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The attitude of a man determine his speech and actions. That is why it is more important for children to leave school with positives attitudes about learning than with acquired and refined skills and knowledge. A child in school may learn to read but unless he also gains a positive attitude about reading he will not read on his own. So it is with science. Along with the acquisition of the skills and knowledge of science should come a positive attitude about science. Furthermore in the field of science as well as a positive one. This is the subject at hand.

It has been said that those who forget the past are condemned to repeat it. The developing nations of the world casting acquisitive glances at the industrialized West should take heed. There is a lesson to be learned from the past serious errors of the scientifically and technologically advanced nations. A historical analysis of the scientific development of the West evinces that too frequently an inordinate emphasis has been placed on the value of science and that the enterprise of science has been exercised with too little caution. The historically emergent lesson is this, “yes, approach science enthusiastically, nut with a judicious quantum of caution.”

### Enthusiasm For Science

That scientists need to foster enthusiasm for science is evident. Enthusiasm is certainly related to the availability of research funds but more importantly it is related to the number of students who might consider reading science. The enterprise of science will not continue long if there are no protégées of today’s scientists. The task is not too difficult. Initial enthusiasm for science is readily produced. Basically all that is needed to bring hurrahs is a roll-call of past scientific accomplishments and future possibilities. That science has produced great benefits for mankind is unequivocal. The most visible of such benefits come surely from the dramatic accomplishments in both the prevention and treatment of disease. Just this past year the news media carried reports of the worldwide eradication of smallpox, a dreaded disease in ages apparently now past.

We are benefited by the availability and variety of foods greatly increased due to the use of fertilizers, pesticides, and herbicides. At the same time man’s labor has decreased. For instance, in one season herbicides can reduce from 60 hours to 12 hours the time it takes to keep an acre of maize

weed free. In a world plagued by the dual problems of population growth and arable land decrease, the large scale use of chemicals is indeed the only way currently available to maintain a sufficient level of food production (Boraiko, 1980). Looking to the future, the above mentioned problem of decreasing arable land may one day be solved. Consider a more specific form of this problem, decertification or desert encroachment. Dry areas already cover one-third of the earth's landmass. Every year 70,000 square kilometers is lost to desert, but men are fighting back. For example, in Iran where migrating sand dunes cover five million hectares of land, an oil-mulch is being sprayed on dunes to help stabilize and to retain moisture in the dunes. This allows drought resistant shrub seeds planted before spraying to germinate and grow, and to subsequently reforest a previously barren land-scape (Gore, 1979).

Irrigation of course has been long used to make dry lands productive, but often with irrigation comes the problem of salt build-up. In the Imperial Valley of the United States 400,000 acres of irrigated land have been underlain by a system of perforated pipes used to flush out the salt residue. Where such projects are economically not possible there is still the possibility of using salt-tolerant vegetables such as a new variety of tomato currently being developed at the Bodega Bay Marine Laboratories, California.

And if there is no water, not even salty water available then there remains the possibility of cultivating desert-adapted plants that have commercial value. In Israel, the United States and Mexico desert experimental stations are cultivating the Jojoba bean or goat nut plant. From the Jojoba bean a super-lubricant can be extracted for industrial use. The California day weed, Euphorbia lathyris yields a white latex that can be refined into crude oil at a cost of about seventeen Naira per barrel. Both of these can be grown in desert environments with traditional, low technological farming techniques (Gore, 1979).

If these above things are insufficient to arouse enthusiasm for science, there are the more exotic, perhaps esoteric fields of study like regeneration. There is now

“evidence that the limited regenerative ability of mammals can be electrically augmented, perhaps enabling them to grow their own replacement limbs and organs.”

(Rehns, 1979)

or, there is the field of fiber optics, which one day may be as revolutionary as the computer. Ahead lies the ability to transmit by light 10,000 simultaneous conversations through a single pair of glass

or plastic hair-like fibers (Boraiko, 1979). These are but a few things briefly mentioned. The list of scientific wonders goes on and on.

It is not surprising then that in past years there has been no lack of enthusiasm for science in many cultures. Indeed, modern man much impressed with his abilities has to ardently embrace a science-based, mechanistic world-view that technical progress has been uncritically accepted as man's highest good. (The acceptance of a mechanical worldview is the result of much more than just an ever-enthusiasm for science. It has more to do with a people who have lost their spiritual mooring, but that is a subject of its own.)

### The Slide Into Disillusionment

In the West, the general public esteem for science and scientists rose dramatically from about the 15<sup>th</sup> century and into the 20<sup>th</sup>. Two events in the 19<sup>th</sup> century, one in Britain and the other in the United States testify to the heady heights to which science has climbed.

The 1851 Great Exhibition in London was a display of a man's scientific and cultural achievements. The aim of the Exhibition was accurately stated by the Edinburgh Review:

“...to seize the living scroll of human progress inscribed with every successive conquest of man's intellect.”

Prince Albert who greatly promoted the Exhibition commented,

“Nobody who has paid any attention to the peculiar features of our present era will doubt for a moment that we are living at a period of most wonderful transition, which tends rapidly to accomplish that great end to which all history points - the realization of the unity of mankind. The distance which separated the different nations and parts of the globe are rapidly vanishing before the achievements of modern invention, and we can traverse them with incredible ease; the languages of all nations are known, and their acquirements placed within the reach of everybody: thought is communicated with the rapidity, and even by the power of lighting...Gentlemen, the Exhibition of 1851 is to give us a true test and a living picture of the point of development at which the whole of mankind has arrived in this great task, and a new starting-point from which all nations will be to direct their further exertions.” (See Montgomery, 1976)

The Americans not to be out done staged their own display of scientific prowess in 1876, the Centennial Exposition in Philadelphia. Recently, Henry Graff of Columbia University has commented,

“It was a time of worship for machinery, and a lust for industrial and political power beyond anything anyone had ever known before.” (See Matthews and Baken, 1975)

Nearly ten million people came to see exhibits that ranged from the latest model false teeth to Bell’s telephone. One of the main attractions was a Corliss steam engine that was 40 feet high, generated 2500 horse power, and ran some 8,000 gadgets in Machinery Hall. The exhibition buildings covered 450 acres.

Indeed technical progress was seen as man’s highest good. But events of the 20<sup>th</sup> century have changed the picture. In 1976 during the American Bicentennial celebration, Newsweek magazine reflecting upon the Philadelphia Centennial celebration commented,

“If Americans were innocents a hundred years ago, They were also imbued with an overweening - and ultimately disastrous confidence in a destiny that turned out to be considerably less manifest than anyone expected.” (Matthews and Baker, 1975)

For Americans in particular the over-emphasis on science and technology was disastrous. It led to great disillusionment. Science has not accomplished the things they had hoped and so there is an increasing lack of interest. Worse yet there has set in a paralysis of over-caution. People just do not want to take any chances on any new development. Given today’s’ climate it is doubtful that the Wright brothers would have ever made their first powered flight or that Henry Ford would have ever sold a single Model T. Recently the eminent American historian Lynn White remarked,

“Why has the level of antagonism toward science so clearly risen in our society during the past decade or so, to a point where many professionals feel not only angered at the mixed public appreciation of their efforts but also threatened by declining support for their researches? The problem is public alienation. For a variety of reasons a significant part of the general public has become distrustful of those goals, values and methods (of science).” (White, 1979)

We have a public one ebullient over its science now alienated and distrustful, and even antagonistic.

This great disillusionment began with the First World War and come to its apex with the ecological disasters of the sixties and seventies. Wars in ages past have had a glamour, almost a

charming attractiveness about them. They were times of honor, great deeds, and heroism, but in the 20th century the swords and shields of gentleman warriors were completely replaced by the products of science: armored tanks, automatic weapons, bombs and lethal gases. On July 1, 1916, 110,000 English and Australian soldiers engaged the Germans at the battle of Somme. In a matter of a few hours 60,000 of them were dead or wounded. The Somme offensive has the dubious distinction of being the “greatest single military slaughter in history” (Montgomery, 1976).

After a brief respite the slide into disillusionment continued with the second World War. There is no need to enumerate in detail the contributions of science to that war effort. Weapon destructiveness and sophistication reached startling proportions and culminated in the development and use of the first nuclear bomb. That science and technology were used in war efforts may well have been excused for we were locked in death struggles. But disillusionment came of age with the technologically precipitated ecological disasters of recent years.

The West awoke one day to discover that its people could no longer safely breathe the air or drink the water or eat the food. One may find excuse from using science to develop weapons, that is to use science for destructive purposes, but what do you say when something developed for man’s benefit results in his harm? What do you say when the 2,4,5 trichlorophenoxyacetic acid herbicide used to increase food production is discovered to cause cancer, birth defects, genetic mutations, and miscarriages? Again there is no need to enumerate in detail the problems of toxic wastes, herbicides, pesticides and fertilizers, of air and water pollution, all the result of scientifically developed, technologically deployed solutions to earlier problems.

Now I do not mean to indict and try science for malicious deceit. I fully ascribe to the principle that science is a moral. Morality is the sole domain of the human spirit. But, because that is true, science can never solve the fundamental problems of the human experience; and an over-reliance upon science will always result in disillusionment. W.H. Auden in *Age of Anxiety* well wrote,

“Self judged they sit, sad haunters of Perhaps who after years to grasp and gaze in  
have got no further. Then their first beholding...”

After years of scientific striving and accomplishment there are many who feel that we are little better off than at the start.

## A Lesson for the Developing Nations

In the developing world, the voices of government, of educators, of the news media call in unison for the scientific and technological development of their nations. They are not without just reason for surely much development is needed to solve many of their pressing difficulties. Yes, but...the developing nations are not immune to the post-development malaise of the West and should thus be ware.

This essay began with the note that education is as much an acquiring of attitudes as it is the learning of facts and figures. Let scientists then, encourage this attitude in their students:

“Be enthusiastic about science, but be cautious. Strive for great accomplishments, but refrain from over-commitment to them. Count the cost of every victory over nature, for in the world today there are many defeats masquerading as victory.”

At the risk of sounding too pessimistic, I would like to conclude with this thought. The French philosopher-historian Chateaubriand once commented that “forests came before civilizations, the deserts after”.

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