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Thoughts on Art, Science, and Politics

The title of this talk covers such a broad range of human activities that I could hardly hope to cover it in a single lecture. What I wish to do is to examine the relationship among these activities, all of which are part of the search of humankind for knowledge of the world and for a set of principles on how to behave in the world.

I shall take my starting point from a poem -- one of the best known poems by the American poet Wallace Stevens, The Idea of Order at Key West.

The poem begins with a line of great poetic power: "She sang beyond the genius of the sea" followed by lovely lines that contrast human voice with the voice of the ocean.

Meaning, the poem tells us, comes into nature by and only by the activity of the human spirit.

The noise of the sea becomes something more than just noise because we hear it and we interpret it.

Likewise, I would add, plants and animals and the heavenly bodies acquire significance for us because human understanding envisions in them an "order," that is, a pattern of relations.

Later, in Stevens' poem the key line appears: "She was the single artificer of the world/in which she sang."

The concept is now more precisely expressed: creation is the result of human activity, of human performance.

Order in the world emerges from active human involvement, from the unraveling of hidden relations between objects and events.

Thus is the music revealed that is hidden underneath the noise of nature; and thus the story concealed in the strata of rocks and the layers of fossil bones becomes manifest.

This is the creation I wish to talk to you about, the adventure of the human spirit: an adventure whose essence is communication, shared knowledge, shared emotion, and shared activity.

This venture has been made possible by the unique qualities of human nature, by the evolution of human brain, human language, and human consciousness out of our animal past.

It is this adventure that gives meaning and even purpose to individual human beings -- a purpose here and now, not a purpose there and beyond; a purpose distinct from the pursuit of personal success as well as from the pursuit of personal salvation, because its meaning comes from participation in a collective enterprise, not from preparation for a personal afterlife.

The central feature of this adventure is understanding -- the search for meaning in the structures, events, and relationships that we encounter and perceive.

Understanding is not a simple or unique operation, and the paths that lead to it can be diverse.

We seek understanding through science, which seeks explanations for the regularities of the material world.

We seek understanding through art, which by creating forms and designs and abstractions expresses and crystalizes our emotions, revealing the hidden harmonies in our souls and making them sharable.

And we seek understanding through history and philosophy, which explore our human past and our thinking processes.

Within each of these realms -- science, art, and humanities--there are diverse modes of understanding, different devices, each with a long history and each with a distinct entitlement within the tradition of thought.

I shall call these modes the "rational," the "irrational," and the "unrational" modes, which differ in their methods, their appeals, and their contributions.

The rational mode searches for order, structure, and predictability.

It does so by reasoning, as in philosophy and mathematics, and by experimentation, as in modern science.

It attempts to weed out the irrational and to be on guard against mixing rational with unrational.

The unrational mode is the search for emotional experience, either creative or responsive experience. It is preeminently esthetic and artistic.

It does not seek order and reproducibility but rather intensity and singularity of experience.

It responds to our quest for emotional fulfillment by revealing associations, and awakening resonances whose content cannot be rationalized or put into words.

This is true of music, or poetry, and of all those artistic activities that convey satisfying or provocative relations of form or color or pattern.

But the unrational mode plays another and more important role in human life. It is the realm of choices, of decision making, of commitments to attachments and ideals. It is the unrational search for understanding that provides a major source of our motivation in personal and social activity.

If we were to act only when we have reached a complete scientific understanding of a situation we would be almost always paralyzed.

What allows us to act more-or-less consistently in different situations is that in the course of our lives, we make commitments to certain sets of values, commitments dictated mainly by unrational elements: rooted in part in the biological endowment of humankind in part in the web of personal experiences from infancy to adulthood - in the process of growing up in the human community. Through a set of such commitments each of us builds a self, a conscious instrument for judgment and for decision, which makes it possible for us to act in a more-or-less consistent way in day-by-day life.

We must distinguish between what I have called commitments, with their examined mixture of rational and unrational content, from what I shall call beliefs, which belong to the realm of the irrational. Beliefs may range all the way from trivial superstitions, such as a belief in personal luck at a roulette table or a belief in horoscopes such as appear in most daily newspapers, to the belief in reincarnation or to the more dangerous delusions such as the belief in national destiny, or in racial superiority, or in one's right to profit at the expense of others. Such irrational beliefs tend to generate a core of irrationality that substitutes itself for the consciously examined self of which I spoke earlier.

And yet, the role of irrational beliefs is not hard to understand. They provide an easy, if false, certainty in the place of self-examination. They substitute a trigger for automatic action for the searching choices that lead to personal commitments.

An illuminating area is that of religion, which involves a remarkable admixture of unrational and irrational elements.

Historically, the function of religion has been the provision of comfort to the human beings, who seeks for meaning in life and who struggles against the sense of futility and the terror of death -- what existentialist philosophers call the absurd feature of human destiny: the tension between human consciousness and the awareness of personal transience.

The unrational, esthetic contribution of religion is to help fight despair by inventing for human life a presumption of metaphysical significance: either the gift of election stemming from special creation or the promise of salvation as reward after death. Religion offers both an excuse and a purpose for human existence. And religion also provides emotional comfort by immersing the individual in communal rites and shared esthetic experience.

Yet, in attempting to invent meaning and purpose for human life, religion often has taken over illegitimate changes. It has claimed to be a source of knowledge and not only of spiritual comfort. Religion has endorsed specific cosmologies and specific versions of natural history, and has backed them with its spiritual authority against the rational claims of science and philosophy.

The current controversy between creation science and biological evolutionary science is only one well publicized example. In terms of the present discussion, the essence of the conflict is the opposition of belief against commitment -- the attempt to substitute the assertion of the literal truth of biblical texts for the commitment to learning from observation and experiment -- the commitment inherent in modern science. And the conflict has profound political implications: revealed religion becomes the handmaidens of special conservative interests in opposition to freedom of inquiry. This is very dangerous indeed: burning of books has always been the prelude to the burning of heretics, from 17th century New England to 20th century Nazi Germany.

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Before the rise of modern science, the deliberate pursuit of rationality in the intellectual sphere was the prerogative of geometry and philosophy and history.

Greek philosophers were more concerned with searching into the human mind and exploring the human conditions than with explaining lightning or earthquakes. Their model for the world was the order of geometry rather than the physical order underlying natural phenomena.

What the humanities provided was an alternate comfort than that of religion, a more objective sense of human life -- a commitment to the proposition that the human condition, is potentially explainable through the study of human thoughts and actions.

When science and the accompanying intellectual freedom developed in the modern world, the authority of religion was undermined by the discoveries of science and, the hope for religious salvation came to be seen as hollow. For several centuries humankind trusted to science and technology as the ways to a better future, a vision of rational progress, a world of justice and freedom.



But the realities of society showed the limitations of this optimistic vision. Within the last half century the most advanced and democratic nations of the world have become engaged in two destructive and futile world wars in defiance of the prediction of social philosophers and statesmen. And in the place of optimism and equality and solidarity, we seem now to live a world of irrational nationalism and unbridled individualism. In this atmosphere, existential despair has become widespread: the despair of human beings who have lost hope of personal salvation without achieving faith in a meaningful collective future.

One of the most terrifying visions of human despair and futility that literature can convey is Samuel Beckett's story "The Lost Ones," presumably an allegory of the human condition.

A throng of individuals is imprisoned in an immense cavern.

They have no implements but a set of ladders.

One by one, without any organized plan, the "lost ones" climb any ladder that becomes available, even struggling for possession of one, and seek to find escape by digging into blind tunnels none of which has ever led to a breakthrough.

What is most frightening is that the lost ones never cooperate.

The exploration done by one of them never has any meaning for the others.

All their efforts yield nothing and mean nothing.

The picture of life that Beckett conveys is one of solipsistic futility.

In The Lost Ones Beckett raises the question of personal meaning and personal salvation, and, finding none, sinks into utter despair.

But, what Beckett fails to convey, or rather conveys by contrast, is that meaning and salvation are not personal categories; they come only from participation in shared activities, in the collective enterprise of mankind.

They come from commitments to shared values, communality, morality, and justice.

The optimism of the Greek philosophers and of those in the Enlightenment came from the vision of societies dedicated to communal values.

The sense of personal meaning comes from our shared responses to the Parthenon, to Sophocles' tragedies, to Whitman's and Shakespeare's verses, to Mozart's music, and to Monet's paintings. And also, from our sharing with others, past and present, the understanding of geometry and natural science, and the shared enjoyment of work and companionship.

The artists and the scholars of the past whose work has meaning for us saw human life as an adventure: not the adventure of preparation for an afterlife, but the adventure of understanding, expressing, and delighting in the world in which we live.

Meaning and salvation come to us because we are adventurers -- not lonely adventurers seeking a personal Shangri-La, but adventurers committed to searching for shared experience -- shared within family, within community, within humanity as a whole. Such a personal life makes the awareness of biological death tolerable as just another incident in the adventure of being.

And the lasting part of the shared experience is the contribution that each of us makes to the collective adventure.

Today I wish to limit my comments to the contributions of a certain subset of adventurers, those whom people think of as scientists: who are committed to discovering and clarifying reproducible patterns in the events of the material world which they choose to explore.

Modern science, starting in the sixteenth century when Galileo, Descartes and Newton introduced the experimental method of exploration and verification, set itself a novel task, profoundly different from the geometry and the philosophy of the ancients.

The goal was understanding of a new kind: to explain phenomena and events in terms of experimentally testable hypotheses rather than of ideal concepts.

The first triumph was the explanation of planetary motion by Newton using Kepler's measurements and Galileo's experimental method coupled with Descartes' analytical geometry.

In place of the ideal circles and geometrical speculations of the ancients, Newtonian mechanics introduced measurement and reduction to simple, generalizable statements -- mathematical equations -- dealing with forces, objects, and their motion.

Science, as it has grown since Newton's time, is founded on two main tenets.

The first is the assumption that the human mind processes are in principle congruent with the structure of the natural world, including the structure and function of the human brain itself. This includes into modern science the scientific study of society and of the human mind.

The second tenet of modern science is that no explanation should be taken as even tentatively correct unless it has been submitted to adequate tests, that is, tests whose results could actually or potentially disprove the explanation once and for all.

An expressive way to put this is to say that modern science -- in fact, science altogether -- is perennially on guard against wishful thinking.

Wishful thinking has to be examined and uncovered not only in its crudest forms, such as the belief in the efficiency of prayer in causing rain or the belief that a horse shoes on the wall can bring good luck, but also in its more subtle ways. In fact, the progress of science often depends on uncovering within the body of science certain unexamined, intuitive common-sense assumptions.

Einstein's crucial contribution to physics, for example, was to catch within the edifice of Newtonian physics the hidden common-sense belief that simultaneity between two events could be established beyond any limit -- a seemingly reasonable assumption, yet, as it turned out in relativity theory, an unjustified one.

More generally, the path of modern science has consisted in going beyond the intuitive levels of explanation. Science proceeds by challenging intuition and advances by further and more subtle reexaminations of assumptions whenever new evidence demands it..

It does not perversely question the edifice it has built, but when difficulties arise it reviews its hypotheses in search of hidden flaws.

This is what happened when the science of electromagnetic waves caused Einstein to explore critically the hidden assumptions of Newtonian theory.

And, in both Newtonian and Einsteinian advances the effectiveness of the new solutions was coupled with a kind of esthetic beauty, a revelation of pleasurable pattern and order, and the confidence in the ability of the human mind to expand beyond the limitations of our sense-limited intuitions.

Esthetic beauty and the quest for intellectual order are not the only driving forces in science, however. The course of scientific discovery is profoundly influenced by social forces. The demand for new technology provided the main impetus for the progress of science in the 18th to 19th centuries, and more recently economic factors have influenced the course of scientific research.

This creates a two-fold pull in the direction of science. On one hand, the internal structure of the subject that dictates the direction more fertile of intellectual advance.

Scientists explore problems that arise in the course of their work and seem soluble at a given time with the means at hand, whether the means happen to be Cartesian geometry for Newton, or fruitflies or bacteria for 20th century geneticists, or synchronous or linear accelerators.

In Peter Medawar's words, science is the "art of the soluble."

On the other hand, the call for technology influences the direction of scientific research.

All findings of science, all advances in scientific knowledge, are potentially sources of power over natural phenomena and can therefore have (and do have) profound impact on human affairs and not only on human understanding. The content of science may, to a certain extent at least, be value-free. But, science does not exist in a vacuum - it exists in a human society permeated with values -- in fact, contradictory sets of values.

In the earliest days of the scientific revolution one of its strongest proponents, Francis Bacon, wrote the fateful words: "Knowledge is power." He clearly thought of the newly emerging science in terms of power -- abstract power over the forces of nature as well as political power in the society he as a statesman was bent on ruling.

The ambiguity of his statement must not have been as evident in the early seventeenth century as it is in the nuclear age.

The tie between understanding and power, between science and technology, tends to blur the profound difference between science -- the search for understanding of natural phenomena - - and technology -- the use of science for practical purposes.

In principle, science is indifferent to technological applications.

The landing of an astronaut on the moon or of a space vehicle on Mars had, for example, little to do with science.

These exploits even used a minimum of science: they required only Newton's laws, transistor physics, and thermodynamics.

The rest was technology -- superbly sophisticated technology but not science.

What the planetary exploration achieved in terms of scientific understanding was relatively little -- a few facts of interest to geologists and astronomers but no new synthesis about the universe or the origin of life.

Planetary exploration fulfilled the emotional wish of humankind to spring free from earthbound limitation.

It enlarged the feeling of power over the forces of nature. It caught the imagination of the television public as a great musical comedy or a great football game might do.

But it also added incentive to the fantasies of space wars, not only in the minds of film makers but also in those of our political leaders.

Whether in space or in other spheres of activity, science generates sources of power by making technologies possible.

How the technologies are employed, their use (or absence of use) and the purposes to which they are put, are not in the hands of the scientists.



They are in the hands of society, that is, of those groups of individuals who have or seek the decision-making power in social affairs.

In the case of the atom bomb, the physicists had turned over to Government their skills in service of a grand new technology.

And it was the Government that made the decision to use the bombs. That is, it was society as represented more or less distantly by elected officials more familiar with the manipulations of power than with the process of understanding.

Once a technology becomes available, the decisions are made by a society dominated by a mixture of impulses: rational calculations, unrational visions, and irrational drives to power and control. In other words, the decisions are made not in the world of science but in the world of politics.

And today, in a world living under an apparently permanent threat of nuclear war, the simple belief in beneficial technology is giving place to widespread skepticism.

Each scientific advance that can generate new technology is being feared as a potential danger.

Let me take as an example my own field, that of molecular biology,

It has generated technologies with vast possibilities in applied biology.

Genetic engineering, the methodology for reshuffling genes within and between organisms, promises new understanding of life processes as well as new approaches to medicine and agriculture.

We can visualize a whole range of applications, from production of cheap hormones to correction of certain congenital defects and to production of superior food plants.

All this sounds wonderful, just as the electric motor or the cotton gin were wonderful one century ago.

Yet, even before the first applications of genetic engineering become visible, we hear voices -- some of them serious and thoughtful voices -- warning us of dangers ahead: of possible accidents, of environmental catastrophes, of corruption of scientists if they become drawn into the service of industrial enterprises.

And the consequences of genetic technology, we are told, may be more subtle than the construction of bombs or the alteration of the physical quality of life.

They may intrude into social relations at the level of mutual respect and social justice, as when eugenists preached the superiority of one human group over another or the inevitability of behavioral differences between sexes. And they may raise novel ethical issues, as in the well known case of Baby M.

The misgivings extend not only to technology but to science itself.

Since science is the source of technology, and technology can generate potentially dangerous applications, we hear critics say, shouldn't science be limited, or constrained, or even stopped in its path?

Isn't scientific research an altogether evil pursuit of power?

Before we dismiss these criticisms and misgivings too lightly, we should realize that, behind criticism of science as an enterprise, there is often a protest against the structure and functioning of society, a revulsion against injustice.

There is a revulsion against social systems in which the fruits of science, like those of labor, are directed to selfish gain or private profit or to the preservation of power structures.

Every environmentalist, every critic of technology, is consciously or unconsciously something of a radical, that is, a person who questions the power relations within society.

The central question radicals ask is, who in society makes the decisions and in whose interest?

Who calls the game and how is the deck stacked?

Sorting out rational and irrational in scientific research may help protect the scientific enterprise from its radical critics.

For example, the science of genetics has been the object of suspicion on the part of critics who see it as a source of racism and sexism.

But what these critics faulted was not the solid content of genetics: it was a superstructure of distortions consciously or unconsciously advocated by a few socially biased geneticists.

Yet, for scientists to dismiss the question of responsibility for the impact of science on society leaves them in an ambiguous position, somewhere between that of philosophers and poets on the one hand and that of handgun manufacturers on the other hand.

How elaborate must the feedback loop of responsibility be before its signals become irrelevant noise?

Can we press indifferently any computer key without asking whether one of them may activate an electric chair or a nuclear warhead?

Awareness of the forces that operate in society becomes important.

The ivory tower has windows for us to look out from as well as doors for delivery of knowledge.

And what we see encourages, or rather compels, our participation.

What form should such participation take?

I recognize the importance for scientists to inform the public of the advances of science so that elected officials will be chosen with better understanding of the landscape of available knowledge.

And I recognize the importance for scientists to act as advisors to officials in the formulation of policy.

But, beyond such formal corporate service by scientists, there remains a serious question of responsibility to which science itself provides no answer.

Science in principle deals with "how come" and not "what for." It deals with good or bad theories and good or bad experiments, not with "good or bad" actions. But the neutrality of science ends at the intersection with technology.

The "ceremony of innocence" stops here, where we enter the field of morality.

And yet, personal morality -- the rules of behavior among individuals in day-to-day interactions -- does not clearly prescribe any specific pattern of responsibility with regard to the social consequences of newly acquired knowledge. In thousands of years of Western philosophy no one has come up with any better prescription than the Golden Rule, irrespective of how different philosophers have justified it.

But what direction does the Golden Rule provide in a world of complex social and economic relations?

Economic realities introduce conflicts between personal morality and social ethics, conflicts that underlie the entire history of human society and become more acute in individualistic societies.

Attempts to resolve such oppositions on a philosophical plan have obscured the essential conflict, between the virtuous commitments of the individual and the drive to survive and prosper in a world where the supply of rewards is insufficient to satisfy all wants, let alone all desires.

The philosopher Isiah Berlin has expressed this dilemma in a provocative form, in terms of a Christian and a pagan ethical system -- one personal, the other communal -- struggling with one another within society.

Again, the ethicist Alasdair McIntyre has suggested that our ethics is incoherent because it is a mosaic of ethical fragments of the past: relics of principles that were

functional in earlier societies with different forms of communal organization but have now become dysfunctional.

According to McIntyre, principles like the Golden Rule could be operational only in societies such as the hypothetical polis of Aristotle, in which citizens identify -- at least formally -- with a communal system of virtues.

In individualistic modern society, the personal and communal systems of virtues are not congruent with each other. Competitive individualism interferes with the virtuous life.

Conflict reigns, or, to put it in McIntyre's own words, politics becomes "civil war carried out with other means."

What does this mean in terms of personal responsibility?

Should we accept passively the divergence between personal morality -- our sense of responsibility -- and the chaotic values of our complex society?

What philosophers tell us is simply that the practice of the Golden Rule cannot be expected to prevail automatically in the affairs of society.

If it is to become operative it must, like any other goal, be actively worked for.

It must be a consciously chosen, actively nurtured prescription for relations among citizens just as for relations between individuals.

In other words it must become a political goal.

An efficient ethics in society can come into being only when individual choices become political commitments, and individual commitments become collective commitments.

The hope for a more just society where the output of science and all understanding may be used for purposes collectively agreed upon -- a society with true political legitimacy -- must first become a political commitment on the part of individuals to make it become so.

Unfortunately, commitment to active political participation, especially at the national level, has been weak in our country. In fact, more extremely so than in any of the other democracies. Little more than one half of the eligible voters register to vote, and little more than half of those registered cast their votes. Indifference to politics is compounded by skepticism of the political process and even contempt concerning politicians. The roots of this situation are deep and complex. They go back at least to the 1830's, when Jacksonian democracy converted the electoral process into a spoils system, destroying the sense of political community that had animated the founding fathers and their successors for half a century.

Now more than ever our complex society requires commitment to communal goals on the part of its citizen. And this need for commitment to active political participation applies to scientists as well as to everyone else -- more so, perhaps, because as I said earlier, scientists are



collectively the source of so much of the power that underlies modern technological society.

Whatever the personal choices of scientists may be, whatever side they may take, their voices need to be heard, not just at the ballot box but throughout the process where choices are made.

If scientists, the purveyors of rational understanding of the world, exile themselves from the arena of social struggles and seek refuge in the ivory tower, they objectify themselves -- they turn themselves into instruments --- and society loses some of its more valuable members.

By this, I do not mean that scientists should politicize science.

On the contrary, politically committed scientists may bring to politics some of the approaches that have made science honest and successful.

In the third Canto of the Inferno, Dante relegates the souls of the uncommitted, who in life had deserved neither blame nor praise, to the no-man land at the entrance of Hell, where the punishment is to be forever among others like themselves.

They have lived passively, doing their chores but contributing nothing to the collective process of guiding and perfecting the community.

Dante, the political poet, calls on us to be the artificers of the world we live in, not only by understanding

it, as in Wallace Stevens' poem, but by a commitment to participation.

There is nothing new in this way of looking at politics as social morality in action.

Rousseau and other philosophers have seen the impossibility of a moral life lived without active concern for the legitimacy of the surrounding society.

If personal morality and social organization will become more congruent, they will not do so through any fatally prescribed historical process.

They will converge only as a result of deliberate, active personal and collective activity. To think otherwise is to indulge in wishful thinking, not unlike a belief in astrology or in miracles.

To serve as political activists, or at least as committed citizens, is not as easy a task as it is to follow the pursuit of science and understanding in libraries or laboratories: and it offers little promise of short-range success and reward.

But it is a task that provides hope rather than despair, and purpose through shared commitment.