the government. A typical version of the latter model might involve a laboratory attached to a major university with established breadth and strength in a particular area, funded, partly by industry and partly by government, at $2 to $3 million annually. Such laboratories could probably not always be fully integrated with the campus, since they would need to do work, such as pilot plant studies, that is not closely tied to the academic program. A semiautonomous operation on the campus, fully utilizing the faculty and capabilities of the university and contributing to the research effort, would probably be best.

3) The single university coupled to a single industry, with industry participating in the funding as in the PSEF model described earlier. (Of course, two or three industries could be involved instead of just one.)

4) The pattern given above, with an *additional* proprietary, two-way contract between the industry and the university.

5) The prime industrial contract (with several university subcontractors on a long-range, joint contract) directed toward nonmilitary technology.

The government agency managers should have had experience with both industrial and university systems, either through participation in them or through dealing with them as contractors. Remarkable prejudices build up—sometimes against, sometimes for—the approach most familiar to the administrator.

The field of university-industry interaction needs more widespread and thorough discussions among those who have been in it, and a small conference or two to bring such people together is overdue. Except for discussion, major funding is the only item lacking in the great experiment to harness together the research establishment troika.

References and Note

1. R. Roy, *Chem. Eng. News* **49**, 12 (1971).
2. P. H. Abelson, *Science* **151**, 783 (1966).

3. Many of these themes have been developed in conjunction with service on various state and federal agency committees, among them the Materials Advisory Panel of the Governor's Science Advisory Committee in Pennsylvania. I am indebted to many colleagues, especially I. Warshaw, deputy division director for engineering, National Science Foundation, for many hours of stimulating discussions; the opinions expressed are my own.

NEWS AND COMMENT

Theodore Roszak: Visionary Critic of Science

Berkeley, California. What is sometimes referred to as the antiscience movement is so hard to define that one suspects it is an abstraction to express the fact that science is under attack from a number of disparate quarters. One of the most ambitious of such attacks is the critique put forward by Theodore Roszak in two recent books, *The Making of a Counter Culture* (1969) and *Where the Wasteland Ends* (1972). Roszak differs from other social critics, for example Charles Reich, in that he sees science as the root cause of society's maladies—"Science is not, in my view, merely *another* subject for discussion. It is *the* subject." He is also among the most radical of science's critics in that it is not technology, pollution, or any consequence of scientific activity he is objecting to, but science itself—its methods, its view of the world, and its dominant role in western culture. Roszak's views on science would commend themselves to attention by their scope, if by nothing else.

A historian by training, Roszak teaches at the California State College at Hayward but lives in Berkeley, a few blocks away from the countercultural sidewalks of Telegraph Avenue. In person he is soft-spoken, with a way of looking that suggests more the inner vision of the mystic than the ardor of "the foremost spokesman of antiscience," a label recently affixed to him by the London *Observer*. Roszak rejects the description. "I am certainly not antiscientific," he told *Science*, "in the sense that I want to throw science out of the culture. But I am antiscience in that I want to question the cultural dominance of science, I want to put it in a somewhat more subordinate place in society, to ground it in a sensibility drawing on the occult, mysticism, the Romantic movement. . . ."

What is the position from which Roszak seeks to dethrone science? In *The Making of a Counter Culture*, a largely sympathetic description of revolt movements among the young, Roszak denotes the culture being countered as the technocracy. The technocracy epitomizes the trends in urban-industrial society which Roszak dislikes—its complexity, its power in relation to the ordinary citizen, its dependence upon an elite corps of technical experts who justify themselves by appeal to scientific forms of knowledge. But science is not just the privileged knowledge that keeps the technocrats in power, it also forces upon society its own way of looking at the world, which Roszak describes as the "myth of objective consciousness."

Roszak means myth not so much in the sense of something which may be false but as an expression of a particular view of the world. Objectivity is the bedrock upon which the natural sciences are built. Since it is science to which modern man refers for a definitive explication of reality, objectivity has become "the commanding lifestyle of our society. . . . The mentality of the ideal scientist becomes the very soul of society."

The myth of the objective consciousness, Roszak argues in the book, sustains the technocracy and distinguishes it from the counterculture. Objectivity leads to alienation, whereas the counterculture draws upon the sense of community. Objective consciousness "*is* alienated life promoted to its most honorific status as the scientific method. Under its auspices we subordinate nature to our command only by estranging ourselves from more and more of what we experience. . . ."

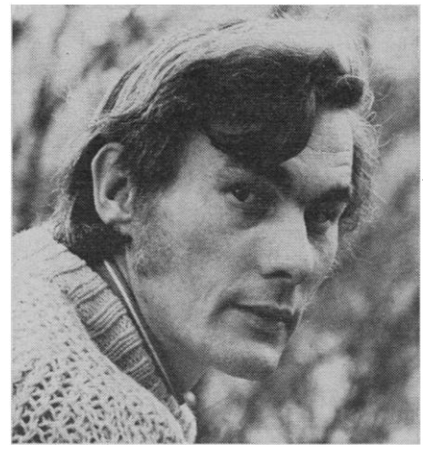
Roszak compares the scientist's role in society with that of the ancient Egyptian priesthood which used its monopoly of the calendar to command the awed docility of ignorant subjects. Scientific knowledge is, in practice, inaccessible to the public at large, which accepts on trust what the experts say. But the experts, at some stage along the way, have been bought out by "ruling political

and economic elites," who use the experts for their own purposes. It is in this fashion that the technocracy has been consolidated. We have arrived at a social order "where everything from outer space to psychic health, from public opinion to sexual behavior is staked out as the province of expertise." Science has deracinated the experience of sacredness.

These ideas are further worked out in Roszak's new book, *Where the Wasteland Ends*. Here he identifies reductionism—the desire to "reduce all things to terms that objective consciousness might master"—as the besetting vice of the scientific mind. Reductionism is born of the act of objectification; it is implicit in the notion that knowledge is to be sought for its own sake, as a thing apart from compassion or humanity. Under the banner of reductionism, science "has taken on the character of a nihilistic campaign against the legitimate mysteries of man and nature," has debunked our cultural heritage, has trivialized the concept of mystery.

Reductionism does not, of course, pervade all of science, but it is, Roszak contends, part of the mainstream of science. As specific instances of the "reductionist intellect at work," he cites behavioral research in which drugs or other means are used to control the personality; direct stimulation of the brain, whether of man or animals, by electrodes; machines designed to display artificial intelligence; and the "nihilism of the new biology" (the belief of biologists such as Jacques Monod that life arose by chance alone provides a nihilistic framework that raises severe doubts about the purposes to which the developing powers of molecular biology may be put). The reductionist feature of these researches is their "turning of people and nature into mere, worthless things"; they epitomize "that peculiar sensibility which degrades what it studies by depriving its subject of charm, autonomy, dignity, mystery."

It might seem unfair to blame scientists, rather than industrialists and developers, for the despoliation of the environment. But, Roszak asks, who provided us with the image of nature that invited the rape and the sensibility that has licensed it? Science has been the only natural philosophy the western world has known since the age of Newton. Scientists may say their task is to tell us how nature works, not how it is to be used well. But "is science then to be pardoned on the grounds that it has systematically taught our society to regard knowledge as a thing apart from wisdom?"



Theodore Roszak

Roszak seeks to disprove the equation, science = Reason = all things good, the notion that science is the guarantor of rationality in a liberal society. This reputation was gained in long-ago battles with the obscurantist elements of organized religion. The heroic age of science is now over. Bigness, progressional structure, subvention by government and industry, have become indispensable to the progress of research. Modern science does not guarantee liberal values—it flourishes in democracies and totalitarian states alike. Whatever the role of reason in the open society, it should by now be clear how easily "the rationality of contemporary science passes over into a mere instrumental expertise within the technocratic hierarchy."

If the thesis in Roszak's two books were to be summed up in a couple of sentences, it might go something like this: Science does not just provide the practical knowledge that underpins our urban-industrial society, it is also the philosophical source of the society's trend away from the values of the community and toward those of the organization. Scientists, in failing to exert control over the uses to which their knowledge is put, have grown to resemble a priesthood founded on arcane knowledge, remote from the lay public but subservient to the secular power.

The thesis suggests a number of questions, some of which Roszak discussed in a recent interview. For example, the objectivity of scientific discourse, which Roszak sees as science's distinctive feature, could, on the contrary, be regarded as little more than a literary convention designed to help achieve consensus. Is not the creative act of discovery just as important a part of science as the process whereby it is validated? Roszak says he would never deny "that the originality of science is fairly rooted in humanity. It is hard at that point to separate the scientist from the poet or the painter. The crucial difference is the next step. The next step leads to the depersonalization of work, the objectification of our own experience. I am not saying I want to see that vanish, but what I am troubled by is the conception that making that step is an advance on the state of wonder that science starts from."

The testing out of a creative insight, even the insight itself, often depends upon the careful reduction of a problem to manageable size. Reductionism is surely more a useful tool than a pernicious philosophy. Roszak answers by comparing scientific knowledge to a map. "Anyone who thought a map was real terrain, not just a representation of it, would be mad. In that respect, in the way we use science, we have become mad. To carry out reduction in science enhances our ability to manipulate the things around us, at least in the short term, and many people feel that as they become more scientific they are getting closer to reality. I think this is crazy."

Even assuming that reductionism and depersonalization of experience are definitive aspects of scientific activity, why should these values become translated from science to society at large? Roszak: "The way in which people conceive of nature is bound to carry over. If science is the most reliable approach we have, who can doubt it is the most reliable way of addressing everything else around us? I think it follows as a matter of course that, once you have established that nature is best addressed in an objective way, then it begins to bleed over into literature. What I am saying in my book is that maybe we should not address nature in that way."

Nonetheless, scientific modes of thought do not seem to be that firmly entrenched, even in the most industrialized societies. Is science really as dominant a cultural force as Roszak contends? He replies that most people are "scientifically illiterate, just as most people in the middle ages didn't understand the Latin of the mass." But when it comes to statements about the nature of things, most people will defer to science. "They are up against the reality principle of their society. They are running the risk of being written

off as irrational if they dispute the authority of the scientist. People cannot dispute scientific authority gracefully—they have nothing to fall back on." The civil defense debates on the building of fallout shelters in the early sixties were a formative experience for Roszak. "When I protested, someone would say, 'Let's not get emotional, let's be as scientific as possible.' That taught me what society's going standards of rationality were."

Assuming that science has the influence Roszak ascribes to it, what should scientists do to reform science or improve society? "That may not depend on scientists. You have a lot of people today who are not paying any attention to the scientific vision of the world around them. There are all the things which are happening here on the West Coast, lots of middle-class Americans are meditating, increasing their awareness. They are into eastern religions, tantra, alchemical research. There is a kind of widespread ferment going on. If this continues, we will wind up being a very different culture, a society in which people do not turn to science for answers."

Roszak says he finds a strange combination of humility and arrogance in the scientists he has met. "They are part of a profession which regards itself as the only sane way of looking at nature—like Undershaft in Shaw's play, who says: 'I don't know very much, I just know the difference between right and wrong' ". Yet Roszak's object is not to blame anything on science. "I am saying most of the problems of society have a scientific core. We are all involved, but scientists are involved in a particularly central way. . . . Maybe my books are too much of a frontal attack on the problem. Maybe what is more necessary is simply to open people up. . . ."

His books have reached a large audience and *The Making of a Counter Culture* (sales exceed 400,000) earned recently from literary critic Lionel Trilling the uneven compliment of being "perhaps the best known and also the best tempered defense of the ideologized antagonism to mind. Like a prophet unhonored, Roszak says he has found more interest in his ideas among English than American scientists. Yet he observes that, from a scientist's point of view, *Where the Wasteland Ends* "must seem very bizarre." One reason, maybe, is that it relies heavily on poetic insight and the power of language to make plausible quite broad arguments about the nature of science. Another possible point of resistance for the scientific reader is that, as Roszak says, "The things I am advocating would wholly transform the position of science in our culture." His vision of science and society may appear alien to others, but to dismiss it simply because of its poetic element would be to do just what Roszak complains of.—NICHOLAS WADE

Women in Michigan: Parlaying Rights into Power

The wave of feminist activism generated at the University of Michigan (UM) (*Science*, 24 November) has rippled into the other two of the state's "Big Three" universities—Michigan State (MSU) and Wayne State.

The Women's Equity Action League has filed a complaint against MSU with the Department of Health, Education, and Welfare (HEW), but so far there is no sign that the agency is planning an investigation.

According to Lansing activist Vicki Neiberg, the movement at MSU has been spurred not so much by noises from HEW as by women who felt they were being conspicuously forgotten as the administration took action to respond to the civil rights movement on campus.

They were unimpressed with the university's affirmative action plan for women, which Neiberg summed up as being "neither affirmative nor action" and which no woman had a hand in developing. An open hearing on the plan was finally held at last February's board meeting, by which time so much frustration had been generated that the meeting lasted 6½ hours. The upshot was that MSU president Clifton R. Wharton, Jr., appointed a 17-member Women's Steering Committee to report on how the university structure could be made more responsive to women.

The committee roared into action and, by June, produced a report calling for everything from special job training programs for minorities to integration of the Spartan Marching Band. The committee's central proposal was that the university create an off-campus women's center, to be supported jointly by the state and local governments and by the university. The center would be headed by a woman with vice-presidential status, the first of her kind. In addition, the center—in line with MSU's public service role as a land-grant institution—would supply legal, professional, and psychological counsel—not only to university women, but to all the women in the Lansing urban area.

Some committee members later acknowledged that they had bitten off more than the university could reasonably be expected to chew, but they were angered by the administration's response, which was that the committee apparently wanted the university to act as a "welfare state."

The university instead proposed that the Office of Equal Opportunity Programs—originally set up in response to black demands—be refashioned into a Department of Human Relations containing two parallel bodies: an Office of Women's Affairs and an Office of Minority Affairs. This proposal passed the board in September and was trumpeted in the local press. Many women regard it as a feeble compromise, but it is looked on with envy by women from other universities, where ad hoc groups are still struggling to obtain the kind of data they need to press their demands.

Meanwhile, the focus of women's activities at MSU has shifted to the drive to get the clerical-technical (C-T) workers unionized. Neiberg, a voluble feminist who describes herself as MSU's "Jewish mother," believes that this is potentially far more significant than organizational restructurings—"even structures can be rhetoric if they don't culminate in anything." Any issue revolving around clerical workers is automatically a women's issue because virtually all of the 2204 clerical employees at MSU (as elsewhere) are