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Teaching- Learning Issues †

Art, Science, Areté

This issue of TEACHING/LEARNING ISSUES was prepared by Dr. Neil Greenberg, associate professor of zoology and lecturer in the Stokely Institute for Liberal Arts Education, University of Tennessee, Knoxville.

*You can not teach a man anything;
you can only help him to find it
within himself.*

Galileo

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To many minds, academic disciplines represent an unnatural constraint on intellectual freedom—an institutionalization of the spirit. This is, I feel, a narrow view, revealing only one side of the apparent paradox that we are most free to act where competing alternatives are most effectively controlled. Indeed, it is through the action of disciplined inquiry that the spirit, in fact, soars. It is such disciplined inquiry—the orchestration of apparently competing patterns of behavior—that characterize the broad categories of art, science, and technology, as well as each of their constituent disciplines. Each of these is dominated and often defined by methodologies which reflect varying proportions of the three interlocked aspects of information processing: input, integration, and output. These aspects are central to all behavior, not the least those disciplined by academe, and cannot function in isolation from each other.

In the process of institutionalizing and disciplining major human impulses, means and ends are often muddled. The *methods* most efficient for various endeavors are often profoundly different, some strictly empirical, some integrative, others reductionist. The *goals*, on the other hand, of fields so seemingly dissimilar as art and science, are found to be more strikingly similar the deeper one digs. Conflicts between disciplines often arise as successful methods are apotheosized and thereby appear to be goals, setting the disciplines in which they are employed at apparent cross-purposes (e.g., "Surely what science does is not construction, but reduction, the dismantling of wholes" . . .).¹ Also, such methods are often uncritically transferred between disciplines, providing a further source of disciplinary conflict and confusion and a misguided sense of the intrinsic correctness of a particular method.² But it is more accurate and certainly more fruitful to regard dissimilar methods as representative of different

stages in the development and consolidation—the maturation—of a discipline.

A clear vision of means and ends underlies effective inquiry: The key interactions between the internal and external environments of organisms involve the flow of information; elements of the external environment are detected, integrated within the organism, and then guide its future actions. I wish to argue that the self-transcending nature of inquiry is most clearly manifest when the various aspects of these three stages of information processing—input, integration, and output—have matured and become balanced within a single personality. These stages also respectively characterize, if not dominate, the academic disciplines associated with art, science, and technology. While disciplines may set at least temporary boundaries around the aspects of the internal or external environments they address, they cannot claim dominion over a methodology. Indeed, disciplines advance most distinctly when they—as well as in the human beings of which they are composed—have attained a harmonious balance between the aspects of information processing underlying their methods, each an institutionalized externalization and extension of a fundamental and essential living process.

Areté

Works of art, science, and technology of high quality are recognized more by their contribution to adaptive change in our culture than by any intrinsic quality. They are essentially responses to stimuli and as such cannot be isolated from their context. They are, in essence, what Emile Zola (writing of art) termed “fragments of nature seen through a temperament.”³ This sense of the necessary context of ideas is challenged by the concurrent disposition—perhaps need—to decontextualize and thereby transform an idea into an eternal, immutable, *truth*: A beacon that man, adrift in the cosmos since at least the scientific revolution, so desperately needs. In each of our long journeys, beacons come and go, new ones replacing the ones we have passed. The human qualities that engender excellence in the processes of art and science are, on the other hand, independent of history, and they are, at least for human purposes, timeless, and a person manifesting such excellence possesses what the ancient Greeks termed *areté*.

The Greek concept of *areté*, which has so profoundly influenced *paidiea*, the concept of liberal education, means more than mere excellence. It refers to excellence that emerges from an heroic effort that fully integrates all the levels of consciousness within a

person, and involves the maximal possible manifestation of one's special talents—self-actualization. And heroism is, as Ernest Becker put it in his master work, *The Denial of Death*, “. . . our central calling, our main task on this planet.” In Becker's view, “society is and always has been a vehicle for earthly heroism”.⁴ Areté originally referred to a coupling of morality, valour, and a sense of duty possible only in a nobleman. To Aristotle, attaining areté was taking possession of the beautiful, the human epitome of which is an act of moral heroism. And in this sense, heroism is no less part of areté than ever, but it can also be understood as an attribute of the creative personality. Creativity transcends the culture in which it is nurtured, and it requires, in Becker's view, “a strength and courage the average man doesn't have.”⁵ This is because

the most terrifying burden of the creature is to be isolated, which is what happens in individuation: One separates himself out of the herd . . . His creative work is at the same time the expression of his heroism and the justification for it.⁶

But although the concept of areté and the means by which it may be attained changes as society changes, it was always deeply connected with education. Sir Richard Livingstone, in his now classic formulation, regarded the true function of a liberal education as the making of a complete human being, one in whom the *areté* of the body, mind, and character are maximally developed.⁷ Werner Jaeger, on whose work so much of our contemporary understanding of the idea of areté is based,⁸ felt that by the time of the Sophists, the question that haunts all cultures was formulated: “What type of education leads to areté?”⁹

The Art and Science of Art and Science

What I am arguing is that areté involves a balanced integration of the essences of art, science, and technology, and that this balance is at the heart of the creative transcendence of disciplinary boundaries. In this respect, the idea of biological information processing is a powerful metaphor that helps keep the respectively cultivated activities and attributes of specialists in art, science, and technology in perspective. Each aspect of this system—input, modeling, and output—can be viewed as corresponding to the particularly emphasized or developed quality of the people who identify (or are culturally identified) as artists, scientists, and technologists.

We can also advance our understanding of the apparent

differences between art, science, and technology, if we adapt a structuralist view of the organism as such an information processing system. In this view, a relatively inflexible or closed (resistant to modification) deep structure is surrounded by successive surface structures, layers that are, in general, more flexible (or open) as they become more superficial. The outermost boundary is the interface with the world. These layers, much like levels of consciousness, interact with each other and with the world in generally predictable ways. Further, their interactions and plasticity can be engendered and nurtured with varying success at different times in our development and maturation. Imagine concentric rings, the qualities of which are partly determined by past experiences. Each can reject or arrest incoming information and then store it and/or pass it through to another level, one of which involves conscious attention.

Our understanding of the essences of art, science, and technology, may be helped by contrasting the attributes and education of those who manifest excellence in these disciplines. Paraphrasing Zola, we can learn much from an examination of the temperament through which a fragment of nature passes, and is thereby transformed. Works of science and technology are as much the product of such transformations as are works of art. Suzanne Langer¹⁰ said, "all genuine art is abstract," but this is true of works of science and technology as well. Indeed, abstraction, in the sense of discriminating, isolating, and emphasizing particular relevant features from a larger agglomeration, is a key attribute of the largely internal processes of neurobehavioral information processing.¹¹ It is the way the chaos of information in which we are immersed is rendered manageable.

It is the selection and handling of stimuli that is the hallmark of the artist within us. It is the making of predictions by means of our playfulness with mental models of the world that characterizes the scientist within us, and it is the selective acting based upon these predictions that is the essence of the technologist within us. Our mental models of the world can be no better than the stimuli we select for their construction, and the selection of an appropriate course of action can be no better informed than the models which guide our thoughts. It is the integration of these qualities within us, derived from our biology and placed in the service of creative confrontation with real or potential change, that gives rise to *areté*.

By temperament and training, artists are, as Ezra Pound¹² put it, the "antennae of the race," particularly alert to new (or previously unnoticed) stimuli because of a sensory/cognitive

apparatus of sensitivity and resolution—a sensibility that combats easy pigeon-holding or premature categorizing of incoming stimuli. Indeed, the artist is called by disposition if not training to smash the false idols of human nature, habit, training, and tradition, that Sir Francis Bacon felt impeded the true “interpretation of nature.”¹³

The stimuli registered in a receptive mind are not only accommodated to the constraints of our biology, they must be integrated with a socially or culturally intelligible model of the world. It is at this integrative interface that models of the outer world are developed from the raw material provided by our senses and subjected to the mental reality-testing by which we formulate predictions about the consequences of future actions. Indeed, this process is the essence of science: Its business is precisely that of science: prediction. By means of “conjectures and refutations,” as Popper put it,¹⁴ we select the most effective or efficient action from the myriad alternatives.

The performance of a particular behavioral act selected to attain a specific goal is guided by our assessment of its future consequences as well as feedback from ongoing consequences that allows us to reconcile small mismatches between our intended and executed actions. From the many possible alternative means of accomplishing a goal, one must be selected and the alternative, often competing pathways must be suppressed. This highly focused enterprise must be accomplished with rather limited tools, but it is, in essence, the technological mission. Once the effectiveness of a particular response is found reliable, it may be automatized and rendered even more efficient, requiring less attention to be appropriately executed. There is no consciousness of rules or decisions; automatized responses proceed unselfconsciously for virtually all behavior including expert skill.¹⁵ This may be sufficient for countless private acts, but to be socially useful, the information acquired by the artist within us, and modeled and experimented with by the scientist within us, must be externalized in a way that makes its connectedness to culture apparent or demonstrable. This is a goal-directed endeavor, at once challenging and demanding creativity in the technologist within us comparable to what we have come to expect from the artist and scientist.

Modernity

Creativity is largely a response to confrontation with an internal or external boundary between the way things have been or are and the way things have become or should be. It is playing with the

alternative resolutions of the emergent dissonance that helps us confront change effectively or more efficiently. This is accomplished in large part by probing at these boundaries and thereby engaging the "experience of modernity" as Marshall Berman termed it.¹⁶ "To be modern is to find ourselves in an environment that promises us adventure, power, joy, growth, transformation of ourselves and the world—and, at the same time, that threatens to destroy everything we have, everything we know, everything we are." It is, Berman envisions, a "maelstrom of perpetual disintegration and renewal."¹⁷ It is here, where the most profound change we will ever experience is encountered, that areté is nurtured and heroism engendered.

It is a difficult but moving experience to approach modernity directly, for example in the power of literary regionalism¹⁸ or the paradigm-shifts that characterize the history of science¹⁹ and art.²⁰ Modernity is a powerful metaphor and serves to structure developing ideas about individual creativity as well the creative sparks that can ignite whole cultures. Indeed, in Eric Hoffer's view,²¹ it is change without concomitant opportunities for individual action and self advancement, a fettering of human potential, that creates the atmosphere of revolution. (And herein is the revolutionary function of art: Art deals in possibilities²² and when we are prevented from realizing them we are aroused. "The essence of crisis," Beck²³ tells us, "is a disproportionality between the amount of misery men suffer and the potentialities of their culture....")

Private and Public Progress

Change is not only imposed by the environment, it is a constitutional part of our growth and maturation. Our development is progressive and during its course we acquire information from both our culture and our individual experience. This information is private—and our accumulation of it is our private progress, unknowable in essence by any other person. Indeed, often unknowable to ourselves.

Knowledge is thus rooted in individual experience. New knowledge belongs to one man before it can belong to all men. Each of us grows, acquires information, synthesizes, and predicts according to our disposition, opportunities and needs. Thoughts that seem uniquely our own we may or may not seek to communicate, but often our decision to communicate is mainly to inform ourselves more completely of the real content of consciousness: The externalization of an idea allows us as well as others to

scrutinize it and feed back into our conception, allowing possible adjustments.

True private knowledge must be more than our memory of facts and ideas obtained from our experience and that of our predecessors and colleagues. Incorporation or internalization of ideas requires more than mere ability to recapitulate them:

All truly wise thoughts have been thought already thousands of times; but to make them truly ours, we must think them over again honestly, till they take root in our personal experience. (Goethe)

In our own development, each of us creates or recreates ideas—this is indispensable to our growth. At a point, sometimes narrow and sometimes broad, our experience may engender thoughts unlike any we have had before; they may be original not just to us but to society. At this point our private boundaries may be comparable to those of our culture and our private progress may contribute to public progress. But a problem that is both private and public is the recognition of the novelty or usefulness of an idea (and herein is the need for the prepared mind which fortune is said to favor). Further, a thought that is apparently uniquely our own must be externalized to have its social novelty or utility tested, and this typically challenges our ability to communicate. This is the so-called artist's problem: the effective communication of an ineffable idea. Science, art, and technology are cultural institutions; to contribute to them we must first find their boundaries. Development and confirmation of our apparent originality requires our mastery of the thoughts in which our idea is embedded. Mastery implies more than understanding, it means also that we can disentangle our idea from irrelevant or misleading corollaries or implications. Our personal progress and knowledge is probably much like that of others in our culture until we reach that boundary. Communication of what we have found beyond the boundary constitutes a contribution to public progress. Society, however, may or may not be receptive: As Stent tells us, to be recognized, a discovery must be linked by "simple logical steps to canonical, or generally accepted, knowledge."²⁴

Zen and the Art of Just About Everything

We are all of us caught in the Romantic double bind: the affirmation of our individuality in the face of a yearning for belonging to a greater whole. One aspect of this, the fragmentation engendered by the Cartesian Paradigm of divide-and-cognitively-

conquer in which we are now immersed, has emerged from our very nature²⁵ to be codified and canonized. Our overawe is understandable, the paradigm has transformed the world dramatically much in the way we transform our children. We take happily whole beings, and, for the sake of efficiency (ours as well as theirs), transmit tiny packets of information grouped along various academic, often obviously arbitrary, lines. This is training, a preliminary to the whole human goal of education: the integration of the individually mastered (disciplined) aggregates of information under the direction of the *student's* unique personality. How like the spiritual processes we are told are involved in Zen! Division and reintegration; abstraction and isolation of key stimulus elements and their subsequent reassembling into a whole; the unselfconscious made self-aware and then restored to selflessness.²⁶ (And here is the greatest danger students, teachers, and their society confront: the temptation to reintegrate the student along personally or socially biased or self-serving lines.) Would that reassembly were so easy! But there is a strategy, one in which the myriad tiny impediments to selfless thought, artless art, are systematically transcended: It is not possessing answers or winning victories over nature, it is the creative confrontation of mystery. It is inquiry, an heroic action, not a state of being. Inquiry in any discipline, pursued relentlessly to its boundaries, takes us to a zone in which sense can be extracted only with great concentration and focused attention. It is here that we encounter another venerable paradox: Only the most disciplined efforts can liberate us! We find also that in this intensely personal twilight zone the mental processes that are engendered are readily and rapidly generalized, indeed expanded, to encompass cognitively or emotionally related ideas—even if they are related by the most tortuous circuits. In the course of this creative grasping at straws, connections are being made deep below the surface. This zone, crackling with energy, is one in which our deepest resources are summoned, and may even do our bidding. Moving through this strange space we find the most fundamental premises of our life constantly challenged—no cloistered virtue here, this is a place for heroism.

E. M. Forster was fond of the quip: "How do I know what I think until I see what I say?" (some of my students would add "or hear what I say"). Kurt Vonnegut also felt that when writing he is "watching a teletype machine . . . to see what comes out." Robert Sekular²⁷ concluded from such observations "that writers often did not know precisely what they would write until they had written it." By such processes of expression and feedback, and

by utilizing diverse means to externalize what is within us, we render the implicit more fully explicit. And this is also the way we cultivate and reinforce the connections between the mental faculties that underlie the dispositions and talents of the artist, scientist, and technologist more-or-less latent in each of us. Paul Rozin²⁸ has argued that even intelligence is profoundly related to the relative levels of interconnectedness or accessibility of different parts of the brain to each other, including the "cognitive unconscious." Areté involves the coordination and integration of these faculties which underly effective action and are, thereby, the source of considerable power.²⁹ Glimpses of this power beneath the surface of consciousness may engender fear, cynicism, and arrogance as often as humility and awe. But it is a power which, by reaching into the deepest interstices of our minds, arches back countless generations, perhaps to progenitor species, perhaps to a divine spark.

NOTES

¹John Banville, "Physics and Fiction: Order from Chaos," N.Y. *Times Book Review* April 21, 1985, 1, 41-42. Banville is presuming that science is no more than the technology of inquiry often termed Cartesian reductionism, by means of which science (Keats feared) might "unweave the rainbow." (See Marshall Rand Hoare's essay review "Alone Together" in *The Sciences*, 1987, pages 52-58).

²Kenneth E. Boulding, "Science: Our Common Heritage," *Science* 207(1980):831-836.

³Emile Zola, "Proudhon et Courbet," In *Mes Haines* (Paris: Bibliotheque-Charpentier, 1923). Originally published in 1886. "Une oeuvre d'art est un coin de la creation vu a travers un temperament" (p. 25).

⁴Ernest Becker, *The Denial of Death*. (New York: Oxford University Press, 1945).

⁵*Ibid.*, p. 171.

⁶*Ibid.*, p. 171-172.

⁷Richard Livingstone, "The Free Man's Education," Chapter 4 In *The Future in Education*, (Cambridge: Cambridge University Press, 1940).

⁸Werner Jaeger, *Paidéia: The Ideals of Greek Culture*, Vol. 1, Second Edition. (New York: Oxford University Press, 1945).

⁹*Ibid.*, p. 286.

¹⁰Susanne K. Langer, *Problems of Art* (N.Y.: Charles Scribner's Sons, 1957).

¹¹Vernon B. Mountcastle, "The View from Within: Pathways to the Study of Perception," *The Johns Hopkins Medical Journal*, 136(1975), 109-131. And Gunther Stent, "Abstraction in the Nervous System," In *Paradoxes of Progress* (San Francisco: W. H. Freeman, 1978).

¹²Ezra Pound, "The Serious Artist," In *Literary Essays of Ezra Pound*, T. S. Eliot, editor (London: Faber and Faber, 1954). Originally published in 1913.

¹³Francis Bacon, *The New Organon and Related Writings* (N.Y.: Bobbs-Merrill, 1960). Originally published in 1620.

¹⁴Karl Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge* (London: Routledge & Kegan Paul, 1972).

¹⁵H. L. and S. E. Dreyfus have studied the acquisition of expertise: "Experts don't apply rules, make decisions or solve problems. They do what comes naturally, and it almost always works." (see R. J. Trotter, "The Mystery of Mastery," *Psychology Today*, 20 (July, 1986), 32-38).

¹⁶Marshall Berman, *All That is Solid Melts into Air*. (N.Y.: Simon and Schuster, 1982).

¹⁷*Ibid.*, p. 15.

¹⁸Jim Wayne Miller, "Reading, Writing, Region," *Journal of Kentucky Studies*, 1(1984), 85-99.

¹⁹T. S. Kuhn, *The Structure of Scientific Revolutions*, second edition, (Chicago: University Chicago Press, 1970). (First edition, 1962).

²⁰E. M. Hafner, "The New Reality in Art and Science." *Comp. Stud. Soc. Hist.* 11(4)(1969), 385-397.

²¹Eric Hoffer, *The Ordeal of Change*, (N.Y.: Harper & Row, 1963).

²²"Imagination alone tells me what can be." (Andre Breton, *The Surrealist Manifesto of 1924*, Ann Arbor, University of Michigan Press, 1969). Freud believed that of all the psychic forces that are compromised by the reality principle, fantasy alone is immune. Art allies itself with revolution, Herbert Marcuse tells us, when its latent content is made *uncompromisingly* manifest (*Eros and Civilization*, Boston: Beacon Press, 1966)

²³William S. Beck, *Modern Science and the Nature of Life*, (Garden City, N.Y.: Doubleday and Co., 1961), 334pp.

²⁴G. S. Stent, "Prematurity and Uniqueness in Scientific Discovery." *Scientific American*, 227(6), (1972), 84-93.

²⁵Becker (op.cit.) dealt with our reticence to admit our ultimately if not fundamentally biological nature. The artist, scientist, and technologist within us are, after all, attributes of our behavioral biology (see Neil Greenberg, "Science and Technology as Human Endeavors." *Liberal Education*, 72 (1986), 35-41), but we characteristically deal with them as through they were transcendent endeavors with which we can distance ourselves from biology.

²⁶Eugen Herrigel, *Zen in the Art of Archery*, (N.Y.: Pantheon, 1953).

²⁷Robert Sekular, "From Quill to Computer," *Psychology Today*, 19(1985), 36-42.

²⁸Paul Rozin, "The Evolution of Intelligence and Access to the Cognitive Unconscious," *Progress in Psychobiology and Physiological Psychology*, 6(1976), 245-280.

²⁹The manifestation of *areté* is of great cultural as well as personal importance. Its cultural power, beyond the leadership in confronting change that it provides, is recognized in diverse cultures and is reflected in the enduring inspiration in engenders. This was eloquently put on a stone commemorating the moral

triumph of the retainers of a wronged nobleman in 17th century Japan (the 47 *Ronin*): "Moral heroism derives from inner sincerity, and can move Heaven and earth and cause feelings in the gods: the noble actions it gives rise to awesomely constitute a standard for loyal subjects over a hundred generations. Hence this heroism can help to correct shallow customs and reinvigorate the samurai spirit. ..Is not its relevance to moral education in society extremely great?" (by Kameda Bosai, engraved on the stone near the Ronin's burial site; S. Addiss, *The World of Kameda Bosai*, Exhibition Catalog, New Orleans Museum of Art, 1984.)

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