scribed above, wherein level of pigmenting potential of a paramutable *R* factor is assumed to be a function of the number of metameres making up a repressor segment associated with the *R* gene. The seemingly regular increases in pigmenting potential of paramutable *R'* alleles resulting from treatment of seeds with diethyl sulfate could be due to loss of metameres either by direct deletion or though an effect on the chromosome replication process that leads indirectly to metamere losses. The direct deletion of metameres is considered unlikely because of the high frequency of induced changes appearing in the offspring following treatment of the seed from which the parent plant was reared, and because of the insensitivity of *R'* alleles in the sperm present in pollen grains to the action of alkylating agents. Perhaps the striking effects of alkylation result from impairment of the repressor segment as a template in somatic cells—impairment such that undercopying of metameres, and hence partial derepression of *R'*, during chromosome replication results.

References and Notes

1. R. A. Brink, *Cold Spring Harbor Symp. Quant. Biol.* **23**, 379 (1958).
2. W. Bateson and C. Pellew, *Proc. Roy. Soc. London* **B89**, 174 (1958).
3. F. A. Lilienfeld, *Bibliotheca Genet.* **13**, 1 (1929).
4. O. Renner, *Z. Induktive Abstammungs-Vererbungslehre* **74**, 91 (1937).
5. G. Buttin, F. Jacob, J. Monod, in *Heritage from Mendel*, R. A. Brink. Ed. (Univ. of Wisconsin Press, Madison, 1967), pp. 155–177.
6. J. Kermicle, thesis, University of Wisconsin, 1963.
7. R. A. Brink, in *Role of the Chromosomes in Development*, M. Locke, Ed. (Academic Press, New York, 1964), pp. 183–230.
8. L. J. Stadler, *Cold Spring Harbor Symp. Quant. Biol.* **16**, 49 (1951).
9. L. J. Stadler and M. G. Nuffer, *Science* **117**, 471 (1953).
10. M. Emmerling, *Cold Spring Harbor Symp. Quant. Biol.* **23**, 393 (1958).
11. D. F. Brown, *Genetics* **54**, 899 (1966).
12. ——— and R. A. Brink, *ibid.* **45**, 1313 (1960).
13. R. A. Bray and R. A. Brink, *ibid.* **54**, 137 (1966).
14. R. B. Ashman, *ibid.* **51**, 305 (1965); *ibid.* **52**, 835 (1965).
15. K. S. McWhirter and R. A. Brink, *ibid.* **47**, 1053 (1962).
16. G. R. K. Sastry, H. B. Cooper, Jr., R. A. Brink, *ibid.* **52**, 407 (1965).
17. R. Hagemann, *Z. Vererbungslehre* **89**, 587 (1958).
18. E. H. Coe, Jr., *Genetics* **53**, 1035 (1966).
19. R. A. Brink, *ibid.* **46**, 1207 (1961); ——— and M. Blackwood, *ibid.*, p. 1185; R. A. Brink and N. K. Notani, *ibid.*, p. 1223; R. A. Brink and J. Venkateswarlu, *ibid.* **51**, 585 (1965); D. E. Kester and R. A. Brink, *ibid.* **54**, 1401 (1966).
20. R. A. Brink and W. J. Weyers, *ibid.* **45**, 1445 (1960).
21. E. D. Styles and R. A. Brink, *ibid.* **54**, 433 (1966).
22. R. A. Brink and M. Blackwood, *ibid.* **46**, 1185 (1961).
23. E. D. Styles and R. A. Brink, unpublished work.
24. E. D. Styles, *Genetics* **55**, 339 (1967).
25. ———, *ibid.*, p. 411.
26. L. J. Stadler, *Cold Spring Harbor Symp. Quant. Biol.* **9**, 168 (1941).
27. J. D. Axtell and R. A. Brink, *Proc. Nat. Acad. Sci. U.S.* **58**, 181 (1967).
28. E. G. Anderson, A. E. Longley, C. H. Li, K. L. Retherford, *Genetics* **34**, 639 (1949).
29. H. Winkler, *Die Konversion der Gene* (Fischer, Jena, 1930).
30. M. Mitchell, *Proc. Nat. Acad. Sci. U.S.* **41**, 935 (1955).

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How May Congress Learn?

Amitai Etzioni

An important question arose recently during a congressional hearing about "The Full Opportunity and Social Accounting Act" (S. 843), an act in which the United States is to review annually the "health" of American society. The question is: Who will be in charge of providing the data about the changing state of the society and how will it be made available to Congress? Stated more broadly, the issue concerns the mechanisms available to the national legislature to update its knowledge. In seeking an answer to this question, one must take into account: (i) the inevitability that knowledge about society will be politically "colored"; and (ii) that the slant of and the access to knowledge is affected by the distribution of resources used in its production and processing.

Political Elements of Knowledge

The current debate among social scientists concerning the "objectivity" of social scientific knowledge is not central to our discussion. Even if it were shown that the social sciences could be completely free of value judgments, this would not mean that they are so at the present time. More importantly, the question of how a society (or its decision-making bodies) "learns" does not concern a "pure" scientific exploration but, rather, knowledge as it is applied to actual social situations. Here pragmatic considerations take priority, and these include political considerations.

Since the writings of Immanuel Kant, it has been clearly established that scientific knowledge is always incomplete and tentative. The gap that exists between what we are capable of learning and what we in fact know is unbreachable. And the knowledge we do have must be continually revised. Hence, one can never rely on the information one receives as such, even when it is the best available; one must always add interpretations to attempt to close the gap between the knowledge available and that which a rational decision would require. Also, scientific knowledge tends to be contained within comparatively abstract and specialized disciplines; it thus provides a highly fragmented picture of reality. Decision-making, however, requires synthesized knowledge and an inter-disciplinary perspective. Thus, science per se provides only limited help for the decision-maker who must find connections among the facts of numerous disciplines, each incomplete in itself.

In short, the relationship between the social sciences and a societal decision-maker is not very different from that between the natural sciences and a medical practitioner: Even if either practitioner had mastered all knowledge which the scientific discipline contains,

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he still would have to interpret, project, and make connections—on the basis of fragmented information and in accordance with the canons of the applied world.

The canons of the applied world, as in the case of medicine, begin with the question, "Does it help?" not, "Is it true?" The precise way in which medicine X works may be unknown, but this is of secondary concern to the practitioner if it cures the illness. Similarly, a societal decision-maker may select a given course of action according to whether or not it will yield the desired results. His criteria for which action "works" has two elements: (i) Does it have the expected societal consequences? (that is, improve the quality of education); (ii) Is it a political asset or liability? As a rule, the decision-maker judges new knowledge by both criteria simultaneously and he "trades" among them. He will tend to reject knowledge that improves the accuracy of his vision somewhat, if such revision (such as the view of China) will prove (or seem to prove) highly damaging politically. Hopefully, he accepts major items of new information even if they are somewhat politically damaging. The more difficult it is to evaluate validity (and it is usually quite difficult), the more important political considerations tend to become. This is a major root of the wide conservative bias against social science findings, the conclusions of which tend to point toward liberal policy.

It is in the interaction between knowledge producers and consumers, as between social sciences researchers and societal decision-makers, that the knowledge is selected and adapted politically. While experts do not deliberately slant their facts to make them acceptable, the variety of interpretations that can be given to the same set of data help the more acceptable ones to be more readily communicated. It is of secondary importance who actually prepares the more politically "digestible" interpretations—the expert himself, a popularizer colleague, a promoter, a staff aid, or the politician himself. Often it is done in collaboration and each provides a degree of interpretation which is then extended by the next one.

Although new knowledge generally filters into societal decision-making processes in this manner, there are significant differences in the degree to which new facts are interpreted and the extent to which politically undigestible facts are screened out. In part, this is a matter of how "hard" the science is, and hence, how demonstrable are its findings. In part, this depends on the nature of the relationship among knowledge producers and between knowledge producers and the decision-makers. This concerns us next.

Pluralism—the production of knowledge at many centers and the available support for this production at many sources—has often been cited as an important condition for increasing the validity of one's knowledge. Invalid theories are more likely to linger longer when one school of thought gains control of all major centers and sources. Similarly, when access to the decision-makers is limited, fewer interpretations (and facts) reach the decision-makers, who are then less aware of the tentative nature of the facts and theories which they have received and of the range of possible alternatives before them.

Pluralism alone is not sufficient; there also must be a roughly equal distribution of resources and access among the sources of information that compete as to who will be the supplier (or among the suppliers) of the decision-makers. If not, the contest may become similar to the confrontation between a young man from the Legal Aid Society and a battery of corporation lawyers. If the young lawyer's case is particularly good, he may prevail; it is more likely that his brief will be less adequate than that of his opponents. An imbalance of this nature becomes especially significant in societal decision-making where there are numerous "judges" and where the actor capable of presenting the most persuasive briefs to the greatest number of judges is more likely to gain an advantage (*1*). [A recent study shows that when RAND made a major new finding of significant interest to the U.S. Air Force, its own patron, it took 150 briefings, repeated "pulling of strings," circumventing of the lines of command, and a great deal of maneuvering before the finding made its way into the decision-making center (*2*)]. Such a strenuous and time-consuming effort could not be undertaken by a member of a university department or a representative of an unaffiliated research center.

At present, it is clear that resources and access in the United States (and many other nations) are far from evenly distributed. The inequities of this distribution reflect the priorities of society. For instance, about half of the federal budget and about half of its R&D expenditure are allotted to defense purposes, mirroring the country's present concern with national security and international military commitments. Other inequities have evolved over the years without having been deliberately planned or decided upon; the great discrepancy between the resources and facilities for the production of knowledge available to the executive and to the legislature, which is of particular importance here, is a case in point.

Enter Congress

The decline of legislatures in all Western democracies has been noted frequently by contemporary political scientists. This is the result of the rapid increase in the volume of the executive's activities without a concurrent increase in the legislature's capacity to oversee them. Thus, to put it somewhat dramatically, in 1955–6, 96 U.S. Senators had to oversee a 66.2 billion dollar enterprise, while in 1965–6, 100 Senators must oversee a 107 billion dollar enterprise, as well as two additional states (*3*). A similarly striking example is provided by the knowledge explosion. The executive, by far the largest knowledge consumer in the United States, uses millions of dollars worth of information to guide its vast, intricate network of activities. If legislatures are to examine these operations, their efficiency, and their rationale, they will require manpower and resources far beyond their present supply. The basis of the problem is not, as it is sometimes said, that few members of Congress have scientific degrees; it would be neither practical nor desirable for Congress to rely for the evaluation of social programs and legislation on a member who, in his youth, gained a Ph.D., let us say, in sociology. Instead, the staffs attached to congressional committees are too small, insufficiently trained, and do not have adequate facilities to conduct independent analyses of the facts presented to Congress.

Legislatures, at the present time, rely primarily on three sources for their information: the executive, partisans (interest groups), and unaffiliated experts. Of these, the executive seems to provide by far the largest amounts of facts *and* interpretations. And for each fact and interpretation thus supplied which Congress is capable of challenging, scores of others (some of which often provide the context for the one challenged) go by unchallenged. Moreover, Congress has only a limited capacity to review the "inputted" data the

executive presents in response to congressional queries. While some Congressmen have acquired a high degree of expertise and knowledge of the areas with which their committees deal (for example, several members of the Armed Services committee), most seem unable to keep pace with new developments and new knowledge. Similarly, while some staff members are experts, many others are lawyers by training and politicians by ambition; they have neither the time nor the facilities, especially computers, to keep abreast of new information.

Partisan groups are the second source of information. The information they supply to Congress is frequently aimed at contesting executive assertions. At the same time, however, this information is highly selective and slanted. The competition among interest groups with a variety of perspectives rarely yields a holistic view of society. And the adversary system allows its participants to determine which issue to focus on, and ignores those parts of the population not represented by interest groups; also, in many areas, interest groups are "specialized" and there are no countervailing groups (*4*). Moreover, the process is not an automatic one; the synthesizing of a multiplicity of segmented and slanted reports into one encompassing and valid report is a far more demanding task than is often implied.

Representatives of universities, unaffiliated research centers, the press, and civic groups provide a third source of information. However, many of these experts are not "unaffiliated" in the full sense and often have special interests or ideologies to present. More importantly, there may be legitimate disagreement among them over facts, and above all, interpretations. But Congress has only a limited capacity to judge between the contested views provided by these various sources. For example, at the recent hearings about "The Full Opportunity and Social Accounting Act," I argued for a separate facility attached to Congress (like the Library of Congress) that would provide for impartial analyses of societal data. My colleague, Philip Hauser, who testified after me, argued that this was not necessary since data provided by the executive was objective, reliable, and dependable (*5*). In this situation, how could Chairman Fred R. Harris and his subcommittee members determine which proposition was valid? Ideally, Senator Harris could ask his staff to check a random set of data presented to congressional committees during the last year. But this would require at least a few men working for a few months, more than the total staff of the subcommittee, and more effort than was allowed for his review of this act. Hence, their judgment, as well as most others, was likely to be made on the basis of "informal" perusals of information already available, on intuition, and political considerations.

It should also be noted that unlike branches of the executive, Congress has few funds to "farm out" research. For example, when NASA sought to stress that its space program had considerable economic "spin-offs," it could grant funds to researchers to search for corroborative evidence. However, if, after the Senate Committee on Aeronautical and Space Sciences had received the report, press reports had indicated that NASA had overstated its case, the committee could not, even if it desired, "farm out" a sample for independent review by a research organization.

Adaptation

The net result is the partial "blinding" of Congress and, in my judgment, the increasing exclusion of the executive's work from democratic supervision. It may be argued that in an age of mass information the "rule" of the expert is inevitable, and that it is just as well that politicians are kept from interfering in administrative processes. Making Congress more effective, it may be said, is making the conservative forces of society more powerful. However, the basis of the problem is that intensive and encompassing societal action requires societal backing (or "consensus") if it is not to be alienating or prohibitively expensive. In the past, the national legislature was a major source of this consensus. Now, since legislatures are provided with insufficient information (while the scope of societal activities is steadily augmenting), their capacity to act effectively is declining. Lack of consensus is a major barrier.

In France, where the legislature is even weaker than in most other Western democracies, an adaptation has evolved: The government experts deal directly with the various interest groups, sharing information with them, learning what their needs and preferences are, and influencing them to back the necessary societal action. The interaction of the experts and the representatives of interest groups generates a measure of extra-parliamentary consensus-formation. (This process is even more visible in the European Economic Community which, in effect, has no legislature, but does have an active bureaucracy.) But these are nondemocratic adaptations, which create an executive bias toward the interest groups and neglect other segments of the public.

Conclusion

If the capacity of the legislature to build consensus and oversee the executive is to be restored, a variety of new resources must be assigned to the legislature. Larger staffs are needed for congressmen and especially congressional committees; the additional staff members should have research training and should not be assignable to functions other than those of a congressional research assistant. A major congressional research unit is needed in which information (other than books and documents), especially statistics, IBM decks, and computer tapes could be stored. A unit of this type would be able to provide a congressman or congressional committee with a detailed analysis and evaluation of data submitted to him from other sources. (To some extent, the Library of Congress provides services of this kind, but we suggest that what is needed is a much more extensive, computer-operated and wholly research-oriented unit). In addition, there should be sufficient funds for congressional committees to "farm out" research tasks. Finally, the informal hearing procedure should be replaced with a more rigorous one, so that witnesses will be more reluctant to give "stretched" interpretations, and more inclined to arm themselves with valid information.

References and Notes

1. The relationship between equality of resources and knowledge is further explored in A. Etzioni, *The Active Society* (Free Press, New York, 1968), chap. 9.
2. B. L. R. Smith, *The RAND Corporation; Case Study of a Nonprofit Advisory Corporation* (Harvard Univ. Press, Cambridge, Mass., 1966), chap. 6.
3. *The Budget of the U.S. Government for the Fiscal Year Ending June 30, 1966* (GPO, Washington, D.C., 1965), p. 490, table 15; *The Budget . . . Ending June 30, 1967* (GPO, Washington, D.C., 1966), table 15.
4. G. McConnell, *Private Power and American Democracy* (Knopf, New York, 1966).
5. Hearing of the U. S. Senate Committee on Government Operations, Subcommittee on Government Research, 90th Congress, July 1967.