



New England
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Working to Promote
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THE NATURE OF SCIENCE

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Scientists seem to laymen to be like the dwarves in medieval folklore chipping away the grey rock hour by hour, day by day, year after year, searching for gold within the seemingly mined-out excavation of the natural world.

According to Dr. Thomas Kuhn, the relentless pursuit of proof of the current paradigm is the predominant activity of scientists today. Scientists try to verify accepted paradigms in appropriate but untested areas "or attempt to adjust existing theory or existing operation in order to bring the two into closer and closer agreement."

So where is the gold in all this? How is it unearthed? According to Kuhn, this continued attempt to prove contemporary theories inevitably leads to the uncovering of anomalies and these anomalies, if great enough, cast doubt upon the existing theory, initiating an overthrow of the old and a search for a new description that will satisfy the new information. Is this the gold, the process of discovery, the uncovering of closer and closer approximations of the truth?

The techniques that scientists use either in the verification phase or the discovery phase are basically the same: observation, classification, measurement, inference and communication, along with experimentation to test hypotheses through controlling variables. These techniques are used in conjunction with a firm foundation in the current tradition of scientific learning often referred to as laws.

If this is the gold, it is not very exciting - this collection of informed

techniques that generate knowledge of the natural world. There must be more. What is it that draws people to dedicate their entire lives to it? Is it the big money, the fame, the hours and years of tedious learning and application?

Perhaps it is the same thing that draws people to the Arts. In Science and Human Values, Jacob Bronowski says: "Science, like art, is not a copy of nature but a re-creation of her. We remake nature by the act of discovery; in the poem or in the theorem. And the great poem and the great theorem are new to every reader, and yet are his own experiences, because he himself re-creates them. They are the marks of unity in variety; and in the instant that the mind seizes this for itself, in art or in science, the heart misses a beat"

Perhaps the real essence of science and the arts is the same. The works of scientists and artists are not pure reproductions of the world. They cannot be—neither in the arts nor in science can the observer be separated from the observed. The stamp of the artist is all over his work, no matter how objective his approach. Physicists have shown us it is also true in science. To again quote Bronowski: "We have reached the stage where the world is integrated within itself, and the gap between the observer and the fact cannot be kept open. The basis of this world is the observation. All the difficulties, whether about the behavior of Mercury or the failure of causality, derive from the separation between the knower and what is known. Only by joining them do we make knowledge."

It is clear to me that both our greatest art and our greatest science attempt to get to the center of things. They attempt to grasp in a clear image, theme, metaphor, theory or law (be it ever so temporary), the nature of this manifestation in time and place, this existence, this universe.

For example, Moby Dick, considered by many to be the greatest American novel, attempts to create a model and thus explain the whole picture—

by shipping out a depressed intellectual on a whaling voyage, shoulder to shoulder with all aspects of humanity, together, pitted against nature, in search of livelihood, vengeance and the answers to life and death. Work of similar scope has been done by many great artists throughout time (e.g., Homer's Odyssey, Michelangelo's Pieta, Shakespeare's Hamlet, Bach's Brandenburg Concerti, Beethoven's Last Quartets).

In a different form, the same type of work was done by Sir Isaac Newton. He saw an apple fall, prompting the insight that the forces that act on the moon and the planets are the same forces that work on the apple. He worked out the math and found that he was right. The expression of his vision of the universe working from small to large like clockwork must have arisen from a desire similar to Melville's to explain and to unify something that is myriad in appearance but pure and simple in its reality. Bronowski reflects this in his statement on Copernicus: "The motion of all the planets around the sun was both simple and beautiful to him, because it expressed the unity of God's design. The same thought has moved scientists ever since—that nature has a unity, and that this unity makes her laws seem beautiful in simplicity."

Even though Newton was only approximately right and Melville called a whale a fish, their works are enlightened visions of the inner workings of our universe. Their undertakings and those of present day scientists and artists are a search for meaning, a concerted search for answers or "The Answer." Isn't this the main pursuit of man, once he struggles free of the grasp of his temporal obsessions?

Of course, the approach science takes in its pursuit of the ultimate answers is unique to itself. Science concentrates on the areas of matter, energy, evolution and such stuff as keeps this natural world doing what it does. Models are devised to explain all the processes

and work is done to see if everything fits these models. When the search for proof gets fine enough, something turns up to demand a revision.

Each step, while uncovering more that we do not know, brings us closer to understanding what we do know. Each new piece of information, creating an opening for swarms of contradictions, brings us that much closer to a unified understanding of how things work and why they are working.

With this "new" knowledge, then, we can choose. The future is here with us now. It is waiting for us to shape it

Dr. Salk said we need "to rebuild the future." To do this, we must "think like nature," we must collaborate with nature—of which we are a part. The techniques of the scientist are changing to account for this collaboration.

The observer and the observed has merged. No longer can we validly see ourselves as acting on nature. We instead recognize that we are—in body, mind, and soul—that which we are observing. We recognize the interdependence of all things—the oneness of all. As Walt Kelly said through Pogo, "We have met the enemy and he is us!"

So these hard-working dwarves, mining the universe, are uncovering the gold of our true nature. As we become aware of this and become who we are, so do we put this science into action.

Thus the nature of science, beyond a collection of exacting techniques, is an odyssey into the nature of reality: who we are, how we got here and how we can get where we are going in one peace.