Technology Assessment in an Emerging World

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While the profound social changes under way today are by no means solely the result of technology, one of the important impacts of technology is the growing need for more concentrated efforts at producing and applying technology assessments; i.e., the need for systematic examinations of the long-range interactions between technology and the rest of societal activity. It is from this situation that I draw my thesis: The very conditions of social change, including the anticipated role of technology assessments (TA's), preclude defining and valuing TA's as exclusively rational, formal, technical activities. Instead, I suggest that the applicability of TA's is at least as great if they are also valued and viewed as a form of art. Here, I do not mean, as is usually meant, that, given their primitive stage of development, TA's are more craft than science. I mean art as art—on a par with, but different than science in process as well as purpose. The implications of this viewpoint for the producer and user of technology assessments are significant, and, if pursued, will overcome the limitations imposed by valuing TA's only to the degree that they approximate purely logical creations, useful only for technical applications. The realization of these benefits will require major efforts to conduct, use, and legitimize TA's as an art form in which logic and the formal methodologies of TA serve the same functions as canvas, paint, and brushes for the painter; or stone, chisels, and mallets for the sculptor; or musical notation, musical instruments, and performance capabilities for the composer.

To argue this thesis, I shall begin with a description of conditions that press for TA's, as it is these conditions which inherently limit the sufficiency of scientific and formal knowledge and methodology brought to bear in the formulation and use of technology assessments. Three major pressures for TA may be singled out: First, there is a growing tendency to re-evaluate the priority of science and technology as a social enterprise, or, at least, pressure for closer examination of what should determine priority in a given situation. Much of the thrust for this re-evaluation arises from changing views regarding the purposes of social enterprise and the sufficiency of the positivist paradigm for describing the human condition and its purposes. Scientific-technical activities themselves have stimulated recognition of two circumstances that directly contribute to this re-evaluation.

One circumstance has to do with accumulating evidence that science and technology are not objective and disinterested enterprises, that the choice of research topics and positions, taken with regard to the interpretation of data and information, are expressions

of subjective interests of scientists and the organizations which support them. The second circumstance is the increasing recognition that adverse secondary and tertiary consequences of science and technology may well override the positive first-order consequences. Both of these recognitions have increasingly become a part of the world view of opinion makers and opinion leaders and their audiences; hence the pressure for careful anticipatory evaluations of the costs and benefits of technological innovation in a changing society.

A second pressure for technology assessment arises from a growing appreciation that societal survival requires a systems perspective, an ecological perspective, and a holistic perspective. This appreciation is greatly reinforced by other changes in images of self and social condition, but, certainly, it grows especially from recognition of the interactiveness of all important processes, especially as they are netted together through the impact of technologies and their infrastructures. A "bits and pieces" or disjointedly incrementalist approach simply won't do, though that message, while increasingly recognized in principle, has been excruciatingly slow to be realized in practice.

The third pressure derives from increasing demands by citizens for participation in decisions affecting their destiny. On the one hand, this demand for participation has also increased the demand for information about proposed technologies so the participants can judge their implications. On the other hand, in the dynamic of participation there is a tendency toward splintering and autonomy, toward group proliferation, and each group demands recognition of its entitlement to influence decisions regarding the destiny of a proposed technological development. Demands for participation plus the proliferation of groups complicates the application of a systems perspective but it also stimulates attention to a wider variety of scenarios about the impacts of the new technologies.

I turn now to the implications of these three pressures for the status of a theory of social change, for such a theory *must* underlie any technology assessment appropriate to our times since it is the fact of social change and technology's contribution to it that necessitates TA's. The fact is, there is no theory of social change adequate to the requirements for rational-logical technology assessments. In spite of our efforts to use sociology, psychology, economics, and the like for anticipating the impacts of technologies on the changing society, it must be recognized that all of othese disciplines are fundamentally inadequate for the task. [1]

Two concrete evidences will have to serve to demonstrate this. First, we have never been able, nor are we now able, to predict birth rates. That fact in itself indicates how little we understand about individuals, groups, or institutions and their interactions over time. A second example: economists are unable to agree on appropriate fiscal or monetary policy, and their projections of economic indicators are correct no more than two or at most three quarters ahead. (That isn't to say these indicators aren't used, but rather that they are not valid over time.) A more abstract example may help here: We don't know, with any conceptual rigor, how small social events generate large ones or how large social events infliuence small ones. A particular version of this unresolved conceptual problem has to do with the effect of the unique event or person on history compared to the "momentum" of the on-going, aggregated processes of society.

Two factors make extraordinarily important and unrecognized contributions to the persisting inadequacies of theories of social change and hence to the limits of logical, formal, approaches of and uses for technology assessments: The unconscious and the process of "emergence".

Among many of us, there is a rather unsophisticated acknowledgment that those

mental processes not at the rational, self-conscious, level influence our behavior . . . or at least they influence other people's behavior, if not our own. However, we usually do not recognize two things. First, the influence of the unconscious is fundamental to what we do at the *rational* level. The very choice of what we shall be rational about, what we value, how we react to the support of or challenge to our values and goals; all of these are driven by unconscious forces that express themselves in feelings, needs, intentions, or the like. For the most part, these forces are beyond our knowledge and beyond our willful control. While we tend to think of these unconscious forces as detrimental—and I believe we do think so because we can't control them—it is important to recognize that they are also the *source* of our creativity, our positive thrusts including rational endeavors, as well as of our destructiveness and inadequacies. When suppressed, these forces become destructive as we've seen all too well in this century. When nurtured and acknowledged they become the muse and companion of creative beings. One way or the other the uncontrollable and powerful influence of the unconscious always effects the actions of each of us including leadership at all levels. [2]

Over the past 300 years the exigencies of personal and group survival have been increasingly overcome through the first-order benefits gained by suppressing the unconscious, extra-rational forces in humans in order to pursue the linear, hierarchical, highly structured activities of industrial society [3]. We live a two-part legacy from that society. First, there seems to be an increasing sense of meaninglessness—itself a by-product of suppression of unconscious forces. Second, a growing portion of people in technologized societies are increasingly protected from the extreme vicissitudes of survival. One result of this legacy seems to be a weakening of incentives to live within the constraints demanded by industrial society: The rewards for doing so seem not as great nor do the punishments for not doing so. In the absence of these constraints there has been an enormous upsurge, both constructive and destructive, of unconscious material acted out in many ways at many levels, not only in this country but around the world. In the absence of ritualized modes for expressing some of this unconscious vitality, behavior influenced by this upsurge of material from the unconscious will be far less predictable and more frequent than in the past when the rewards for suppression were greater and, therefore, the structures of society were more constraining and legitimate.

This leads me to a brief consideration of the process of "emergence", a concept explored illuminatingly by the distinguished scientist and philosopher Michael Polanyi [4]. Polanyi and others have argued that the process of evolution, of transformation, is an emergent one; that is, the characteristics of what evolves cannot be predicted from the characteristics of the parts which compose it. We cannot predict the content of this paragraph from the words that comprise it, nor a new theory in science from the problems that inspire it. Similarly, we cannot predict a new art style from what preceded it, nor a new organism from what was alive before it came on the scene. After the fact, we can create a cognitive structure showing the relation of what evolved to what came earlier, but not before the fact. The whole is more than the sum of the parts and what the whole will be cannot be predicted from the parts or their partial interactions. There is every reason to suppose this applies as well to evolving social systems.

To many observers, society, especially Western society, is in just such an evolutionary condition now. This is exemplified by the three pressures for TA described earlier. It is also exemplified by the dissolution of the old definitions of reality, the rise of unconscious forces contributing to the turbulence of the present, and the world-wide interaction of cultural, ecological, and technological forces. If this condition of emergence is

indeed our situation then we cannot predict what the social construction of reality will come to be: What the social myths will be that give direction and meaning and, most importantly, what will be the form of societal regulation, all considerations crucial for TA's.

Rather than being a stable social system that can be represented by a systems analysis, we are in the process of evolution to something else, and it is this emerging condition that is referred to in the title of this paper. But such an emerging condition means that TA's unavoidably lack grounding in an adequate theory describing the processes of social change because no such theory describing the processes of social change can be formulated under the emergent conditions that characterize our times. It is ironic that the need for TA's arises precisely because we are in such a transition period whose very characteristics deny us a truly formal analytic and synthetic capability. Indeed, if TA's have an impact they will contribute to the very emergent processes that present them with such a conceptual barrier!

For example, as one who was very much involved in the examination of whether or not moderate security recombinant DNA research should be undertaken at the University of Michigan, it is clear to me that the informal technology assessments submitted during these discussions enhanced and complicated both the substantive and value issues. By so doing, they also emphasized that radical social inventions will be necessary to make possible effective citizen participation in such discussions and in those related decisions which affect their potential well-being. That is, the TA's *changed* the social reality in which such TA's will be used in the future. Precisely what the emergent political-technical arrangements could be that would respond to the many conflicting and ambiguous considerations involved, is something we shall have to discover; it is something that will emerge, hopefully.

In sum, TA's are produced and used in a societal situation whose very characteristics, including the putative impact of TA's, make it impossible for TA's to represent the interactions of technology and society over long time periods by formalisms that work for stable systems or those whose transformation characteristics are known.

What more revealing role, then, can TA's play? For certainly we agree that, for whatever reasons, they can and sometimes do provide understanding and incentives to act, that otherwise are lacking, even though we are unclear about what human motives and needs are being met this way. I propose that both the TA producer and the TA user see themselves as creating and responding to a new art form, an emerging art form, if you will. For it seems to me, that the purposes to be served by TA's are more in keeping with those served by art and the artist.

Note, I am *not* asserting that TA is an art form as now practiced or used. Rather, I am saying that it could be and I believe should be treated that way because, in so doing, all of the benefits of TA's as now conceived would be enhanced and freed to be more than they can possibly be now. At the very least, the misleading constraints of creating and using them as if they were exclusively a scientific-technical product would be avoided [5]. The following observations are intended to stimulate thoughts concerning the possibilities of creating and using TA's in an emerging world in a way that enlarges all those involved thereby, hopefully, increasing the chances for the evolution of social arrangements which meet the humane aspirations inspiring TA's in the first place. To that end, let us look at a few important aspects of the creation and function of art and note the similarities to what happens or could happen with TA's and the possibilities for enhancing the utility of TA's if they were treated as art.

Perhaps there is no better place to begin than with reference to the distinguished art historian and philosopher Sir Herbert Read. He has argued in his classic *Icon and Idea* that:

> The arts have been the means by which man was able step by step to comprehend the nature of things. Art has never been an attempt to grasp reality as a whole—that is beyond our human capacity; it was never even an attempt to represent the totality of appearances; but rather it has been the piecemeal recognition and patient fixation of what is significant in human experience. The artistic activity might therefore be described as a crystallization, from the amorphous realm of feeling, of forms that are significant or symbolic. On the basis of this activity a 'symbolic discourse' becomes possible, and religion, philosophy, and science follow as consequent modes of thought [6]

In other words, it is the function of art to be the means by which we initially formulate or structure our perceptions of reality. These new perceptions then, fundamentally influence other modes for representing reality like science and politics. The artist is the "re-perceiver" or new perceiver: In the future, others follow those insights, and Read documents this historically. If one substitutes TA for art in the above quotation it would be grossly presumptious to assert that TA's do perform this way now. But, given that the function of TA's is to influence our sense of reality, especially of future realities, it certainly isn't an unworthy aspiration to seek to do what other forms of art have done. Indeed, if we are to be worthy of the task set for us by the pressures to do and use TA's, I don't see how we can avoid the challenge to participate in the emergence of another form of art.

In this light, consider that art revives, reinforces and restates the mythic themes that give meaning and direction and vitality to our life. It expresses those archetypical themes of living and dying that have always been the root and thrust of human activity. Theories about the nature of society are also myths that one way or another express these themes. Like art, social myths stabilize society: They give the reasons for why it is the way it is and what's valuable in it. But art also carries in it the seeds of new art, the new art forms, the new expressions of the myths. So too, do social theories since they eventually generate their own anomalies and thereby generate social change.

TA's can perform a role like that traditionally fulfilled by art. They can help stabilize this society by reinforcing attention to certain aspects of our life that are emphasized by prevailing definitions of social reality such as the centralness of technological and economic considerations. But TA's can *also* provide a basis for beginning to "re-perceive" society according to a different mythology by drawing attention to anticipated impacts and implications resulting from the acceptance of either the existing social myths or alternatives to them. Like art *as art* TA's could be new vitalizers, new direction-givers through transformed myths about the nature of social reality.

Indeed, for some of those involved, making and using TA's are themselves expressions of classic archetypical myths such as the Promethean myth: Through TA's we claim the fire of foresight, a godly perogative, and psychic vultures then eat at our guts as we anxiously wonder about the consequences of our actions. Or the TA creator or user may see him/herself playing out the myth role of the hero—finger in the leaky dike; or galloping through the night calling out the alarm; or inventing a brave new world against heavy odds. Alternatively, TA'ers can perceive themselves as acting according to the "good soldier" myth, the myth of karma, carrying out one's job as well as one can, being a contributive cog in the great wheel of society.

Art is a mirror. Through art one sees oneself and one's relations to self and society.

Through art one can see society and reflect on its purposes and its reasons. TA's can and should be such a mirror. As the developing piece of art holds the mirror up for the artist to peer into so too should the developing TA. Completed, it should hold the mirror up to the user as art does to the listener, viewer, or reader.

If we acknowledge TA as an art form serving this function then *feelings* become a major contribution to the creation and use of TA's.

To the extent that feelings are acknowledged, TA's could and would elicit otherwise suppressed questions about one's self, one's motives and goals [7]. Creating TA's and using TA's should and can draw attention to questions of what *really* counts: How do I *feel* about what *I* am *doing*, about what others are doing? What is really worth doing? What of the world is controllable? Is the future knowable and if not, what am I doing? Conventionally, in our roles as producers and users of technical knowledge, we protect ourselves from acknowledging the place of feelings through group norms that stress rationality and credibility. But unconsciously, perhaps consciously, we know that the gut issues for ourselves and for others go beyond the neat formulations that "credibility" and logic demand into realms that generate in us fear, exhilaration, confusion, despair, etc.

Thus, TA's treated as art, impose on producer and users the obligation to "know thyself", to plumb the depths, to seek to be authentic. This is a heavy obligation, too heavy for some of us. But if, knowingly, we refuse to look in the mirror we lose a sense of authenticity, of feeling we are truly grappling with the real issues. One way or another we sense unworthiness in ourselves and in our work. What is more, by ignoring these feelings we also demean the valid contribution of technical discourse by distorting its significance. On the other hand, if we acknowledge that *part* of the purpose of TA's is to elicit feelings in both producer, thereby affecting the product, and in the user, thereby affecting the application, then additional techniques for generating ideas, hunches, etc., about what to pay attention to become available and become credible.

In order to produce new creative and productive interpretive insights of emphasis and relationship in its audience, art is deliberately and necessarily ambiguous [8]. Art never conveys only a single message or a single interpretation. Through ambiguity art inspires a searching for synthesis, for holistic understanding. It is possible—I would assert desirable—to view TA's this way too. The value of a TA lies in its capability for eliciting a multiplicity of alternative interpretations. Instead of ignoring or demeaning ambiguities they should be embraced as further stimuli to insights, new understanding, and motivation.

This would not be difficult to do. Working from the context provided by the TA it is always possible to explicate plausible interpretations that conflict with those chosen for emphasis. This can be done simply by pointing to the incompleteness of facts and data—what more needs to be known—and to the inherent questionableness of whatever particular theory underlies the rationale for the emphasis given in the study.

However, there is another way of engendering ambiguity—by drawing on images, feelings, and senses that are less structured than those elicited by the means just described. Here the intention is to draw on the brain's right lobe—on the intuitive—and on the reservoir of myths and archetypes that fuel our creativity—on the unconscious [9]. This is not the place to detail these methods; suffice to say, in this realm TA's could make direct use of more familiar forms of art as well as old and new techniques for personal and interpersonal elicitation of alternative insights, images, values, and syntheses. [10]

A brief speculation is in order in anticipation of the question: Who would be the artists and who would fund them if TA's were to evolve in this way? The societal

changes referred to earlier also influence those creating and using TA's. Doubts about the sufficiency of the Western view of human potentials and our relationship to the cosmos, questions about what values should undergird a humane world, experimenting with newly meaningful life ways represent the experience of some, perhaps many, of those creating and using TA's [11]. Heretofore suppressed aspects of human creativity are bubbling up in these people too. That most of us have aesthetic interests and awareness is amply evident away from the desk if not yet at it.

I expect, then, that there now exist, among those who create TA's and those who fund and use them, some who will be resonant with the idea of TA as an art form and who will risk experimenting with such a vision. Through its successes and failures, nurtured by a community of people who do not think it strange in light of their other efforts to move toward a more humane and human world, this idea could make its way, accumulating recruits and evolving out of its membership skilled artists who transform their unconscious creative forces into a form of art rich in both rational and extra-rational expression. Thereby, TA's might make a unique andn powerful contribution to enlightened governance of this civilization while contributing to the emergence of the next.

Notes and References

1. For critiques of the inadequacies of, particularly, economics by economists themselves, see: Boettinger, H., Big Gap in Economic Theory, *Harv. Bus. Rev.* 1967, **45** (4); Dale, E., The Unfavorables, *NY Sunday Times*, Financial Section (Nov. 7, 1971); Georgescu-Roegen, N., *The Entropy Law and the Economic Process*, Harvard U. Press, Cambridge, 1971; Heilbroner, R., On the Limited "Relevance" of Economics, *The Public Interest*, (12) (Summer 1968); Lowe, A., *On Economic Knowledge; Toward a Science of Political Economics*, Harper and Row, New York, 1965; Solo, R., New Maths and Old Stabilities, *Sat. Rev.*, (Jan. 22, 1972); Thompson, W., *A Preface to Urban Economics*, Johns Hopkins Paperbacks, Baltimore, 1965. I emphasize critiques of economic concepts and methods because we are prone to accept the validity of that discipline and to use economic models extensively in TA's. For a summary and bibliography of critiques of sociology, psychology, etc., see my *On Learning to Plan—and Planning to Learn*, Jossey-Bass, San Francisco, 1973, pp. 48–59.

2. See Houston, J., Prometheus Rebound: An Inquiry into Technological Growth and Psychological Change, *Technol. Forecast. Soc. Change* **9**, 241–258 (1976).

3. It is crucial to recognize that much of our activity is neither rational (deliberately designed to fit means and ends) nor irrational (crazy, self-destructive, uncontrolled), but is instead extra-rational (play, aesthetics, religion, ritual, habit, convention).

4. Polanyi, M., *The Tacit Dimension*, Doubleday, New York, 1966.

5. Joseph Coates has also drawn attention in his writings to the art-like characteristics involved in creating TA's. See for example, Technology Assessment at NSF, in *Perspectives on Technology Assessment*, S. R. Arnstein and A. N. Christakis, eds., Science and Technology Publishers, Jerusalem, 1975, pp. 11–17.

6. Read, H., *Icon and Idea*. Harvard University Press, Cambridge, Mass., 1955, p. 18.

7. I'm indebted to Dr. Robert Kantor, psychotherapist, art critic, and art collector for this observation. What I've done with it is, of course, my responsibility.

8. Kantor, R. E., The mutability of art styles and research in perception. *Art J.* **27** (3), 279–283 (1968).

9. For further observations on this, see Berg, M. R. Methodology, in *Perspectives on Technology Assessment*, S. R. Arnstein and A. N. Christakis, eds., Science and Technology Publishers, Jerusalem, 1975, pp. 63–72.

10. For an authoritative examination of these techniques and their psychophysiological bases see, Ornstein, R. E., ed., *The Nature of Human Consciousness*, W. H. Freeman, San Francisco, 1973.

11. That these are real issues and interests for TA-types was amply evidenced by the International Society for Technology Assessment conference agenda and the intensity of comment stimulated by the speakers and workshops.