

INTERNATIONAL BUSINESS MACHINES CORPORATION

San Jose, California

December 6, 1956

Dr. Ward Pigman
University of Alabama
Medical Center
Birmingham, Alabama

Dear Dr. Pigman:

I have read carefully the full sixty-one page draft of the report of the American Association for the Advancement of Science, Committee on the Social Aspects of Science, "Society in the Scientific Revolution," dated October 31, 1956.

You and the rest of the committee are to be congratulated for producing this excellent report. I feel that it is a landmark in the development of a concern on the part of scientists for the problems of the interaction of science and society. It is gratifying to see the A. A. S. taking an active part in studying these problems which heretofore have been the concern of the few special organizations such as Federation of American Scientists, The American Association of Scientific Workers, and the Association for Social Responsibility in Science.

It is my hope that the Council of the A. A. S. will authorize a continuation of the work of this committee. My suggestion for the orientation of the work of the committee next year is to center on the significance of cybernetics, feedback networks, communication theory, and operational research in connection with the relationships between science and society. Norbert Wiener has published an article, "Eight Years of Cybernetics and the Electronic Brain" in The Pocket Book Magazine, No. 2 (1955) pp. 44 - 60. Dr. Wiener has said: (underlining is my addition for emphasis)

"The study of communication theory as a means of stabilizing society is also beginning to lead to new concepts in sociology . . .

In the last few years greater insight into the organization of policy and control has been demonstrated, and part of this insight has come from cybernetics. Effective behavior and effective control must be informed by some sort of feedback process which reports to the organism, whether it is a machine, an individual human being, a corporation, or a state, that it has either achieved its goal or fallen short. Administrative officials must take part in a two-way stream of communication, not merely one emanating from the top down. Otherwise the top officials may find that they have based their policy decisions on a complete misunderstanding of the facts their subordinates possess. . . .

Crudely put, a system that controls itself by negative feedback is one which is so organized that when any part of it ceases to function well the impairment itself serves as the impetus for the system to start restoring its proper functioning. The concept is not completely different from the old one of the United States Government as a government of checks and balances.

Such a system tends to maintain relative stability. The way a human being remains standing is a simple example (simple as the feedbacks in the human body go) of negative feedback. . . .

Besides these explicitly cybernetic ideas there are two new directions of thought in regard to control which emanate from sources that were not originally cybernetic but which have the most intimate intellectual connection with cybernetics.

One of these is the theory of games and economic behavior worked out by Dr. John von Neumann of the Atomic Energy Commission and the Institute for Advanced Studies at Princeton, New Jersey.

According to this theory each person tries to play to maximize his gain on the assumption that the other players are also playing to maximize their own gains. . . .

Another source of a modern theory of organization comes from what has been known since World War II as operations research. Professor Marston Morse of the Institute for Advanced Studies was one of the people most active in operations research during the war. In such matters as the laying of a mine field or the systematic bombardment of a region it became necessary to determine what policy of placing the mines or of distributing the bombardment would lead to the greatest probability of effective damage to the enemy. Since then similar techniques based on probabilities have been found useful in working out many problems in industry, especially in solving the difficult economic problem of determining with what inventories and what reserves of goods and materials a business might operate most successfully. . . ."

The development of an adequate understanding of the interaction between science and society is prerequisite to any proposals for action on the part of the A. A. S. which represents science in general. The above quotations from Norbert Wiener suggest ways of developing better communications between scientists and society; and between physical scientists and social scientists.

There is one point in the draft which I would question. Page 2, 2nd paragraph, 12th line. The reference to "96" elements dates the material back a few years. I suggest revising the sentence to read:

From these explorations, man learned that the elements fitted into groups forming a periodic table which predicted the existence of 92 elements; all of which now either have been discovered in nature or have been produced artificially. Through advances in experimental techniques and the theoretical postulation of an additional row in the periodic table, additional synthetic elements have been predicted of which number 93 through 101 have been artificially produced and identified.

A discussion of the elements and periodic table in a popular form can be found in the following articles in the Scientific American.

"The Synthetic Elements" by Perlman and Seaborg,
April 1950.

"The newest Synthetic Elements" by Ghiorso and Seaborg,
December 1956.

Very truly yours,

F. B. Wood

F. B. Wood
Staff Engineer

FBW:hp

cc: Dr. Dael Wolfe
AAAS, Executive Officer
1515 Massachusetts Avenue
N. W., Washington 5, D. C.

Dr. Barry Commoner
Washington University
St. Louis, Missouri

Dr. Gabriel Lasker
Wayne University
Detroit, Michigan

Dr. Chauncey Leake
Ohio State University
Medical School
Columbus, Ohio

Dr. Benjamin Williams,
Industrial College of the Armed Forces
Washington, D. C.