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Can Government Deal with Science?

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Can Government

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The following is an adaptation of a speech delivered by Prof. Martin at the Sixth Life Sciences Symposium at the Los Alamos Scientific Laboratories in New Mexico. The proceedings, including Prof. Martin's speech, will be published in the *American Industrial Hygiene Journal* under the general title, "The Impact of Energy Production on Health: II. The Development and Communication of Health Information."

The Problem

Of the many people who make important political or social decisions in this country, very few are scientifically trained. Yet it is obvious that many of the most important decisions facing us depend very heavily on the answers to questions that are outside common experience and in the realm of science or technology. A list of a few of the more obvious problems in the news confirms the pervasiveness of underlying scientific issues: nuclear waste disposal, cancer-inducing chemicals, sources of energy, control of harmful chemicals in the environment, etc.

We do, of course, have methods for answering the scientific questions that underly these problems. Policy makers have science advisors. Administrative agencies hold hearings in which the testimony of experts is received. Fact-finding committees are formed. Advisory panels composed of lay people and scientists are asked to investigate problems, make findings, and suggest solutions or possible courses of action. Courts listen to the testimony of expert witnesses. Pressure groups appeal to the decision makers or to the public in the hopes that the public will apply pressure to the decision makers. Each of these is a method of answering scientific questions, though, of course, they vary considerably in their reliability and desirability.

To the naive, the problem of finding the best approach might seem an irritatingly simple one to solve. After all, the scientific method is widely known and understood by experts. Why can't a bit of common sense, good faith, and the scientific method take care of the problem?

The answer lies in the basic differences between the product of the scientific method and the needs of policy makers. The scientific method produces hypotheses, attempts to test them, and treats as provisionally verified those that cannot be refuted. But no scientific theory, however hoary its credentials, is ever finally verified. Probably the best-known example of the dangers of overconfidence in science is Newtonian physics, whose reign was long enough to have raised it to the status of scientific dogma. Kant is said to have believed that the principles of Newtonian physics could be derived from pure reason. Twentieth-century observations suggested by Einstein, however, showed that Newtonian physics is merely a close approximation of the way the universe runs.

In contrast to scientists who can wait forever for a correct answer, politicians and policy makers need to make decisions within limited periods of time. Often it is literally more important that a decision be made than that it be correct. Even in less drastic cases, the extra certainty that might be derived from waiting longer is not worth the cost of delaying the decision. If Congress or the Department of Energy needs to make decisions on how much money to put into fusion research, it is somewhat counterproductive to wait until one is absolutely certain that fusion research will be successful. If the question is whether or not to ban a certain food additive on the grounds that it may cause cancer, delay may both increase the number of possible cancer cases and increase the economic dislocation in businesses which manufacture or use the additive.

Some Proposals

Clearly, the scientific method and the needs of the policy makers are at odds. Clearly, something other than the scientific method per se is necessary to give provisional answers to the policy makers. One of the more publicized

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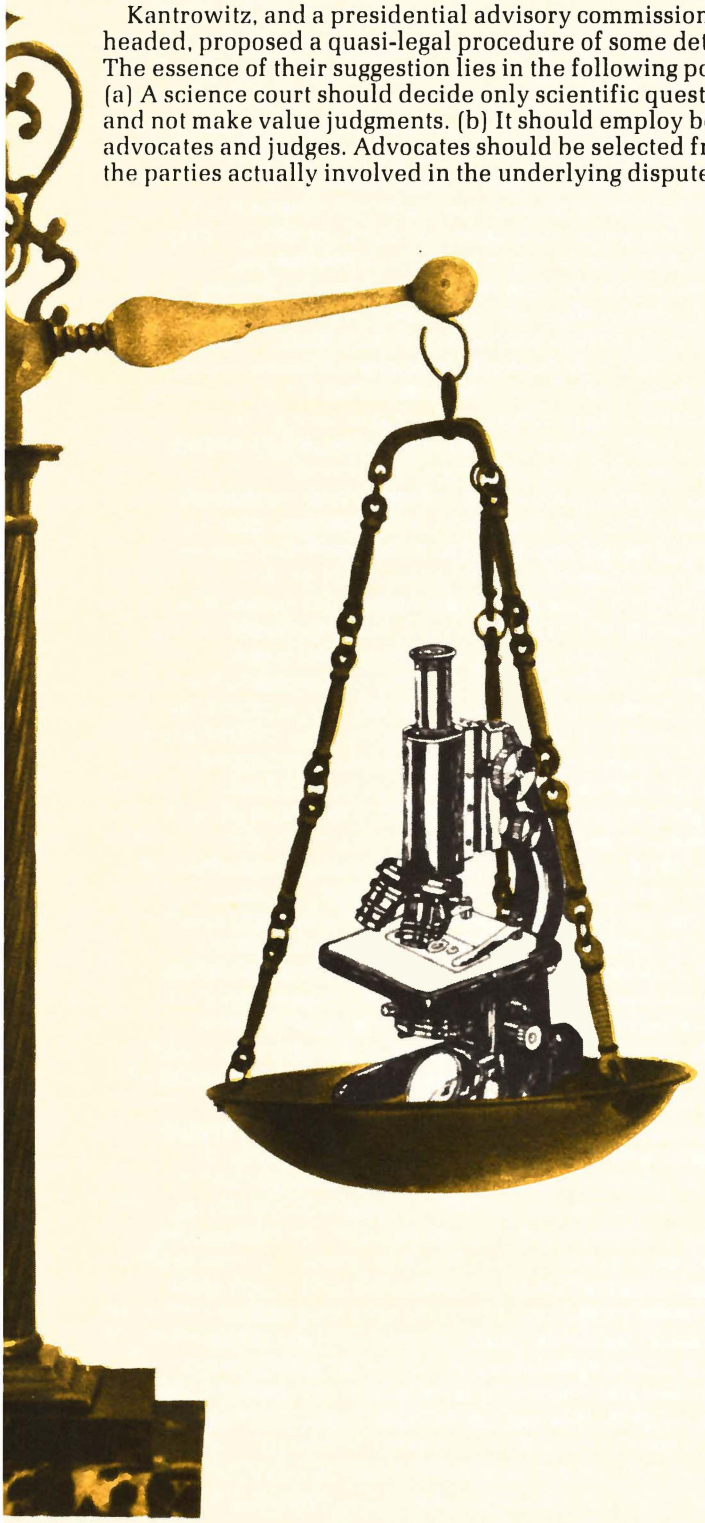
methods for answering the scientific questions underlying policy decisions in the past several years has been the "science court" proposal of Dr. Arthur Kantrowitz of Avco-Everitt Laboratories.

Kantrowitz, and a presidential advisory commission he headed, proposed a quasi-legal procedure of some detail. The essence of their suggestion lies in the following points: (a) A science court should decide only scientific questions and not make value judgments. (b) It should employ both advocates and judges. Advocates should be selected from the parties actually involved in the underlying dispute, and judges should be chosen for their learning in the area and for their impartiality. (c) The basic procedure would require each side to make proposed findings limited to assertions of fact.



Findings as to which there was agreement would be taken as accepted. Hearings would be held concerning those that remained. Hearings would allow cross-examination, either oral or written, under some informal procedure. After considering the evidence, the science court would pass on the disputed proposed findings, making findings of its own, the sum of which should lead to a decision on the underlying scientific question, e.g., does saccharin cause cancer in human beings, and if so, to what degree and under what circumstances? The science court would not, under the proposal, try to suggest what should be done with the answers to the questions proposed—it would not, for example, recommend that saccharin be banned, sold freely, or whatever. These questions would be answered by the policy makers, enlightened by the findings of the science court.

I have, of course, glossed over many problems, such as how to select adequate judges. Each of these questions has been given careful thought and each has, in my opinion, an answer that is plausible enough to make a test of the science court worth trying.

Although the "court" in "science court" may be somewhat inappropriate, it is an indication that Dr. Kantrowitz looked to the legal model for fact-finding. Why should the legal model, famous through popular television programs for its histrionics and its susceptibility to manipulation and error, be a model for providing answers to scientific questions?

The main reasons, I believe, are two: First, the more glaring weaknesses to the legal, fact-finding method are not inherent serious weaknesses; they can be minimized. That they are not minimized in the legal system itself is attributable to a host of social, political, and historical factors which a new institution, intelligently planned, might be able to avoid. Second, the chief virtue of the legal approach is that it is responsive to the need for producing answers that are "final" for the particular dispute in question—"final" and reasonably reliable. In particular, the legal system has one technique that seems peculiarly suited for ferreting out the truth, where possible: the device of cross-examination—the opportunity for opponents to question each other about their positions. One of the chief frustrations of modern discourse is to read two learned discussions of an issue which reach opposing results and which never seem to answer each others' arguments.

To be sure, the science court is not the only proposal that has been made in connection with the problem of finding accurate scientific information on which to base policy decisions. The advisory panel approach mentioned earlier, was employed to make suggestions both in Cambridge and Ann Arbor with respect to municipal policy toward recombinant DNA research. An intriguing experiment called the National Coal Policy Project brought people from the coal industry and various environmentalists to seek solutions to environmental problems of coal usage. Participants were required to agree to abide by a kind of golden rule which forbade, for example, withholding

pertinent information or lightly impuning the motives of others. The approach is elaborated as "the rule of reason" of Professor Milton Wessel at New York University School of Law. The sponsors reported pleasure with the outcome of the meeting, though it should be noted the approach depends rather heavily on the good will of the participants. Yet another proposal that has been made recently is the "conflict-clarifying conference" proposed by Washington attorney Don Scroggin, which calls for the various representatives of conflicting views to submit position papers which summarize the data and rationales leading to their conclusions. At a conference a referee would preside over the production of a final paper. The paper would include agreed-upon statements and reference to areas of disagreement, each party addressing the areas of disagreement in the same language and explaining the reasons for an inability to reach consensus. As Scroggin has noted, it is very similar to the early stages of the science court procedure, but stops short of an official determination on the grounds that general agreement is the only acceptable definition of "scientific fact" and that conclusions beyond scientific fact are necessarily value laden.

Goals to be Achieved

Undoubtedly, I have glossed over numerous other proposals of various types. In the face of so many proposals it becomes advisable to ask whether or not the goals of any such effort can be articulated. I believe that they can (and for the basic expression of some of these goals I am indebted to Scroggin).

The first goal must be accuracy, so far as possible. Just as important, we must recognize limitations on our abilities to achieve accuracy—an essential corollary of the goal of accuracy is the quantification of ignorance. Any process chosen must not only make educated guesses, but must also attempt to tell us how probable or reliable those guesses are. A second goal is that factual decisions be separated from policy decisions. Scientists are not particularly well equipped to tell us whether cigarette smoking creates an *unacceptable* risk of cancer, though they may be well qualified to tell us whether it creates a risk of cancer, and if so, how great that risk is. Scientists are no more (or no less, for that matter) qualified to assess the acceptability of a risk than others; thus, their value judgments should not be artificially magnified by association with their scientific expertise.

Though the unacceptable-risk issue may be an obvious example of policy decisions that should not be made by our truth-finding device, a less obvious (and thus perhaps more "insidious") kind of policy decision is the question of how to proceed in the face of ignorance. Take, for example, the question of what should be done if it is concluded that there is insufficient information on the possibility of a nuclear accident from a fission reactor. How to proceed in the face of this ignorance is clearly a policy question rather than a scientific question. But what if, as often happens, such issues occur much earlier in the fact-finding process—for example, when mathematical models are used that must assign certain values to variables whose true values are not in fact known? Such factual assumptions, no matter how justified, imply decisions as to how to proceed in the face of uncertainty. Any process that makes such assumptions must, therefore, clearly identify them for the policy maker and indicate how they affect the certainty of the answer to the overall scientific question.

A final goal for any system that purports to answer scientific questions for policy makers seems obvious but is rarely referred to: the method chosen for determining scientific facts should be economical. Vastly important issues may justify vast efforts and expenditures to reach accuracy, but a grand court of scientific inquisition is hardly justified to help determine whether a few thousand dollars should be trimmed from a NASA budget.

Emphasis on Procedures

I think that this last consideration may be the tail that ought to wag the dog. In other words, I would suggest that no single approach is the solution to the problem of obtaining accurate scientific information for a wide range of policy makers. Indeed, one of the problems with the science court proposal may be that it is so grandiose that it is appropriate only to a very limited class of problems of great national significance. The science court *procedure*, on the other hand, might be used by existing governmental agencies, with modifications to take into account their own peculiar circumstances, especially reasonable economic limitations. I understand that Dr. Kantrowitz has recently proposed such an emphasis on procedure rather than institutions. In light of the goals listed above, however, certain elements should be considered central to any procedure adopted. Some methods are simply better than others.

First, some form of cross-examination should be preserved, though not necessarily in the formal legal sense. Intelligent direction by some sort of referee can minimize the opportunities for abuses such as witness badgering. What must remain, however, is the requirement that the opposing positions face each other and address the issues in the same terms and in the same forum, each being required to explain their own view of the reasons for the differences between conflicting positions.

Second, as noted above, uncertainty should be labeled and, where possible, quantified.

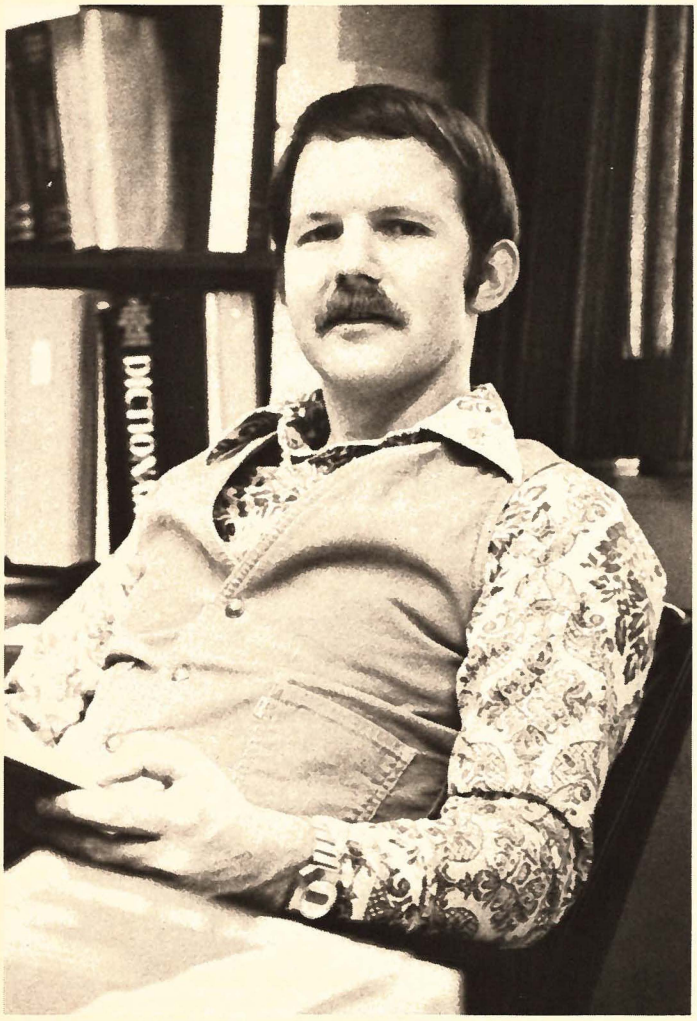
Third, proceedings must be conducted with impartiality. Neutral judges or referees are probably the best guaranty, and where possible openness and public scrutiny can help encourage impartiality.

These considerations are quite general, of course. If there is to be a move at the national level toward rational scientific policy making, I would suggest two steps to advance that goal. First, the appointment of a task force somewhat like the commission headed by Dr. Kantrowitz. This group would be charged with the function of drafting a set of general procedural guidelines, incorporating the general goals just mentioned. Having performed this function, the group could be dissolved. Then, second, a more permanent group could be constituted to assist decision-making bodies, such as administrative agencies, in applying the general procedural guidelines produced by the first group to the particular problems of the agency, coming up with a procedure tailor made for that agency. At the same time, following the suggestion of Professor Abraham Sofaer of the Columbia Law School, certain pervasive substantive problems—such as determining whether certain chemicals are cancer causing—might be addressed by task force groups that could suggest a uniform procedure best designed for the particular substantive issue.

By adopting fact-finding procedures, rather than urging entirely new institutions, success is more politically achievable. Changes are more commonly wrought by evolution than by revolution. The approach of modifying existing methods rather than creating new institutions also has the virtue of preserving as yet unappreciated virtues of current methods for fact-finding. We should be humble about our abilities to invent entirely new methods of accomplishing important goals. The present means by which we make our decisions, however defective, are unlikely to be totally unresponsive to current needs. A kind of Darwinian principle guarantees that *totally* useless institutions won't survive.

These suggestions may lack the pizzazz of a science court, with all its glittering images of marble columns and the like.

A friend has already "warned" me that I wouldn't get asked for interviews about this suggestion, as I was after I wrote about the proposed science court for the *Michigan Law Review*. So be it. The people whose job it is to make decisions are suspicious of radical change. We all are—often justifiably. Whether they are right or wrong in resisting radical change here, the real hope for any change lies in helping decision makers tinker with what they have, and thereby gaining their cooperation, rather than suggesting altogether new institutions that will diminish their authority.



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