Science and Anti-Science at the Smithsonian Institution

Sophia Vackimes

> *It is impossible to escape the impression that people commonly use false standards of measurement-that they seek power, success and wealth for themselves and admire them in others, and that they underestimate what is of true value in life. And yet in making any general judgment of this sort, we are in danger of forgetting how variegated the human world and its mental life are. There are a few men from whom their contemporaries do not withhold admiration, although their greatness rests on attributes and achievements which are completely foreign to the aims and ideals of the multitude. One might easily be inclined to suppose that it is after all only a minority which appreciates these great men, while the large majority cares nothing for them. But things are probably not as simple as that, thanks to the discrepancies between people's thoughts and their actions, and to the diversity of their wishful impulses.*
>
> -Freud (1961:1)

Introduction

During the summer of 1994 I began working on a science anti-science project as part of my participation in the Ford/Mellon Research program at Princeton University. During this time I began researching a) the core idea of whether or not "Big Science" should continue to be considered as a matter for political and public support here in the United States, and b) the outrage of scientists who view their research as being lightly dismissed by an ignorant public. The reason for focusing on "Big Science" is not only the obvious attractiveness of research such as the SSC (Super-conducting Super Collider) which was stalled by Congress, but more so the form the arguments raised on both sides of the issue take.

Part of the science anti-science debate has been centered around the notion that the lay public does not know enough about science to be able to discuss its place in our society. Thus, it could be argued that, for this reason I would be unable to participate in the debate, but here I take the position discussed by Bruno Latour in *How Can We Foster Agnosticism?*

> To combine some degree of 'insiderness' and 'outsiderness' can indeed be taken as the most general methodological injunction. Even this does not hold for the sociologist of science, however. If you say to be biologist, 'you cannot study a frog because you are a frog, you will be laughed at.... Only when science is the object of study is the merit of the outsider's position denied...[but] no one denies that the sociologist of religion can be both an agnostic and a good sociologist, but a sociologist of science in not permitted to be an agnostic. (Latour 1981:200)

In the initial stage of this research I was not really sure of where I would find evidence of a science anti-science debate, so I dug into heaps of books and journals in an attempt to locate relevant sources of information. Was the problem real or merely a perception of a problem? Is there a problem lurking in every high-tech lab?

Collecting a vast array of articles on two words–science and anti-science–became my initial task. One of my first sites of inquiry was the Journal of the American Association for the Advancement of Science (AAAS). I wondered how a non-scientific debate would be presented to their scientific readership for consideration?

Neither the cover, nor the ads, nor the lengthy articles showed any indication of a problem. The scientific community expands as quickly as ever; the future of our nation for the next century has been proudly described, prescribed, inscribed. The heavy gloss photography was not giving away any clues either. The advertisements were distracting. The fact-laden articles were not about problems, but rather about scientific clarity, the new enlightenment, and technological advances so evident in our age. But then an exhibit was inaugurated.

The Smithsonian Institution: a New Exhibit

"Science in American Life" opened at the National Museum of American History in April of 1994. Its conception had quickly come under fire by the American Chemical Society which had granted the Smithsonian 5.3 million dollars for this enterprise. It was subsequently reported that "the exhibit curators carefully rethought the exhibit" (Bird 1994: E15). Simultaneously with this exhibit's opening, another museum controversy, this time at the Smithsonian itself, was also being commented on by the press:

> It was a humiliating spectacle, scholars being forced to recant the truth. Curators at the Smithsonian's Air and Space Museum in Washington have been compelled by veteran's groups to rewrite the text for an exhibit on the bombing of Hiroshima. (Bird 1994: E15)

That "Science in American Life" was not the only exhibit at a national museum which has encountered opposition lately is cause for grave concern, especially since it is clear that political pressure is being used to dictate the direction of the Institution's activities.

"No Scientist, but a Friend of Science," was a sidebar in the journal *Science* which announced that U.C. Berkeley's ex-chancellor, Michael Heyman had become a new head of the Smithsonian. According to the announcement, Heyman is considered a "great fund-raiser, especially for science programs, and a champion of ethnic diversity" (Flam 1994:729). The erosion of the Smithsonian Institution's academic and intellectual freedom began immediately after Heyman's appointment. At the opening of "Science in American Life," it was reported that the program ran into "difficulties," and the display of the Enola Gay at the Air and Space Museum was canceled. Mr. Heyman's new direction for the Smithsonian is illustrated in the following interview at the National Press Club luncheon:

> Mr. Karmin: ...the Enola Gay is not the only controversy at the Smithsonian–don't worry...

Mr. Heyman: I thought I was getting off the hook here. (Laughter)

Mr. Karmin: ...there's dismay over the Science in American Life exhibit which seems to be characterized, in the questioner's opinion, by the same excessive political correctness. Do you have a comment?

Mr. Heyman: Well, I don't want to give a long speech, and I probably could because I've spent now seven hours with that exhibit, and I've spent an evening and a whole day in a wonderful seminar with representatives from the American Physical Society—those are the physicists of the United States, including a Nobel Laureate, who were very critical of the exhibition. In their view, the exhibition is—degrades science and is unbalanced in the sense that it views science's failures to a much greater extent than sciences triumphs.... I have a certain amount of sympathy with that viewpoint. I was trying to think of why and I said to myself, suppose that we put on an exhibition about the legal process, and we used lawyer jokes.

Caveat Emptor

(Please consider that each of the following sections can be read as you would visit a museum: skip whatever you wish, read whatever you wish. The total time for reading all the material in the exhibit, watching the interviews, participating in interactive displays, and doing experiments is about 17 hours. Thinking time is extra. Based on my observations, the average visitor probably spends about 20 minutes to go through the exhibit. The first sitting spot is about four hours into the exhibit on some lawn chairs. What follows are textual renditions of sections from the exhibit.)

Science in American Life

On entering the first section of "Science in American Life," a sign hanging at the entrance introduces the exhibit as follows:

Like politics, business, or religion, science is right in the thick of American history. Today science and technology permeate culture and daily life.... The challenge for the 21st century is to make responsible choices about science and technology.... This exhibition does not focus on scientific discoveries in isolation, but on historical episodes in which the American public has grappled with the implications of living in a scientific and technological age.

Orientation Area

A group of life-size photographs of eight adults and two children of different ethnic backgrounds; men, women, and two teen-agers greet the public. Recordings of their opinions on science are heard while each one of them is spotlighted. Some of these individuals appear

throughout later on as hosts of individual sections. The backdrop behind them is made up of several panels which depict significant periods in American History from the 1870s onward.

Laboratory Science Comes to America, 1876-1920

Ira Remsen's Lab. The first section starts with a reconstruction of Ira Remsen's laboratory at the Johns Hopkins University in Baltimore, Maryland. Ira Remsen and his colleague, Constantin Fahlberg are represented heatedly discussing matters pertaining to the discovery of saccharin after Fahlberg had gone ahead and patented it. The public is asked to keep this conflict in mind for it will arise again in the exhibit. A panel reads "Stop & Think" and notes that "women and minorities" were excluded from science study at major universities during this period.

> ...besides being workplaces, research labs have become important cultural symbols of truth and objectivity. As every advertiser knows, charts and test tubes, spectacles and white coats are all icons that the American people have come to trust.

Hampton Institute, Virginia. A wall-size poster shows a scene at the physics lab with Hugh Brown instructing, while eight black men and two black women perform scientific experiments. Hampton was founded in 1868 in order to educate former slaves in an effort to help them adjust "to life as free men and women." A graduate of Hampton, James Murie is also portrayed; he was half Pawnee, and became himself a Pawnee ethnographer, being one of the first investigators to use recording devices and wax cylinders to preserve cultural items.

Scientists in the City. Another huge poster; Mulberry Street in Lower East Side, New York City circa 1900. It is a crowded street scene in which migrants and immigrants trade, work, and share urban space. Charles Frederick Chandler is shown as a campaigner against merchants who tampered with milk; a lactometer is displayed. Harvey Washington Wiley led the battle for food safety, and sought to show that the use of sodium benzoate in food was poisonous. Ellen Swallow Richards, is noted as the first woman to graduate from MIT with a B.S. degree.

HOST: Cynthia Friend, Chemistry Department, Harvard University:

> ...although obstacles facing young women interested in science today are different and certainly less onerous, they should take a cue from Ms. Swallow Richards. She taught us a lesson that still applies today.

Coal Tar: the Beginning of Synthetics. A toxic black and sticky waste product, tar is used to synthesize many everyday commodities. A display in the shape of a tree shows different tar products; pitch, phenols, disinfectants, salicylic acid and aspirin, bakelite, phenol, saccharin, food flavorings, TNT, photographic developers, dyes, antipyrine, anilines, benzene, and laxatives. The introduction of synthetic versions of organic chemicals created industries that, among other things, supplied Levi-Strauss' jeans company with a cheap supply of synthetic indigo; the picture of an indigo producer from the Sahara is displayed.

The ominous wedding of industry to the Nazi war effort is shown in a political cartoon. In America, with World War I in progress in Europe, Morgan Taylor Brugett, President of Organic Chemistry at Columbia University declared "I have no hesitation whatever in saying that a well-developed synthetic dyestuffs industry is absolutely necessary for the security of our country."

Measuring Minds. During World War I psychologists tested recruits in order to distinguish those men unfit for battle. The testing was deeply flawed, and the results often reflected racial, and cultural biases. Several different IQ tests from different dates are displayed in a case. Army mental testing eventually helped to shape educational testing.

Science for Progress, 1929-1940

> *A sentence which begins 'science says' will generally be found to settle any argument in a social gathering, or sell any article from toothpaste to the refrigerator.*
>
> –The Nation (1928)

The World Fair. "Science and their supporters promote science as the key to a better future." This area is designed with the World Fair of 1939-40 in mind:

> ...an extravagant show paid mainly by large industrial corporations [which] capitalized on the public's fascination with science and left many Americans eager for more. People came to identify science with progress; economic, social and even moral.

The Trylon and Perisphere. These two symbols emphasize the belief of progress brought on by scientific and technological achievements. A small audiorama shows short newsreels which depict the scientific advances of the era. Heralded at the end of World War I; "science will bring progress in...worker efficiency, agriculture, food testing, public health, and home economics." These films show progress as "corporation sponsored," a "world made better by science." Also featured are quizzical mixes of science and science fiction such as the fair's General Motors pavilion and air-conditioned men's suits. World Fair souvenirs such as model cars, postcards, and lapel pins are displayed. Behind them a large picture of a man begging for food during the Great Depression is shown. In order to "save capitalism" corporate leaders "launched a vigorous advertising campaign that promised a better tomorrow."

The Scopes Trial. The Scopes "monkey trial" which "challenged the traditional authority of religion on the issue of teaching evolution in public schools" is also featured. The microphones used to broadcast the trial during "the golden era of radio" are displayed in a case.

Science Service. This journal "carefully cultivated a public image of the scientist as a dispassionate, objective seeker after truth." Although in the 1930s, the image of the lone scientist is the strongest, it was then that companies started hiring inventors and scientists to work in teams for their research laboratories.

Toys For Boys. This exhibit shows children's scientific experiment sets; chemistry, engineering, and physics activities were marketed for the aspiring young male researcher, "instilling in them the beliefs of a scientific culture." During this time "[f]ashion is created out of test tubes" as scientific progress is "made available" to women through the development of synthetic materials used in clothing.

Behavioral Science. The age of behavioral science is illustrated. Skinnerian experiments were designed to improve weapons of war; a homing pigeon with a helmet is used to guide missiles.

HOST: S.B. Woo, Physics Department, University of Delaware:

> We in the scientific community need to develop better strategies for 'selling' science to the public and convincing them of its value to society.

Man In a Chemical World. A mural by A.C. Morrison, 1937, is shown. It reads "Science Supporting Industry." "Pure science" is represented as a woman who kneels besides a large and strong man who upholds the factories and laboratories of the chemical industry above his head.

Mobilizing Science For War, 1940-60

The barbed-wire entrance to this section emulates the gateway to a military camp. Overhead hang several posters which advertise the national effort against wartime enemies; the Japanese and the Germans. The caption reads "USA More production," "The Federal Government invests in science for national defense.... Big Science builds the atomic bomb and poses a dilemma for the modern age." A huge mobilization of scientists begins, and the national investments in scientific research will result in an industry which after the war will take new forms. The size of these projects, and the expenditure needed to support them will pave a new road for scientific research. "The federal government joined the scientific partnership that included universities and industrial corporations."

National Defense. "The Federal Government invests in science for national defense...'Big Science' builds the atomic bomb and poses a dilemma for the modern age." The national investment in scientific research, which included universities and industrial corporations, resulted in an industry shaped by the exigencies wartime spending and development priorities.

Women and Minorities During World War II. Women and minorities were recruited to work on wartime aims such as the Manhattan Project. A CD-ROM display can be activated by the public which plays back oral histories as told by some of the projects' workers. Among them, a Chinese woman, Chien Shung-Wu, a nuclear physics worker at Columbia University and Leona Woods, a graduate student of Nobel Laureate R. Mulleken.

The Cyclotron. Development by E.O. Lawrence in the 1930's, representations of this device comprise the next section. Together with a model of his particle accelerator is the cigar box in which a sample of plutonium was sent to the Smithsonian Institution.

A panel labeled "Stop Look and Think" reads:

> Do you believe that scientific research necessarily brings practical benefits, enough practical benefits to justify the expense? Or do you believe that pure scientific research should be supported simply for its own sake? If you were a member of Congress voting on the budget would you vote to spend tax dollars to support pure scientific research?

Atomic Chain Reaction. The largest area of the exhibit is a life-size model of the testing "pile" used by Enrico Fermi and his collaborators. The first self-sustaining chain reaction is represented by the exhibit's recreation of the pile. Next to the pile, a visitor can simulate a reaction. 94,000 workers were employed in the production of making plutonium for several bombs, and as a result the town of Hanford, Washington was built by DuPont under government contract.

Hanford Controversy. Subsequently, Hanford became a storage area for nuclear waste and other refuse which eventually polluted the Columbia River. Access to government documents through the *Freedom of Information Act* was requested by residents of the area as a pattern of new illnesses undeniably emerged in the community.

HOST: Jose V. Martinez, Program Manger for Atomic Physics. U. S. Dept. of Energy:

> Science is being called upon to solve this problem of safe, permanent storage of some 100 million gallons of radioactive waste....

First Atomic Explosions. Nagasaki. A small arcade shows five pictures of the effect of the bomb on the ground: one shows a woman whose bare back has the pattern of the fabric of her clothes burned into her flesh; another one has a dusty silhouette of a disintegrated human being on some stairs. "In a world at war, the discoveries of Big Science had helped to change the rules by which people and nations live together."

Doomsday Clock. "A symbolic warning of the lateness of the hour as mankind confronts (or fails to confront) the urgent problems of our time" (*Bulletin of Atomic Scientists* Dec. 1947). The cover of this scientific newsletter is "the doomsday clock"; its hands are drawn closer to midnight during times of international conflict.

Popular Culture. Americans reacted to the atomic threat with commemorative neckties, atomic songs and polkas, atomic sewing needles, the Bikini bathing suit, and candy dispensers for "Atomic Fireballs." Next to this case, is the fallout shelter of the Anderson family of Ft. Wayne Indiana. It had been installed beneath the front yard at their home.

Better Than Nature, 1950-1970

Science for Better Homes. The era of "Wife Planned Homes," and "Complete Community" development begins. A typical suburban Albuquerque home is built in this area. A television in the living room is on and it shows typical programs which include "what to do if the bomb goes off," while a housewife vacuums the floor. A Formica covered kitchen with

orange colored plastic utensils is on view. In the garden covered with a synthetic lawn a shed-full of pesticides is ready for peacetime "bugfare."

The Pill Comes to Life. Around the corner the development of the contraceptive pill is discussed. A product of the SYNTEX laboratories in Mexico, it was originally developed to "control populations in Third World countries...but ironically found its greatest use and had its greatest impact on American women." A panel reads: "birth control stirs religious controversy, specially among Catholics" and a headline of a 1968 Gallop Poll reads: "Majority of US Catholics Disagree with Pope's Ban."

Planned Parenthood. Margaret Sanger and the crusade for women's access to birth control is noted here: "[a] trained nurse, she opened the first birth control clinic in Brooklyn, New York, in 1916, and also helped found Planned Parenthood International."

HOST: Vivaya Melnick, Cell Biologist and Bio-ethicist, University of the District of Columbia:

> We must be aware that seemingly 'simple solutions' often have implications that range from basic individual rights to global, political, and economic relationships.

About twenty different commercially available pill dispensers show a transformation in the marketing of dosages of the drug as testing continued for its side effects.

Silent Spring. In a separate section, an interview with Rachel Carson is featured. She "changed the way society viewed science." For her, the natural world was a delicate living organism. She authored *Silent Spring, The Edge of the Sea,* and *The Sea Around Us.* Pesticide-destroyed pelican eggs, and later developed "safe" pesticides are on display here.

Science in the Public Eye, 1970 To The Present

The wall panel has a frieze which shows a sequence of pictures of planet Earth rising above the displayed items.

Mass Media. "In their living rooms, Americans could see great scientific achievements, including the Apollo 11 moon walk...on TV and in the popular press, people could also see technical disasters...Three Mile Island, the Challenger disaster, and Chernobyl." With the aid of mass media, the populace began developing environmental consciousness and a concomitant willingness to question scientific authority.

Cold Fusion. B. Stanley Pons and Martin Fleischman work on cold fusion cells, and eschew the scientific practice of publishing their results in a scholarly journal. They use mass media instead to publicize their controversial results. A young schoolgirl's project with an interpretation of this experiment is on display.

Science-Fiction. Together with scientific discovery, popular culture continues to portray science. A life-size Frankenstein stands next to a case which displays posters and memorabilia from science-fiction films: Fritz Lang's *Metropolis*, Boris Karloff's *Frankenstein*, Spielberg's *Jurassic Park* (complete with the movie's mosquito in piece of

amber), and Woody Allen's *Sleeper*. Over-arching these items several mythical figures are painted: a siren, a gorgon, sphinxes, and two-headed monsters.

The Super-conducting Super Collider. A cartoon which has a diagram of an atom with the SSC bill in the center. Electrons are named after states bidding for its construction. It would have been the world's largest atom smasher, but its lingering construction at Waxahachie Texas, was canceled by Congress due to funding costs reaching into the billions of dollars. In the largest case of the whole exhibit are two crimson-red 5 foot long cut-up sections of cylinders which belonged up the defunct SSC.

In Search of the Ozone Hole. How can a society distinguish a crisis avoided from a crisis that never was? How can people choose between competing scientific explanations and make wise decisions about complex technologies? Susan Solomon, led the first expedition to Antarctica in 1986. As a result of this sort of research, the sale of aerosols dropped, and were later banned by the FDA.

Stanley Cohen's Lab. Here is where the first recombinant DNA organism was made; "factories of bacteria" could be started; products such as insulin could now be produced. "Scientists crossed the barrier that separates one species from another and created organisms that would never exist in nature...to its supporters genetic engineering was full of miraculous promise. Others saw it as pure arrogance–science tampering with the essence of life." The Assilomar Conference was a forum where scientists began to express concern over the production and uses of recombinant DNA, and the ethics of interfering with nature.

HOST: Matthew George, Department of Biology, Howard University:

> My own work on the evolution of DNA involves one of the greatest controversies going right now, namely, can the origins of the different human racial groups be traced to a single region of the world?

Biotechnology. Boyer, Stanley Cohen's partner, starts a new company in California called Genentech. A map of California shows university campuses, biotechnology labs, and financial firms which compete in a new field: Microgenics, Cooley-Godward, Avigen, Adeza, Ernst & Young, Intelligenetics, Molecular Design Ltd., etc.

Recombinant DNA. A video featuring the images of the Marx Brothers is introduced by movie commentators Siskel & Ebert. It illustrates how recombinant DNA works; when a gene is exchanged for another the effect is like when a music score is substituted for another one at a concert. An orchestra playing the overture to "La Traviata," would sound instead like "Take me to the Ball Game."

Biotech Basics. The applications of genetic engineering in agriculture are depicted. The engineering of tomatoes would result in fruits which when treated with arctic flounder genes would store for months. An illustration by artist Terry Miura shows a frenzied scientist applying an electric shock to a "Frankentomato."

Green Biotech. An interview with garbologist Bill Rathje. What about waste management? Should enzymes be industrially produced to eat up the fabric in mass

manufactured "stone washed" blue jeans? Should bio-degradable plastics be manufactured? Should plants that exude plastic be cultivated?

Medical Biotechnology. The treatment of gene-linked diseases is dealt with here. Ashanti DeSilva, age four, was the first person to receive new genes as a medical procedure. Correctly functioning genes were added to her white blood cells restoring her immune response with each treatment.

The questions raised throughout this section are: "IS IT SAFE," "IS IT RIGHT," "WHAT CAN I DO?" Suggestions are made in this section as to where a person might turn to for information on certain issues raised in the exhibit. Addresses and phone numbers are given for agencies which deal with environmental issues. An exit interactively polls visitors on their thoughts about the relationships between taxation, public opinion, and "Big Science."

Science Center

This is the "Hands On Science" area, in which several experiments and social issues can be explored. Visitors can use lasers to see light and calculate distances, unravel the mysteries of DNA and understand how would it be used in a forensic case, measure radioactive hot spots by using a Geiger counter, discover uses of plastics and how they can be recycled, analyze mental quotient testing considering historical context, and check out sunglasses' UV rating while learning about the nature of the Ozone hole. Visitors can also take home an activity sheet in which science in everyday life is explored. A bibliography for those persons who wish to follow up on any subject is presented, and a visitor's book is provided for individual responses and opinions.

Science and Anti-Science

The media expressed mostly negative views about the exhibit, and generally "Science in American Life," has been labeled as an anti-science presentation. Henry Allen of *The Washington Post* described it an "homage to political correctness as well as science" and he complains that "'the science god' is not correctly represented throughout." The curators, he says, missed several important scientific advances of our century while presenting innocuous images to the public such as plastic, electricity, penicillin, birth control pills, saccharin, pesticides, nylon, the atomic bomb, and Tupperware (Allen 1994:B2C3).

This critique underlines four basic themes that would become the central attacks against the exhibit: abused political correctness, misrepresentation of scientific achievements, omissions of scientific contributions to society, and a failure to recognize the greatness of science. The form used in these "attacks" on science is similar to those described by Robert Park of American Physics Society who wrote about the Enola Gay exhibit at the Air and Space Museum: "proposed scripts for the exhibition dripped with postmodern, academic, politically correct language" (Park 1994:G2). Faye Flam in *Science* also commented that scientists worked with the curators to modify the original text, and that the attitude of the exhibit was toned down from the "earlier versions [which] had more pejorative captions attached to

exhibits such as the atomic-bomb story and items on pollution" (Flam 1994:729). The exhibit's chief curator, Arthur Molella addressed the complaints thus:

> How could an exhibit on science in American life–an exhibit in a museum devoted to the understanding of American history–ignore matters of such importance? What the exhibit is about in its broadest terms is an *extraordinarily complex and evolving interrelationship between science and society.* (Molella 1994b:266 my emphasis)

At the core of the present exhibit's problems is the long-standing controversy which has been labeled science anti-science by many writers. This matter takes many forms which range from open discussions on the role which science must take in our society, to heated arguments which decry "attacks on science." What are these two positions?

What Is Science?

Thomas Kuhn proposed in his *Structure of Scientific Revolutions*, that science is not as empirical an activity as it is often portrayed to be; it is a gradual buildup and molding of facts which eventually are confirmed by scientists who deem them as realities. Kuhn calls these re-articulations the nature of "normal science" (1970:35). Moreover, each scientific revolution rejects precious scientific theories in favor of others. This succession of a theory in favor of another one incompatible with it signals the shift not only of paradigms, but also of problems available for scientific scrutiny (Ibid:6). Changes in science signal that it is bound to the culture in which it functions. Paradigms not only provide a framework for the formulation of hypotheses, and experimentation, but also contain the framework for congruent explanations of results, and the devices with which to discard anomalies in discovery systems (Ibid:33). New paradigms provide flexible thought coordinates which reinforce changing thought processes.

Historically, scientific facts have been re-appropriated as part of the discourse of scientific hegemony. The effigies, legends, and facts of the past are claimed as heritage of the present establishment in order to maintain power and legitimacy. Latour and Woolgar in *Laboratory Life: the Construction of Scientific Facts* (1979), describe the work in a peptide laboratory in which French scientists isolated, articulated, and re-articulated their discoveries as inscriptions. The authors' concern was to delineate the manner in which some statements appeared more fact-like than others. They described in detail the cyclical process of text reification; facts were constructed and then stabilized, and thus artifacts were produced (Ibid:175). "It is small wonder that the statements appear to match external entities so exactly: they are the same thing" (Ibid:177). What results are texts which are fictions, not in the sense that they are "something made" or "something fashioned," but rather in the original meaning of fiction which is that they are merely "as if" thought experiments (Geertz 1973:14). That scientific facts are reworked, is not really a problem; it is the way science is. *E pur si muove.*

What Is Anti-science?

Labeled as "anti-scientists," are a large group of people from different walks of life who not only avidly consume the popular bibliography put out by reputable scientists, but who

also question the determinism which guides scientific activity in our country. They include laymen, social scientists, humanists, professionals, and politicians who are described as "muddleheaded," (Gross and Levitt 1994:1), and which possess a uniformity of tone which is unambiguously hostile towards science, and they are also labeled "the academic left" (Ibid:2). This group's hostility towards science not only "extends to the social structures through which science is institutionalized...there is open hostility toward the actual *content* of scientific knowledge" (Ibid:2).

Science And Democracy

Paul Feyerabend in *Science in a Free Society*, considers scientific activity in this country. He asks a first question which is " What is science" ? and he tells us it is explained by many in many ways, and since perhaps we will never truly understand its mystery, there is no point really in discussing this matter (Feyerabend 1978:73). His second question is, What's so great about science? This point is hardly ever addressed or openly debated; "the excellence of science is 'assumed,' it is not 'argued for'" (Ibid:73). In our society scientists act the way "the One and Only Roman Church acted before them: Church doctrine is true, everything else is Pagan nonsense" (Ibid:74). The assumption of the inherent superiority of science has moved beyond scientific circles and has become an article of faith for almost everyone; no longer a particular institution, it forms part of the basic fabric of our democracy (Ibid:74). But we are warned that science can deteriorate and become as dogmatic as religion the moment the opposition is crushed (Ibid:75). Scientists must operate in the knowledge that their field has been greatly privileged in our society, but it does not posses special rights, and it cannot act on mere appeal of Truth or Rationality. That the participation of laymen will at times be counter-active to science, is certain, but "decision making in a democracy must be learned" (Ibid: 87).

The public is not only the average person in the street, but it is has also constituted itself in organizations with different functions, as is the case with the Congress of the United States and the Smithsonian Institution, both of which have been entrusted with the duties of producing, collecting and relaying knowledge, and defending public rights.

That grandiose public institutions such as the Smithsonian need extensive economic support "in an age of limits," is a fact in America today. The interdependence between private money and public organizations became evident in the choice of Michael Heyman as director of the Institution who for the first time in its 148 year history is neither a scientist nor a certified scholar. Instead, Heyman, is a lawyer who is considered a great fund-raiser, especially for science programs (Marshall 1994:728). Care must be taken as to the provenance of economic support because while "Science in American Life," has been described as bearer of an allegedly anti-scientific message, it is the source of economic support itself which is making loud and clear assertions as to the strings attached to its gifts. The Center for the Study of Commercialism addressed such a concern to Secretary Michael Heyman:

> 'Renting' the Smithsonian name and logo to corporate donors for use in their advertising compounds the problem. This 'generosity' may well come back to haunt your August institution.... One of your donors might turn out to be a major polluter, major cause of illness, or perpetrator of shady business dealings.... (Center for the Study of Commercialism 1995)

In the exhibit there is a small plaque on the wall which reads "other contributors" (that is besides the American Chemical Society with its more than 146,000 members): Brown University, Catholic University of America, Heil Scientific Company, Johns Hopkins University, Stevens Institute of Technology, U.S. Department of Defense, U.S. Department of Commerce, U.S. Military Academy, U.S. Department of Health, and Education and Welfare. *Chemical and Engineering*, provides a list of additional contributors to the exhibit which includes: 3M, Allied-Signal, Merck, Dow Chemical, Eastman Kodak, DuPont, ICI Americas, Monsanto, Shell Chemical, Union Carbide (Ross 1994:36).

Magic, Science And Religion

From the title of Malinowski's landmark essay, one would expect a demarcation, a division in these three activities of primitive man. Malinowski argued that all three of these activities are facets of human understanding; they are isolated from one another. Writing during the Second World War, Malinowski was wrongfully following the ideas of his time in describing human societies in Darwinian evolutionary stages in which Western culture had evolved from savagery, through barbarism to finally become civilized. But the field of anthropology has dismissed such notions, while it has also "evolved" into studying the activities not only of the "savage," but also of "highly sophisticated" groups of people. Cultural relativism exists, and contemporary ethnographies describe conservatory musicians, doctors, lawyers, psychiatrists, primatologists, and physicists.

Yet, in this century Western scientists have steadily increased their "superiority" with regard to the rest of mankind's activities by claiming cultural symbols. And so they can go about discovering the origins of the universe and large expenditures are allocated so they can do so. Steven Hawking in *A Brief History of Time*, in a quantum leap of five consecutive paragraphs sums up the Jewish/Christian/Muslim tradition of the origins of the universe in *Genesis*; Aristotle's dislike of 'the idea of creation because it smacked too much of divine intervention; Kant's *Critique of Pure Reason*; St. Augustine's questioning of God's moment of the creation of the universe and Edwin Hubble's discovery of the distancing of galaxies in order to introduce his own theories. In *The God Particle*, Leon Lederman, former AAAS president and Nobel Laureate appears on the book cover in business apparel as he stands in front of a galaxy which crowns him as if he were wearing a halo. He smiles as he is tossing Newton's/paradise's apple.

What these examples illustrate is the appropriation of cultural icons to explain the mysteries not only of physics, but also religious topics, thus appealing to the "emotional power of cosmology" (Traweek 1988:3). Through this manipulation scientists claim a heritage and the right to transform it. "Big Science" then, is a controlled by a group which has, like a religion,

> (1) a system of symbols which acts to (2) establish powerful, pervasive, and long-lasting moods and motivations in men by (3) formulating conceptions of a general order of existence and (4) clothing these conceptions with such an aura of factuality that (5) the moods and motivations seem uniquely realistic. (Geertz 1973:90)

But while science claims that it deals with the purest form of reasoning available to mankind, the scientific method, its actions encompass magic and religious thinking.

Heretics In Their Midst

The most sacred ideas of many societies are religious, while in ours there is a fusion of the sacred and the profane. Where Einstein left off in his search for omniscience with a "unified theory of the universe," and wrote that God played dice, Lederman writes about "the God particle", and starts his book with the phrase "[i]n the beginning." In our society, however, special depositories for the *mysterium tremendum* (mystery), *majestas* (majesty), and *mysterium fascinans* (fascination), and the *ganz andere* (wholly other) of science must exist (Eliade 1959:9). These are our science museums. Washington D.C.'s Smithsonian Museums are visited by twenty-nine million people a year. Among sacred national symbols such as the Lincoln Memorial, the White House, and the Vietnam Memorial, the Smithsonian Institution exhibits the Spirit of St. Louis, the first ladies' gowns, the Hope diamond, the Star Spangled Banner; beliefs are strengthened and consolidated. Visitors seek to be awed and transfixed by wisdom and mystery.

I turn to Mircea Eliade, historian of religion, to describe the causes for the irritation with the "Science in American Life" exhibit. In *The Sacred and The Profane* (1987) Eliade wrote how humans ascribe religious meaning to space. The boundaries between the sacred and the profane are essential in the establishment of an *axis mundi*; the point from where all else evolves. The exhibit has created controversy because it has violated the fundamental image of power ascribed to "Big Science."

The lay-out of this exhibit is quite simple. It consists of gateways, rooms, one passage, more rooms and an exit. Yet the use given to them sums up the experience of our society during the last century. To go through them one mainly wanders from one display to another. There is no ritual in our visit, whereas religious space contains several ritualistic areas. Usually the gateways of temples *show* the solution of continuity in space immediately and concretely, and therefore have great religious importance. They are symbols and are at the same time vehicles of *passage* from the one space to the other (Eliade 1987:25). Clearly labeled are each of the six sections of the exhibit; each of them was created with the feeling of a particular historical period. STOP, LOOK, AND THINK signs with questioning adults and children throughout the exhibit contradict religious awe and disbelief; sacred space and dogmatic representations are avoided, everyone here has a voice, and a mind. Though there is ample freedom in the way one visits the exhibition, one section must be suffered by all who enter it. It is the passage which deals with the blast of the atomic bomb over Hiroshima. This section breaks the religious time with a shocking reality because the events at Hiroshima were so brutal. The curators brought on the degradation and desacralization of religious values and forms of behavior. Sacred space was obliterated, and democratically "peopled by ghosts [history], chaotic space [non-demarcated], demons [curators], and foreigners [minorities]" (Ibid:29).

Avoiding the display of "trite" personalities, such as Einstein, the curator violated the "totemic principle" of the scientific clan, causing great anxiety in the group, for clans need

"mental solidarity to a far larger extent than does civilized man" (Ibid:22). A clan or totem group is:

> a mode of social grouping [with] a religious system of beliefs and practices. As religion, it expresses primitive man's interest in his surroundings, the desire to claim an affinity and to control the most important objects. (Malinowski 1948:20)

Another violation of space in Eliadean terms is the inclusion of illustrations from popular culture in the exhibit. That the American mind is fraught with ideas of monsters from outer space, that dinosaurs can be manufactured from DNA (Spielberg), or that Frankenstein-like experiments are compared to the manufacture and commercial patent of tomato genes and genetically engineered Onco-mice should not be surprising. Monsters abound in our culture. We do not live in a totally rational era. Why would half-human half-animal gorgons, sphinxes, and centaurs appear in a scientific exhibit? Why not? Isn't gene splicing just a bit more sophisticated than assembling body parts? Without the appropriate icons for the belief of science's supremacy, the scientific establishment becomes vulnerable. The exhibit is:

> an unknown, foreign, and unoccupied territory which still shares in the fluid and larval modality of chaos...an unknown, foreign, and unoccupied territory (which often means, 'unoccupied by our people'). (Ibid:31-32)

Totem And Taboo

Two elements make up the transformation of the ritual territory into cosmos. One, the installation of the *axis mundi* which, as we have seen, has been impeded repeatedly by the curators. The second is "repeating, through a ritual of construction, the paradigmatic acts of the gods" (Ibid:53). Robert L. Park of the American Physical Society feels the "museum presentation is severely skewed: "'[r]ing the bell of evil, and viewers will automatically blame a scientist.'" (Park quoted in Nemecek 1995:21). That scientists who are represented are equated with evil shows how the exhibit denies access to the gods; the offense becomes mythical. If the symbols of the ruling scientific class must prevail, they *must* be displayed. The purpose of this prevalence is the continued symbolic obliteration of the myths, rituals, and icons of non-Western societies.

With the rise of social history, history from the bottom up, the orientation of many historians changed and so did curatorial direction. Historically, scientific exhibits have remained in the phase of objects being presented as commodities and museums were mainly an inventory of items. When "Science in American Life" was inaugurated, it was an exhibit which before it had even opened its doors had stirred controversy because the traditional representations of science had been altered. Some of the novel items found in this exhibit were mythological figures, "hideous furniture," handouts printed with politically correct ink, carpet made out of recycled soda bottles, psychedelic fabric patterns, ugly pictures of the Hiroshima explosion, a bikini with an unrecognizable waistline, and a cut-up section of the SSC; in fact all items were ghostly shadows of our forgotten (scientific) ancestors.

Donors' expectations were perhaps along the line of the Exploratorium in San Francisco, or the Air and Space Museum at the Smithsonian Mall itself. Bright red laser rays,

shadows that stay for several seconds on a photosensitive wall, or giant soap bubbles greater than any adult in the room should have been shown. Large, surprising, colorful objects and experiments fill the Exploratorium. What is notable is that there is no *questioning* of the materials presented, no response is elicited from the audience. Instead of fun, the foci of "Science in American Life," are "critical intersections of science and society, revealing patterns of mutual influence" (Molella 1994c: 2).

Harmony Ideology

It is important to note that the statements made against the exhibit, have been put on the same heap as those labeled anti-science. The notion seems to be an either/or choice among the positions that can be taken regarding of the role of Science in America. Distinct voices, whether personal or professional are treated as those of a muddled group which dislikes science. This purported "apathy" towards science implies deeper accusations than those directed towards the "ignorance of the savages," who must be led by the hand toward progress. Science enjoys this status not because of its "comparative merits, but because the show has been rigged in its favor" (Feyerabend 1978:42).

What the defenders of science have consistently done in their discourse is to polarize the discussion in terms of binary oppositions:

> The academic left...is far too diverse and internally contentious...[their] tone is unambiguously hostile.... To put it bluntly the academic left dislikes science.... The hostility extends to social structures.... There is open hostility toward the actual content of science... (Gross and Levitt 1994:2-3)

This cluster of complaints is erected on the loose suggestion of several false syllogisms.

Lévi-Strauss, in *The Raw and the Cooked* (1964), described the thoughts of "primitive men" as a system of binary oppositions. Throughout this essay we have seen that several authors oppose Enlightenment and Civilization, science and anti-science. Savagery, ignorance, medieval, academic left, and hostility are opposed to rationality. The arguments are presented in a "logico-mathematical" manner (Ibid:30). Would then the only possibility of describing human cultures be along this simple Lévi-Straussian distinction?

Let us consider for a moment that these constructions are indeed true: that anti-science opposes science, that the academic left is hostile to science, and that the hyper-modern language prevalent in some quarters of academia rejects Enlightenment. What we have then is a modern paradox, for it is precisely the scientists who are coming up with the binary oppositions. The form that the science anti-science debate has taken is a conscious and gradual manipulation of symbols in order to facilitate a political maneuver. This manipulation is a demand for negotiation on the representations of science which appear in the exhibit.

In our culture we constantly find that we must *take sides*, we must *be balanced*, that we must *be rational*, and that we must *negotiate with the enemy*. Yet these "diplomatic" attitudes are so prevalent that we often fail to analyze how thought intrusive and controlling these requests are; these arguments are misleading and intimidating. The balance concept assumes a Lévi-Straussian opposition of equals, but there is no equality between academicians

and special interest groups. Equality here is being used as a rhetorical device, and consequently, the Smithsonian's position would be worsened by an acceptance to balance things out. This is a use of "harmony practice," in which balance "eventually plays itself out for the benefit of the stronger disputant" (Nader 1990:5). It seeks to undermine the authority of the curators and thus their novel perspectives. In Commenting on "Science in American Life," American Chemical Society chairman William Nevill argued that "[t]he final product is not what ACS wanted or what the Smithsonian wanted" (Flam 1994:729) thus underscoring the point that balancing attempts did not work. In responding to Nevill's critique, the exhibit's curator, Arthur Molella retorted:

> ...[His comment] trivializes this debate by lending credence to a simplistic polarity between an old DuPont advertising slogan about better living through chemistry and a desire to depict science as 'pollution and death'.... This is ludicrous...the exhibit's script reflected *my* best judgment. (Molella 1994b:13 my emphasis)

In a time when we are so used to compromises and harmonizing (negotiation), Molella's position is exceptional. The curator escaped group think, there has been no subordination of independence, nor was academic freedom compromised. Modern censorship acted subtly through the misrepresentation of political positions and reappropriation of rhetorical devices while it seeks to obliterate legitimate and individual points of view. This trend is increasing; Gross and Levitt have urged that "certain forms of vigilance are appropriate, troublesome as they may be to preoccupied teachers and scholars" (1994:253).

Is it legitimate that in order to remedy the menace to the scientific community, natural scientists should police and suppress dissent?

The restriction of freedom of inquiry "guarded by self-appointed sheriffs of scientific correctness...[is a position which ironically] reflects a flagrantly anti-scientific prejudice" (Winner 1995:74). "Laymen can and must supervise Science...it would not only be foolish *but downright irresponsible to accept the judgment of scientists...without further examination* (Feyerabend 1978:98 my emphasis)." The demarcations of science vis-à-vis spheres of political, economic, and academic control, *and* the current social science boundary-work which examines it should be made available to the public for questioning and scrutiny. This is precisely what "Science in American Life" has done.

References

Allen, H.
1994 Science is Golden: At American History Museum a Backward View of a Century of Discovery. In *The Washington Post* 27 Apr.

Center for the Study of Commercialism.
1995 Letter to Michael Heyman. 7 April.

Eliade, M.
1987 *The Sacred and the Profane: The Nature of Religion.* New York: Harvest/HBJ.

Feyerabend, P.
1978 *Science in a Free Society.* New York: Schocken Books, Part Two pp. 73-122.

Flam, F.
1994 Privately Funded Exhibit Raises Scientists' Ire. In *Science* 265: 729.

Fun Science.
1994 Pamphlet. Washington: Smithsonian Institution, pp. 4.

Geertz, C.
1973 *The Interpretation of Cultures*. New York: Harper Collins.

Gross, P. R. and Norman L.
1995 *Higher Superstition: The Academic Left and Its Quarrels With Science*. Baltimore: Johns Hopkins University Press.

Hawking, S.
1990 *A Brief History of Time: From the Big Bang to Black Holes*. New York: Bantam.

Kuhn, T.
1970 *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Latour, B. and S. Woolgar.
1979 *Laboratory Life*. Beverly Hills: Sage Publications.

Lederman, L.
1992 *The God Particle: If the Universe is the Answer, What is the Question?* New York: Dell Publishing.

Lévi-Strauss, C.
1964 *The Raw and the Cooked*. Vol. I of *Mythologiques*, Chicago, University of Chicago Press.

Malinowski, B.
1954 *Magic Science and Religion*. New York: Doubleday & Co. Inc.

Molella, A. P.
1994a Reply to Faye Flam's sidebar Privately Funded Exhibit Raises Scientists' Ire. *Science* 266: 13.
1994b Research Vistas. *Smithsonian Institution*, Winter: 2.

Nader, L.
1995 Civilization and Its Negotiators. In *Understanding Disputes*, Kaplan, P., ed. Oxford: Berg Press.
1990 *Harmony Ideology*. Stanford: Stanford University Press.

Park, R. L.
1994 "Science Fiction." *The Washington Post*. 25 Sept.

Ross, L.
1994 Science in American Life: ACS-backed exhibit opens at the Smithsonian. In *Chemistry and Engineering*. 5: 4-5.

Science in American Life.
1994 Pamphlet. Washington: Smithsonian Institution.

Traweek, Sharon.
1988 *Beamtimes and Lifetimes*. Cambridge, Mass: Harvard University Press.

Winner, Langdon.
1995 Sheriffs of Scientific Correctness. In *Technology Review* 2: 12.