

# CREDIBILITY, COMMUNICATION, AND CONUNDRUMS: FACING THE REALITIES OF THE SCIENTIFIC ENDEAVOR AND THE LIMITS OF KNOWLEDGE

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**Abstract:** The System Dynamics community has an obligation to the public to teach the epistemological basis of System Dynamics models including an acknowledgment of the humanistic components of the scientific endeavor. Concern about scientific credibility has been expressed in recent articles in *The System Dynamics Review*. Barlas and Carpenter (1990) say: "No model can claim absolute objectivity, for every model carries in it the modeler's worldview" (p. 187). Lane (1994) comments on Habermas' argument that knowledge is never objective, but that "truth and rationality are phenomena of communication: knowledge arises from free discussion" (p. 113). And Vasquez, Liz, and Aracil (1996) make the case that Putnam's view of Internal Reality offers an alternative between "naïve realism and relativism" which offers SD a way to "clarify the strong interactive character of the modeling process" (p. 36). As Gerald Holton, Professor of Physics and History of Science at Harvard University said, "the scientific and humanistic aspects of our culture are complementary aspects of our humanity that co-exist," in the words of poet S.T. Coleridge, "in the balance or reconciliation of opposite or discordant qualities" (Holton, 1995, p. 38).

## 1. The Decline of the Credibility of Science In the 1990's

Science has been losing credibility in the public's perception as we approach the year 2000. We are now far from the euphoria of the 1940's when Vannevar Bush, in his report *Science, The Endless Frontier*, wrote, "Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress. (qtd. by Holton, pp. 5-6)." Up until and throughout the Cold War, the public accorded science research projects and scientists almost unlimited confidence and generous, even extravagant funding. TV commercials for aspirin and other remedies relied on the credibility of scientists-even ersatz ones such as actors who played the roles of physicians on TV-to sell their products. Almost any male who donned a white lab coat and spoke authoritatively on TV could be believed. But, the scientific illiteracy of the public has now taken a different turn. According to a 1996 critique of the meaning of science in American life, the public's ignorance is manifest in its insistence on absolute certainty from scientists, and its perception that admissions of uncertainty are proof that science, like everything else, is merely subjective and relative (Toumey, 1996).

The shift away from acceptance of the authority of science occurs, as Spengler predicted, as we approach the year 2000. The authority of science is being questioned, and sometimes undermined, as members of the public probe the relationship between the funding of projects, and their scientific findings, especially in studies related to tobacco or to experimental drugs.

But, at a deeper level, the public challenges science because, despite the hype and the plethora of products created by science and engineering, we have achieved neither harmony with other humans, nor with our environment. The popularity of books on poetry, and the care of souls, and the cleansing of streams and skies, reflect a human hunger for metaphysical balance and spiritual fulfillment. Even more damaging than questions of fraud and the relationship of funding to findings in scientific research is the "vocal segment of literary critics and political commentators associated with the avant garde of the postmodern movement." Stated simply, these debunkers of science claim that there are no objective, verifiable truths; that "There is no Nature: there is only a communication network [among scientists]" (Holton, p. 23). For these critics, science is little more than a veiled attempt to acquire power.

The place of science today, according to Isaiah Berlin, is a result of a revolt against the central core of our Western tradition, which rests on the following three dogmas:

1. "to all genuine questions there is one true answer..."
2. "true answers to such questions are in principle knowable"
3. "these true answers cannot clash with one another [but] must form a harmonious whole" (Berlin, 1990, p. 209).

Predictably, Berlin continues, as we observe the cycle of human history, rebellion against Enlightenment's search for rational order builds, and a counter movement, the Romantic Rebellion gains momentum; this revolt glorifies "romantic self-assertion... and in the end brutal irrationalism and the oppression of minorities" (Berlin, p. 225). We can only hope that in the face of the superficially irreconcilable contraries of Enlightenment rationality and objectivity and Romantic passion and subjectivity, we will comprehend what the poet William Blake meant when he said that "without contraries is no progression" and "the road of excess leads to the palace of wisdom." In other words, the shift from the predominance of one world view (the rationalistic) to its contrary is inevitable, and is a sign of vitality. Furthermore, the extreme distrust of science will lead us to wisdom if we recognize and teach "the needed

*complementarity* (my emphasis) of the rational, passionate, intuitive, and spiritual functions" (Holton, p. 29).

## 2. The Radically Anthropocentric Nature of Science

All human endeavors—scientific or poetic—are radically anthropocentric. As the cultural historian Giambattista Vico wrote in *The New Science*:

In all languages, the expressions relating to inanimate things are formed by metaphor from the human body and its parts and from the human senses and passions. Thus, head for top or beginning; the brow and shoulders of a hill; the eyes of needles and of potatoes; mouth for any opening; the lip of a cup or pitcher; the teeth of a rake, a saw, or a comb; the beard of wheat; the tongue of a shoe; the gorge of a river; a neck of land; an arm of the sea; the hands of a clock;... a vein of rock or mineral;... the bowels of the earth (Bergin and Fisch, 1970, p. 88).

But contemporary science has placed a premium on the non-personal, or impersonal aspects of the scientific endeavor. In the attempt to portray science as totally objective and rational, in denying the subjective, the emotional, and the philosophical worldview of the scientist, science has been misrepresented and, not surprisingly, widely misunderstood by the public. Gerald Holton, looks for what is usually left out of scientific reports, namely:

an artifactual residue of an individual's specific attempts to understand a problem during its nascent phase, which Einstein called 'the personal struggle.' This is the period *before* the new work has come to fruition, been rationalized, pruned of all personal content, published and absorbed into the mainstream of science through the mechanism of justification. This is however, *after* the earliest and rarely documentable stirrings of the scientist's new idea. Insofar as I can find the necessary evidence, I tend to focus as much on the state of disorder that precedes the conclusion as on the conclusion itself (Holton, p. 106).

Happily, says Holton, some scientists are willing to share their private struggle with the public, as did Richard P. Feynman, after being awarded the Nobel Prize in 1965:

We have a habit in writing articles published in scientific journals to make the work as finished as possible, to cover up all the tracks, to not worry about the blind alleys or to describe how you had the wrong idea first.... So, what I would like to tell you about today is the sequence of ideas, which occurred, and by which I finally came out the other end with an unsolved problem for which I ultimately received a prize. (Holton, p. 111) .

The arts, and particularly the visual and metaphoric imagination, play a crucial role in science. Galileo's training in the art of "perspective rendering in chiaroscuro" helped him to "envisage" the true relationship of sun and moon, despite the limitations of a crude telescope. (Holton, p. 88). Another scientist on record as a visual thinker is Einstein, who reportedly said, "I rarely think in words at all.... I have it in a sort of survey, in a way, visually." (Holton, p. 89). Metaphor and analogy, the basis of poetry (and, as Vico observed, of all language) are based on illusion, and are based on imagined or created, rather "real" relationships. Yet metaphor and analogy have led more than one scientist to profound insights into Nature, as in Thomas Young's work on light waves and Enrico Fermi's understanding of neutrons (Holton, pp. 94-5).

## CONCLUSION

Let us now remove our white lab coats and abandon the mystique of pure, objective science, not in exchange for the insidious "everything is relative" cliché, but rather for an open recognition and dissemination of the view that science, as performed by human beings, is of necessity anthropocentric. In his essay "Formation of a More Comprehensive Theory of Life," S.T. Coleridge said that "to account for a thing is to see into the principle of its possibility, and from that principle to evolve its being. Thus, the mathematician demonstrates the truths of geometry by constructing them." He then quotes Vico as saying, "Geometrica ideo demonstramus, qui facimus; physica si demonstrare possimus, faceremus" (Coleridge, p. 569). Stated succinctly, Coleridge agrees with Vico that "we can account for geometry, because we create it; before we can account for physics, we must be able to create there also." In other words, even with our vast stores of data, and our deep insights into the structure of DNA and the composition of stars, we are limited by our human ways of knowing. Not being God, how can we pretend to God's view of the cosmos? According to Holton, "the challenge which all scientists and other intellectuals must now face... [is] to bring science into an orbit around us instead of letting it escape from our intellectual tradition" (p. 57). Science and poetry have shared the work of helping us understand ourselves and our cosmos throughout human history, and we cannot afford to deny the worth of either. Indeed, both scientist and poet manifest "the power of imagination that reveals itself in the balance or reconciliation of discordant qualities" (Coleridge, p. 269).

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