Essays of an Information Scientist, Vol:8, p.21, 1985
Current Contents, #3, p.3-11, January 21, 1985
Also see Reprint by Donald Michael, p.23, Essays, Vol:8

Current Comments®

Click to go to Reprint

EUGENE GARFIELD
INSTITUTE FOR SCIENTIFIC INFORMATION®
3501 MARKET ST., PHILADELPHIA, PA 19104

When Information Overload Is Too Much of a Good Thing (An Introduction and Reprint of "Too Much of a Good Thing? Dilemmas of an Information Society" by Donald N. Michael)

Number 3 January 21, 1985

Many years ago, after attending a Gordon Research Conference, I visited Dartmouth Medical School, Hanover, New Hampshire. There, my good friend Shirley Grainger, the director of the library, introduced me to Zbigniew J. Lipowski, professor of psychiatry. (Last year he moved to the Clarke Institute of Psychiatry, University of Toronto.)

Over the past 10 years, Lipowski and I have exchanged letters and reprints. Lipowski is a prolific author but takes a particular interest in the subject of sensory information input overload in mental disorders.[1-3] That subject is a vast domain that I will not try to summarize here. But surely the connection between information overload in mental disorders and in scientific communication is not farfetched. In fact, James G. Miller, a systems scientist, formerly president of the University of Louisville, Kentucky, discusses the pathology of information overload in psychiatric disorders in a chapter of his monumental 1978 book *Living Systems*.[4] (p. 121-202) Indeed, as Donald N. Michael shows us in the essay reprinted here, it is a worldwide societal problem. Over 20 years ago, Richard L. Meier, City and Regional Planning Department, University of California, Berkeley, predicted that information overload would occur with increased automation.[5]

Recently, I suggested that some of my overzealous colleagues in information science cause iatrogenic information overload.[6] Perhaps the greatest complaint heard about information retrieval (IR) systems is "too much information." Most users want answers to specific questions. Traditional literature retrieval systems are not designed for that purpose. I was very conscious of this when we first started publishing *Science Citation Index*® (*SCI*®). So we emphasized that *SCI* would help retrieve highly specific, relevant, focused information. After 30 years' experience and fivefold growth of the literature, we know that it will take more than the perfect bibliographic classification system to solve the individual's problem of information overload. Every new solution breeds a new set of problems.

As Michael points out, information overload is not a new phenomenon. It is just much more prevalent and apparent than it was in the past. One indicator of its widespread impact is that no one ever asks me to define the term when I use it. Everyone appears to be drowning in a flood of information. Most of us have dozens of books, articles, and reports waiting to be read. It is sometimes an uncomfortable feeling to be running constantly just to keep in place. Reading *Current Contents*®, like your daily newspaper, may give you a general awareness of progress, but it does not reduce the pile on your desk. Such feelings will vary considerably as you travel from the information-rich lands to the information-poor ones.

There is, of course, no perfect solution to the problem. Scientists are by nature and definition more curious than they can actually afford to be. None of us will ever have enough time to read everything we want to read. Many years ago, I told you about that great classificationist, Henry E. Bliss.[7] He had discovered, like the encyclopedists who preceded him, that to find satisfaction in science, one had to perceive the relationships between subjects. Indeed, the ultimate review article or book does this for us. I think that Michael has written one of those rare unifying pieces on a difficult but pervasive subject.

When I wrote to Michael last year, I told him I found his article while scanning my personal computer report (*Automatic Subject Citation Alert*) designed to reduce overload. But, as selective and purposeful as the computer may be, such reports produce a vicious circle. Instead of feeling more in control, we sometimes feel like throwing up our hands—that the world is out of control. We can't cope. Ultimately, each of us has to find his or her own particular solution.

In "Too much of a good thing? Dilemmas of an information society," Michael gives us the philosophical basis for understanding why this will always be part of the human condition. I hope you will agree with me that it conveys a very important message for users and designers of information systems of the future. Michael's 1973 book *On Learning to Plan & Planning to Learn*[8] is also a useful reference relevant to the topic of information overload.

Michael is emeritus professor of planning and public policy at the University of Michigan. He is now freelancing and enjoying life in San Francisco. This paper was originally a talk presented at a seminar sponsored by the Minneapolis Foundation. It was selected earlier as one of the *Vital Speeches of the Day*[9] published by City News Publishing Co., Southold, New York, in November 1983 and subsequently appeared in *Technological Forecasting and Social Change* last year. It is reprinted here with his permission and that of Elsevier Publishing Co.

We have also appended a brief selected bibliography of articles and books published on the subject of information overload.

* * * * *

My thanks to Linda LaRue and Bella Teperov for their help in the preparation of this essay.

REFERENCES

1. **Lipowski Z J.** Sensory overloads, information overloads and behavior. *Psychother. Psychosom.* 23:264-70, 1974.
2. ----------. Affluence, information inputs and health. *Soc. Sci. Med.* 7:517-29, 1973.
3. ----------. Transient cognitive disorders (delirium, acute confusional states) in the elderly. *Amer. J. Psychiat.* 140:1426-36, 1983.
4. **Miller J G.** *Living systems.* New York: McGraw-Hill, 1978. 1102 p.
5. **Meier R L.** Information input overload: features of growth in communications-oriented institutions. *Libri* 13:1-44, 1963.
6. **Garfield E.** Letter to editor. (Iatrogenic information overload.) *J. Inform. Sci.* 8:39, 1984.
7. ----------. Education by steeping, nibbling, or classification? *Essays of an information scientist.* Philadelphia: ISI Press, 1977. Vol. 1. p. 95.
8. **Michael D N.** *On learning to plan & planning to learn.* San Francisco, CA: Jossey-Bass, 1973. 341 p.
9. ----------. Too much of a good thing? Dilemmas of an information society. *Vital Speeches Day* 50:38-42, 1983. (Reprinted in: *Technol. Forecast. Soc. Change* 25:347-54, 1984.)

Appendix

Broadbent D E. A mechanical model for human attention and immediate memory. *Psychol. Rev.* 64:205-15, 1957.
Jacoby J. Perspectives on information overload. *J. Consum. Res.* 10:432-5, 1984.
Lock S. Information overload: solution by quality? *Brit. Med. J.* 284:1289-90, 1982.
MacKay D M. *Information, mechanism and meaning.* Cambridge, MA: MIT Press, 1969. 196 p.
Malhotra N K. Reflections on the information overload paradigm in consumer decision making. *J. Consum. Res.* 10:436-40, 1984.
Meier R. Communication overload. *Admin. Sci. Quart.* 7:521-44, 1963.
Milgram S. The experience of living in cities. *Science* 167:1461-8, 1970.
Miller G A. The magical number seven, plus or minus two: some limits of our capacity for processing information. *Psychol. Rev.* 63:81-97, 1956.
Miller J G. Information input overload and psychopathology. *Amer. J. Psychiat.* 116:695-704, 1960.
Miller J G. Psychological aspects of communication overloads. (Waggoner R W & Carek D J, eds.) *International psychiatry clinics: communication in clinical practice.* Boston, MA: Little, Brown, 1964. p. 218-23.
Ortega y Gasset J. Man must tame the book. *Wilson Bull.* 10:305-7, 1936.
Quastler H. Studies of human channel capacity. (Cherry C, ed.) *Information theory.* New York: Academic Press, 1956. p. 361-71.
Weick K E. The twigging of overload. (Pepinsky H B, ed.) *People and information.* New York: Pergamon Press, 1970. p. 67-129.
Wilcox R H. A measure of coherence for human information filters. *Psychometrika* 22:269-74, 1957.

Too Much of a Good Thing? Dilemmas of an Information Society

Donald N. Michael

Information cuts both ways and herein lie the dilemmas or paradoxes arising from ever more information created, processed, and disseminated by proliferating information technologies. More information can result in more control but it also creates circumstances that reduce or defy control. It clarifies some issues but it obscures and complexifies others. It enlarges the opportunities for participation in decision making and in doing so it both increases and reduces the incentives for adversarial confrontations in the courts and on the streets. It brings more ideas into the marketplace but at the cost of raising the noise level to where nothing can be heard clearly. Unprecedented amounts of information can be brought to bear on issues of policy and action but the persons who must use the information to make decisions become overloaded and everything gets muddled. In some cases one feels more information really gives an understanding of a situation. In more cases more information deepens a feeling of uncertainty. Information gives some ever greater access to a more complex world while condemning others to deeper isolation and alienation. It facilitates the coherence of groups and, at the same time, helps groups to splinter. It can make for both centralization and decentralization of power. In such ways information entices some into ever more demands for information and others to turn away from more information because it upsets habits of mind and action.

Several responses to these dilemmas and seeming paradoxes merit noting. One is a tendency to see only one side of each of these divergencies and to espouse or decry them. Another is to observe that there is really nothing new here. Information and information technology have always had these effects. Indeed the educative process itself embodies an abiding tension between a conserving function and an undermining function, between learning reliable answers and asking unsettling questions. Others find comfort in the presumption that the pluses and minuses of these dilemmas cancel out, or that, overall, the pluses add up to more than minuses.

I take the position that, while the dilemmas and paradoxes of information usage are not essentially new, they embody very serious consequences that demand intense attention. Human situations do not average out or balance like physical processes do. Events and individuals influence circumstances irrevers-

Reprinted from: *Technol. Forecast. Soc. Change* 25:347-54, 1984.

ibly. And always it is information that makes humans irreversible in their experience. You can't reset humans to a past "square one." The educated and uneducated, the living and the dying, the exuberant and the depressed, the powerful and the defenseless, the winners and losers do not average out. Instead the interplay between polar circumstances produces something else and that something else may or may not be what we want.

Then too, there is in the condition of humankind a tendency for good things to unravel. Gresham's law warns of the contagious consequences of one bad apple and we are exhorted to "eternal vigilance." From another tradition comes the teaching of the renowned guru Ramakrishna: "While seeing god in all persons and all things, look for the hole in the pot you purchase." The "shadow," those unconscious destructive aspects, in each of our personalities and institutions is always undermining the good and we well know about the paving on the road to hell. Therefore, while acknowledging the wonders that could and do accompany the so-called information revolution, I will emphasize here the dilemmas that tarnish or blacken the bright predictions imaging a world ever more information-"rich." If we don't recognize and engage these dilemmas, the information-"rich" world may well make us all poorer. But before looking more closely at some critical issues, some information is in order about what I shall mean by "information."

To begin with we should keep in mind that information acts on us in two ways. We use it to create more things such as new technology and more complex relationships such as the international banking structure or the national security structure. Then we use information to tell us more about that which we have created. And we get that information increasingly through technology and relationships that are the products of new information, such as satellites and word processors.

Beyond this distinction "information" has come to mean everything and nothing in the 3-way collision between philosophy, technology, and entrepreneurial and governmental hype. From that snarl I'll extract these fragments: I will mean "information" to refer to *data*, such as the unemployment rate, or the TV image of a football play, or the news statement that a prize horse has been stolen. "Information" will also refer to the *interpretation* of such items of data, and to the interpretation of the interpretation, like, "what the President *meant* to say, when he was interpreting the unemployment data, was...." So, one person's data is another person's interpretation, which in turn becomes data for further interpretation and so on.

The situation is awfully muddled. Sporting events are interpreted by some with the care and sophistication others lavish on numerical data. News broadcasts are received by many and designed by the TV producers as entertainment (as the recent brouhaha over Christine Craft's sex discrimination suit against Metromedia amply evidenced). Or take the pop sociology claim that, as a result of the information technology revolution, we now live in a global village because all around the world we get the same information at the same time. What in fact we live in is a bit of residual colonialism. The pattern on the screen, the data, is the same everywhere, but the *perceived* "picture" can be different for different cultures and for them the interpretation of the picture is surely different. It is precisely the *communality of interpretation* that coheres people into a village. That communality is now absent and, as I shall observe, we are getting farther from it in some ways, thanks to the information revolution.

The shared-interpretation characteristic of "villages" contrasts fundamentally with our belief in the virtues of ever more information. Most humans at most times and many humans today live in a "village" world of ritual, routine, and closed minds where the need for, or at least the demand for, information was small or non-existent. The answers were all there already. By contrast, some of us live in a peculiar world characterized by a growing demand for more information. A few words about the sources of our demands for ever more information will help focus my preoccupations.

First is the desire to reduce uncertainty by regaining control of an increasingly turbulent world and for the accompanying feelings of security and power. I will return to this desire: it will be the focus of my remarks. Second is the desire to be entertained. There is the entertainment accomplished through active curiosity creating and using information. The artist, scientist, and engineer entertain themselves with information and sometimes so does the computer game player. Far more characteristically, there is the entertainment accomplished through the passive consumption of information in such forms as sporting events, "news," all sorts of novelty created and conveyed by the media, information about other people's lives, etc., etc. Third is

the desire to profit from the demand for information. Organizations and technology are created to generate, process, and distribute information. This information in turn produces more organizations and technology to create information *about* information and to process and distribute it. In other words, information creates the desire for still more information.

I turn now to the focus of these remarks: the dilemmas and paradoxes that accompany our deeply ingrained belief and expectation that more information will reduce uncertainty because it is the basis for control of things, markets, the future, people, and even self. And that control is the way to personal and organizational security or to power and through power to security. It is a grand irony of our culture that this belief, bequeathed us by the age of Enlightenment, has turned on itself. Instead of more control, more information has led to an ever increasing sense that things are out of control, less certain. Information about environmental deterioration, economic disarray, toxic wastes, national security, the dissolution of the family, or the stumbling of the schools all points in the same direction: we are unable to control our society, informally to guide it or formally to regulate it, into performing the way we—any group comprising a "we"—would want it to perform. With exceptions, to be sure, the general picture seems to be that more information about society leads to more uncertainty and to behavior that further increases the uncertainty and further reduces our sense of being in control. Here are some reasons for this.

First, more information often reveals we do not know enough to know the consequences of what the information reveals. This is surely so with regard to toxic substances, where, for example, scientific information suggests that there are probably combinations of toxic substances or toxic and nontoxic substances that may synergistically interact in our bodies to produce additional toxic effects. But everyone is uncertain about what these combinations or effects might be. Or, less speculatively, there is evidence that small doses of toxic substances may have long-term effects, but no one is certain.

That more information often tells us that we don't know, perhaps don't understand, is a consequence of an unprecedented state of human affairs: a world where information is rapidly creating a situation where everything is connected with everything else. This is an operating fact. A rapidly diminishing number of human activities are insulated from each other in time, space, and consequence. But information about that information-created *system* comes to us chiefly in bits and pieces, as if events and objects were separated or separable. Just look at the structure and content of "news" as one example. To be sure, there are admirable efforts at providing background information that to a greater or lesser degree reveals the systemic character of an issue. But it is expensive and difficult to provide such information. Moreover, and of critical importance to our exploration, few of us are skilled in thinking in systemic terms or, more to the point, few are motivated to think systemically. If one perceives systemically, then neat divisions into black and whites, either/or's, cause/effect, winners/losers disappear and clear-cut confirmations compatible with our preferred beliefs disappear and with them the comfortable certainty of knowing what's going on and what to do about it. Pogo's discovery that "We have met the enemy and they is us" is hardly ever comforting.

One result of our bits and pieces approach to information—and there are others that I shall return to—is that it is easy to abstract, from the information reflecting the system but unrecognized as such, alternative interpretations of "what is" and "what to do about it" that are based on *pieces* of the picture. This is chronically our situation today with regard to every public policy issue we face. The blind men, each defining reality according to information about their part of the elephant, neatly exemplify the condition in which *more* information has put increasing numbers of persons and institutions. What information about the human condition *should* demonstrate is that there are no linear causes and effects because information has created a network of relationships wherein each maintains the other in a circular process. But our conventional ways of thinking create information in formats that encourage the generation of endless partial cause-effect explanations. And our norms reward asserting these as the truth.

What happens, then, is that in areas where we have a preferred truth more information is gratifying, but in other areas contending interpretations raise uncertainties about the whole information base and encourage distrust of the capabilities and honesty of those espousing contrary positions, as when scientists or engineers disagree about the feasibili-

ty or sensibleness of space-war weapons or the safety of, say, formaldehyde.

Our traditional response is to praise the plurality of opinions and interpretation as necessary for the democratic process and as the way to understanding and solutions better than any given position affords. Fine, if all those partial positions result in an appreciation of the issue's systematic nature and to a revision of perspective. But with so much information, with a prevailing belief about reality more at home with insulated parts, and with a normative system that rewards adversarial, either/or, win/lose approaches to life, multiple perspectives lead increasingly to cynicism and muddle, not to clarity or new vision. [There are important exceptions and we should learn from them. The growth of understanding that humans are part of a planetary ecology and must act accordingly is such an example. But note that most policies still set jobs against environmental protection. More egregiously, business interests object to the loss of productivity due to the costs of environmental protection instead of recognizing that earlier productivities were never that high. Instead they were *miscalculated* because they ignored the "externalities" of environmental (including human) degradation which, systemically, were always there.]

At this point let me make it clear that I am in no sense advocating less information—an "ignorance is bliss" approach. What I am emphasizing is that we do not understand what is required of us to use more information well. Right now, information is part of the problem more than it is part of the solution. To illuminate more convincingly what changes are necessary in our ways of doing and being, if we are to use information well, I must highlight additional aspects of how information currently presented and used leads into ever deeper muddles, not to say impasses.

Consider then, that for some, one's sense of interdependence deepens because more information demonstrates the multiple connections with other persons, organizations, and circumstances. And more information *creates* interdependence: there is growing mutual dependence on giving and receiving information. Also, organizations and persons base their behavior on information about each other and about the environments in which both perform. (It bears acknowledging that more information can *for a time* encourage myopic preoccupation and increasing insulation.) But, then, uncertainty also increases because there are more actors one must take account of and one can't be certain of their motives or actions. The uncertain interdependence between Third World potentially defaulting nations, profit-making banks, jobs dependent on export markets, and First and Third World political forces is made evident to all involved by the enormous flow of information from this interdependent system. Indeed there would be no such precarious system without such information flows.

The consequences of present actions for future generations is an increasing source of uncertainty. Information from future studies about possible long-term effects (as well as information that produces the effects) of toxic substances, resource depletion, environmental alterations (like increasing CO_2), value differences, social change dynamics, war, all create acute uncertainties about what we are doing to our children, and their children. Some see this as the ultimate interdependence.

Finally, more information tells us about ineptitudes in practice and fumblings of purpose, and about duplicity, or biased motives of information suppliers, whether they be corporation or university public information offices, government agencies, or special commissions. The pervasiveness of this kind of information makes suspect honest differences of interpretation and erodes the legitimacy of institutions and organizations. We are uncertain about who and what to believe. This leads to my next topic: information overload. Again, I'm referring to information used for profit or power, or intended to reduce uncertainty or to inform decisions.

Choices must be made even though increasing information is more likely than not to make them more uncertain in their premises and their outcomes. But choosing what information to use *itself* depends on information. Not only are we overloaded with information but we are overloaded by the task of choosing the information to take our chances with! Whatever information we use depends on our preferred beliefs about reality, about what is important. But the enormous variety of information faces a reasonably open mind with a changing reality wherein preferred beliefs are open to question. How many beliefs were undermined by the overthrow of the Shah of Iran, or by Viet Nam and now Central America, or the crises in US auto production or steel, or the failures of American management practice?

So, the burdensome question confronts us: "In the face of all the information I must contend with, as a responsible, alert private or public individual, what do I take in? What do

I need to know in order to act?" The answer depends in part on what may well be one's information-eroded definition of social and personal reality. In turn, affirming or revising it requires more information. The answer also depends on what information I am going to trust, even if it is incomplete. I have pointed out how information about information sources often undermines trust in them. For example, we now have had three studies on the Love Canal toxic effects. In order, the first, commissioned by the EPA, said there were evidences of genetic damage; the second, from the White House, said that wasn't so; the third, from Congress' Office of Technology Assessment, said neither previous study was adequate. But information trustworthiness also depends on a more subtle and more intractable process. The system-creating power of information itself changes personal organization, and national ways of being and doing. So the *meaning* of specific information is changing and one needs more information in order to evaluate the information one *had* hoped to act on. But the dismaying fact is that there are no adequate models of social change. This is generally recognized with regard to historical, social, and psychological models: it is also true for economic models as now acknowledged by numerous distinguished economists.

As a result, "decision makers" are buried ever deeper in loads of information and information about information. At the same time they are told that the information revolution should make it easier for them to arrive at decisive, informed decisions which presumably will get them back in control. Is it any wonder that growing numbers of them feel incompetent or ignore unfamiliar types of information they ought to pay attention to, or lash out at some presumed source of all their problems?

To my mind the most disturbing systemic consequence of uncertainty and overload, as I've described them, are their disrupting impacts on governance.

By governance I mean those ways by which we agree to be reliable personally, organizationally, and societally. We do this via laws, norms, rituals, shared beliefs, roles, etc. These are incorporated within institutions such as those responsible for education, early socialization in the family, religion, the market, and government.

There are many ways to describe the profound challenges to governance. I shall concentrate on those for government and I'll illustrate them with three types of examples: 1) how more information and overload provide both the basis for more tightly knit and more various special interest groups and for more splintering and divisiveness among groups; 2) how "sovereignty" is being dismantled and transformed; and 3) the challenges to political leadership norms and psychology.

Networking is believed to be a corrective for "centralization" but it *also* relocates "centers" of influence and frees them from geographical localization, whether the network be one seeking a weapons freeze, or an injunction to stop offshore drilling, or one to repeal the dividends withholding law, or pass an anti-abortion amendment, or whether it is a continuing attempt to control carried on by the Sierra Club, or an ad hoc strike of the Independent Truckers Association. More information generated and used by networks results in gains of power for some and losses for others.

On the face of it this is a plus for the workings of the democratic process. We tend to expect that persons, each "doing their own things," together add up to the common good. So, too, with multiple networks, each thriving on ever more information. But the "invisible hand" has not *by itself* worked for the common good since Adam Smith first proposed it and there is good reason to suppose that without other norms, as, indeed, Smith insisted there be, it will not work equitably here. Already, it is clear that, while open to any players who want to form networks, it is those with the money and power to create information and to use it that make the most of it. In the United States and elsewhere, the Third World is rapidly losing out in this shuffle of centers of information-preempting power.

Consider, too, that while more information and information technology can correct an outmoded view of the world as composed of parts, it also encourages, through the indigestion its richness induces, entrenchment in favored causes and a hardening of a "we"/"they" stance. This entrenchment is surely reinforced by our positive attitude toward adversarial combat in court, on the field, and in the marketplace. But, whatever short-range rewards accrue from "suboptimization," in a tightly interconnected world, they can only result in long-range losses. Among other consequences, entrenchment results in a splintering of public understanding rather than cohering into a consensus regarding the systemic, underlying issues. "Noise," in the form of information overload, displaces information-created signal. (Note, however,

"noise" can serve to obscure, for better or worse, off-the-record developments that otherwise might be exposed as information.) Further, entrenchment, accompanied by distrust and cynicism and alienation outside the network, are at least as much the companion processes of networking as are new perspectives leading to consensus and community within a network.

Earlier, I claimed that interdependence leads to greater uncertainty because there are more actors each with more information to interpret. Now, add that more information reduces the predictability of outcomes from independent moves intended to enhance or maintain sovereign power. Consider, more information produces ideas, biologically hazardous substances, and weapons whose impacts on the social and natural world are unpredictable. However, given planetary awareness of their real or potential impacts—also the products of information and its technologies—these products are sure to be subjects of intense interest to unpredictable or unanticipated organizations and personalities. Viet Nam, the Nestlé's baby food boycott, terrorist "protests," and the nuclear freeze movement testify to this. Consider, too, as the critical issues become more systemic and are recognized as such, the sovereign boundaries of corporation, state, nation—and person—will become more subject to challenge and less capable of being maintained according to the autonomous preferences of the "inhabitants." It's a rare business or government agency that doesn't feel encroached on by the requirement to provide an environmental impact statement. As one astute participant in the international world has put it privately, "The only way a sovereign nation can pursue its self-interest effectively is to subordinate it to the common interest of the system of nations." As we are coming to realize, local jobs, incomes, and life-styles are less and less exclusively the consequences of domestic decisions or have consequences only for local preoccupations.

The situation I've been describing is both painful and a deep threat to the leader's sense of self, of competence, that is, of feeling knowledgeable and in control. Or it *can* be felt as a threat. Much more typically, it is far easier for a leader to avoid, to deny that feeling: to ignore information that undermines sovereignty or certainty or to entrench behind preferred ideologies. It is far easier to deny that a frustrating situation is located in the systemic nature of an information-rich world and instead blame it on a malevolent adversary or the stupid "data processing" of misguided citizen groups or corporate presidents. The beneficiaries of conventional leaders reinforce these avoidance tactics because, coming from the same general background of ideas, they, too, want simple answers; "Don't confuse me with the facts," as the saying goes, especially if they refer to a complex system.

To my mind, more information and more information technology pose for all levels and types of institutions the greatest challenge facing civilization—short of avoiding nuclear holocaust. The depth and extent of the challenge is evidenced by a summary of consequences that accompany an information-rich world: 1) changes and redistributes the loci of power and action; 2) changes the operational and, eventually, the symbolic meanings of "sovereignty," interdependence, and authority; 3) changes the relevant understanding of social process from disconnected, linear, cause/effect relationships to multiply interconnected, circular relationships of cause-effect-cause-effect-cause...; 4) forces priority valuing of issues that have been secondary to the focus of government or corporate responsibility; the planetary environment, future generations, biological impacts; 5) undermines the conventional definition of leadership competence; 6) requires a portion of citizenry that can think and value accordingly.

For the very reasons I have reviewed, we do not know how to meet these challenges: we shall have to *learn* how to do so. And we shall have to learn *how* to learn to do so: this is part of the uncertainty. We must, I believe, become a society based overall on the norms and conduct of learning, if we are to meet these challenges humanely and effectively, indeed if we are to endure as an open society. I am speaking about learning that consists in discovering the worthwhile questions to ask at least as much as it does in seeking new answers to old questions—new questions about: Where do we want to go? How might we get there? Are we getting there? Do we still want to? It depends on acknowledging openly *what* one (or one's organization or group) is uncertain about and using that acknowledgment via a process I call "error embracing" (which I shall describe presently) to achieve resilience rather than control in a turbulent world.

Instead of expecting leaders to *know* the answers, leaders would be judged competent to the degree they were learners, and em-

power others to learn. There really is no other choice since claims to know cause and effect and what to do for certain in an information overloaded world are either foolish or fraudulent and ultimately disastrous. To acknowledge error, indeed openly to anticipate and design procedures for discovering its nature on the basis of acknowledged uncertainties and to apply what is learned to the next step—the process of error embracing—is almost unheard of in our leadership philosophy. Typically one is rewarded for not making errors, or for being able successfully to blame others if they are detected, or for trivializing them if blame won't cover up. To be sure, some politicians, administors, and executives will sometimes in private acknowledge that, contrary to their public performance, they are confused or uncertain. But this evasion obstructs, rather than empowers, learning at all levels.

I believe the norms and conduct appropriate for learning are *necessary* for coping with the high information world but they are not sufficient, which is my last observation, the most important of all. Throughout the hype and hope fueling the information revolution is the usually implicit, usually unquestioned, assumption that with enough information we can solve our problems. Presumably, that would include the ones I've raised here. Won't more information itself tell us how to transcend the dilemmas it produces? No, it won't. It can help once a prior requirement is met, the most difficult requirement of all for this society: a system of reasonably well shared *values*. It is the *values* a person, an organization, or a society hold that determine what information is important, and what interpretations are useful, and, indeed, what constitutes a problem or opportunity and a way of effectively dealing with it. (Think how some of us value the world in competitive terms—others in collaborative terms.) Our values do the selecting, even if they are not explicit or acknowledged. So, prerequisite for using information well are shared values that give direction to where *we* want to go, that bound what are acceptable means for getting there, and that provide, in the learning mode, means for getting there and for evaluating if we are doing so and for reassessing whether we still want to. In other words, an overarching, shared world view.

Such value-based world views characterize all other viable cultures and, earlier, one such world view drove Western culture in directions that astoundingly well served the interests of white males. Indeed, it brought us to our present state of accomplishment and disarray. But that value system is increasingly challenged, though still highly influential. And, as I've argued, while more information and, especially, more information technology could facilitate a new value convergence, they discourage that desirable outcome at least as much.

I see no evident solution to our situation. It's going to be tough sledding, however we go about using information. It is no accident, I think, that in Western mythology, humans were forced *out* of the Garden of Eden by the first information revolution—when Eve and Adam ate of the tree of knowledge. The bites continue and reentry remains barred.