional while futuristic writing based on sound theories and analyses is considered non-fiction. Sci-fi has inspired the scientists with possibilities of time-travel and space-travel to an extent where futurists like Stephen Hawking and Alvin Toffler have built sound reputations for themselves exploring these themes.

Apart from sci-fi and futuristic writing, there are biographies of scientists that may invoke debates and sustain interest being hinged on debates. For example, consider the play Copenhagen centered on a meeting of scientist doyens.

A third quite effective strategy adopted by scientists to popularize their endeavours is to joke about their work, appear as caricatures in cartoons and animated movies and parody their own seriousness. This is a winsome method indeed as the stereotype of the boring scientist is turned over its head. Poems that dramatize science wars and retell stories of scientists also evoke interest in the origin of science polemics as in "Said Ryle to Hoyle" that recounts how Hoyle's Steady State Hypothesis was battered by Ryle's Telescopic observations(See Dawkins MSW. PartII 172). Similarly, erudite treatises may be written couched in literary frames as The Emperor of All Maladies: A Biography of Cancer by Siddhartha Mukherjee. The text alludes to Leo Tolstoy's Anna Karenina. It describes a cancer cell as immortal. JBS Haldane's scatological poem "Cancer's a Funny Thing" also builds upon the theme (MSW. Part II. What Scientists Study. Dawkins 172). It is said that when in 1930, physicist Wolfgang Pauli hypothesized a new, unseen particle called the neutrino in order to account for the missing component of energy in certain experiments on radioactivity that seemed to violate the conservation of matter and energy, he stated his achievement almost as a censure: Pauli asserted that he had committed the 'ultimate sin' by predicting the existence of a particle that could never be observed. 'Cosmic Gall' about Neutrinos by John Updike may also be quoted to illustrate the Pauli's point:

Neutrinos, they are very small.
They have no charge and have no mass
And do not interact at all.
The earth is just a silly ball
To them, through which they simply pass,

Like dustmaids down a drafty hall
Or photons through a sheet of glass.
They snub the most exquisite gas,
Ignore the most substantial wall,
Cold-shoulder steel and sounding brass,
Insult the stallion in his stall,
And scoring barriers of class,
Infiltrate you and me! Like tall
And painless guillotines, they fall
Down through our heads into the grass.

IV. The Pitfalls

Worship of science too can become irrational sometimes. We may speak of 'scienticism' here. One recalls the 'spherical cow' metaphor that emerges from a spoof on the reductive reasoning of scientists that imposes simplistic interpretations on complex phenomena. Everything may be reduced to facts. It may be emphasized and revealed that number crunching is another thing and science does not always work best through reductive thinking. In fact, the continual enigma presented by and the fascination with the 'schrodinger's cat' hypothesis only stresses the difficulty of considering contingencies as the hinge of any thesis. How to define and capture flux and how to comprehend complex phenomena will be the subject of science; it may be realized, however, that phenomena are not reducible to physical laws merely. They are too complex and virtually irreducible to equations though humans by nature would impose their own perceptions on these philosophical or physical.

Another strategy also exists, though its gains are dubious and may be it earns notoriety rather than fame for science and scientists. It is hoax. Starting with alchemy, the pursuit of gold in the history of science that bespeaks of human fascination with the glitter of gold. In fact, an eighteenth century play was called the alchemist. Soon it was realized that alchemy was a pseudo-science rather than science. Hoax is science that makes news but is found to be fraudulent, morphed or tempered on investigation. It is a bogey claim to some discovery or invention. Hoax feast on science and some of them are legendary enough. For instance, there was a hoax when media in 2002 raised furore over the possible disappearance of the 'blonde' gene disappearing imputed to WHO study ; in truth, however, no such claim was made by WHO. And what happened to the 2K virus the dread of all computer programmers?

V. The Copenhagen Debate

Science is also considered the measure of human progress. It demonstrates our capability in our perceptions of the abstract as well as the minutae, but at the opposite end, also our insignificance in a universe of astronomical distances. It pampers the anthropocentricism that keeps the morale of humans up. Histories and Biographies emerge from this man-centric outlook. Sometimes the biographies of scientists become interesting case studies of a scientific venture, even a political or social commentary capturing the milieu of the times. Such a semi-biographical play is Copenhagen by Michael Frayn that has a particular meeting between two scientists in 1941 as its focus. One was Werner Heisenberg who gave his name to the "Uncertainty Principle" well-known amongst scholars of physics and chemistry and the other was Niels Bohr, an equally famous counterpart.In 1927 they did some research together and it is supposed to be of significance to the nature of the second world war. According to Wikipedia, the play had its premiere in London in 1998 and it was successful: 'Copenhagen opened in the National Theatre in London and ran for more than 300 performances, starring David Burke as Niels Bohr, Sara Kestelman as Margrethe Bohr, and Mattew Marsh as Werner Heisenberg. It was directed by Michael Blakemore' (Wikipedia).The play had its Broadway opening in 2000 and was adapted into a TV movie in 2002 by Howard Davies produced by the BBC.

As an excerpt from Copenhagen, a play on science goes: Act II

Bohr:It works, yes. But it's more important than that. Because you see what we did in those three years, Heisenberg? Not to exaggerate, but we turned the world inside out! Yes, listen, now it comes, now it comes.... We put man back at the centre of the universe. Throughout history we keep finding ourselves displaced. We keep exiling ourselves to the periphery of things. First we turn ourselves into a mere adjunct of God's unknowable purposes, tiny figures kneeling in the great cathedral of creation. And no sooner have we recovered ourselves in the Renaissance, no sooner has man become, as Protagoras proclaimed him, the measure of all things, than we're pushed aside again by the products of our own reasoning!- We're dwarfed again as physicists build the great new cathedrals for us to wonder at - the laws of classical mechanics that predate us from the beginning of eternity, that will survive us to eternity's end, that exist whether we exist or not. Until we come to the beginning of the twentieth century, and we're suddenly forced to rise from our knees again.

Heisenberg It starts with Einstein.

Bohr It starts with Einstein. He shows that measurement - measurement, on which the whole possibility of science depends - measurement is not an impersonal event that occurs with impartial universality. It's a human act, carried out from a specific point of view in time and space, from the one particular viewpoint of a possible observer. Then, here in Copenhagen in those three years in the mid twenties we

discover that there is no precisely determinable objective universe. That the universe exists only-as a series of approximations.Only within the limits determined by our relationship with it. Only through the understanding lodged inside the human head.(ACT II)

The socio-cultural milieu and concerns of the age that spawned and saw the world wars comes through in this dialogue from the play in ACT I:

Heisenberg I've no idea what's a secret and what isn't.

Bohr No secret, either, about why there aren't any. You can't say it but I can. It's because the Nazis have systematically undermined theoretical physics. Why? Because so many people working in the field were Jews. And why were so many of them Jews? Because theoretical physics, the sort of physics done by Einstein, by Schrödinger and Pauli, by Born and Sommerfeld, by you and me, was always regarded in Germany as inferior to experimental physics, and the theoretical chairs and lectureships were the only ones that Jews could get.

Margrethe: Physics, yes? Physics.

Bohr: This is physics.

Margrethe: It's also politics.

Heisenberg The two are sometimes painfully difficult to keep apart.

Bohr So, you saw those two papers. I haven't seen anything by you recently.

Heisenberg :No.

While physics is compared to politics much as technology can sometimes be equated with arm race, so is ski-ing compared with physics again in Act I:

Heisenberg: Your ski-ing was like your science. What were you waiting for? Me and Weizsäcker to come back and suggest some slight change of emphasis?

Bohr: Probably

Heisenberg: You were doing seventeen drafts of each slalom?

Margrethe: without me there to type them out.

Bohr: At least I knew where I was. At the speed you were going you were up against the uncertainty relationship. If you knew where you were when you were down you didn't know how fast you'd got there. If you knew how fast you'd been going you didn't know you were down.

Heisenberg: I certainly didn't stop to think about it.

Bohr: Not to criticise, but that's what might be criticised with some of your science.

Heisenberg: I usually got there, all the same.

Bohr: You never cared what got destroyed on the way, thought. As long as the mathematics worked out you were satisfied.

Heisenberg: If something works it works.

Bohr: But the question is always, What does the mathematics mean, in plain language? What are the philosophical implications?

Heisenberg: I always knew you'd be picking your way step by step down the slope behind me, digging all the capsized meanings and implications out of the snow.

Margrethe: The faster you ski the sooner you're across the cracks and crevasses.

Heisenberg: The faster you ski the better you think.

Bohr: Not to disagree, but that is most . .. most interesting.

Heisenberg: By which you mean it's nonsense. But it's not nonsense. Decisions make themselves when you're coming downhill at seventy kilometres an hour. Suddenly there's the edge of nothingness in front of you. Swerve left? Swerve right? Or think about it and die? In your head you swerve both ways. . .

Margrethe: Like that particle.

Heisenberg: What particle?

Margrethe: The one that you said goes through two different slits at the same time.

Heisenberg: Oh, in our old thought-experiment. Yes. Yes!

Margrethe: Or Schrödinger's wretched cat.

Heisenberg: That's alive and dead at the same time.

Margrethe: Poor beast

Bohr: My love, it was an imaginary cat

Margrethe I know.

Bohr: Locked away with an imaginary phial of cyanide.

Margrethe: I know, I know.

Heisenberg: So the particle's here, the particle's there.

Bohr: The cat's alive, the cat's dead

Margrethe: You've swerved left, you've swerved right.

Heisenberg Until the experiment is over, this is the point, until the sealed chamber is opened, the abyss detoured; and it turns out that the particle has met itself again, the cat's dead.

Margrethe: And you're alive.

Bohr: Not so fast, Heisenberg.

Heisenberg The swerve itself was the decision.

Bohr: Not so fast, not so fast!

Heisenberg: Isn't that how you shot HendrikCasimir dead?

Bohr:HendrikCasimir?

Heisenberg: When he was working here at the Institute.

Bohr: I never shot HendrikCasimir.

Heisenberg: You told me you did.

Bohr: It was George Gamow. I shot George Gamow. You don't know - it was long after your time.

Heisenberg: Bohr, you shot HendrikCasimir.

Bohr: Gamow, Gamow. Because he insisted that it was always quicker to act than to react. To make a decision to do something rather than respond to someone else's doing it.

Heisenberg: And for that you shot him?

Bohr: It was him! He went out and bought a pair of pistols! He puts one in his pocket, I put one in mine, and we get on with the day's work. Hours go by, and we're arguing ferociously about - I can't remember - our problems with the nitrogen nucleus, I expect - when suddenly Gamow reaches into his pocket...

Heisenberg: Cap-pistols.

Bohr: Cap-pistols, yes. Of course.

Heisenberg:Margrethe was looking a little worried.

Margrethe: No - a little surprised. At the turn of events.

Bohr: Now you remember how quick he was.

Heisenberg:Casimir?

Bohr: Gamow.

Heisenberg Not as quick as me.

Bohr: Of course not. But compared with me.

Heisenberg: A fast neutron. However, or so you're going to tell me...

Bohr: However, yes, before his gun is even out of his pocket . . .

Heisenberg: You've drafted your reply.

Margrethe: I've typed it out.

Heisenberg: You've checked it with Klein.'

The play blurs the line between philosophy and science. In fact, the play emphasizes that philosophy may guide or misguide a scientific endeavour and it may engender a scientific enigma but it may even resolve it.

In Act II there is a discussion on the open-ended nature of science. Not science that works as, to put it in Isaac Asimov's words from I, Robot 'the slide-rule genius' may say, not science as an open-shut case rather science that puzzles and poses challenges to human observation, perception and claims to objectivity. Consider this statement from Act II:

'Bohr: And I'm met at the barrier by Einstein and Ehrenfest. And I change my mind because Einstein - Einstein, you see? - I'm the Pope - he's God - because Einstein has made a relativistic analysis, and it resolves all my doubts.'

The statement, however, is so ambiguous that it seems rather an affirmation of doubts than resolving of them. And this is emphasized in the dialogue that follows:

'Heisenberg: No, but I show him the strangest truth about the universe that any of us has stumbled on since relativity - that you can never know everything about the whereabouts of a particle, or anything else, even Bohr now, as he prowls up and down the room in that maddening way of his, because we can't observe it without introducing some new element into the situation, an atom of water vapour for it to hit, or a piece of light - things which have an energy of their own, and which therefore have an effect on what they hit. A small one, admittedly, in the case of Bohr . . .

Bohr: Yes, if you know where I am with the kind of accuracy we're talking about when we're dealing with particles, you can still measure my velocity to within - what . . .?

Heisenberg: Something like a billionth of a billionth of a kilometre per second. The theoretical point remains, though, that you have no absolutely determinate situation in the world, which among other things lays waste to the idea of causality, the whole foundation of science - because if you don't know how things are today you certainly can't know how they're going to be tomorrow. I shatter the objective universe around you - and all you can say is that there's an error in the formulation!'

After a while Heisenberg tries to expound on his ideas by creating analogies wherein he is a photon and Bohr is an electron.Bohr, apparently, draws upon the same analogy to continue the scholarly debate.

It appears that the open-ended nature of the debate must be responsible for the play's popularity, though some intricate scientific questions were involved and demanded from the audience sound scientific knowledge and even participation in the debate.

VI. Conclusion

Beyond this, science exudes influence on all fields and all fields give back to science. This symbiosis becomes obvious where science fiction and futuristic writing have guided prospective inventions. Sometimes there are resonances of fiction in science like the 'god particle' Higgs Boson, the 'robots' envisaged by Isaac Asimov, and fantastic hybrids like unicorns and sphinxes that inspire genetic engineering. Science in media helps. Science is released from the scientific clique. Media has made all watertight compartments impossible- all realms have bearings on others. They could have been instrumental in ushering the nuclear and atomic bombs.

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