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Dr. Frederick B. Wood: The Philosophy of General Systems Theory

SYNOPSIS OF REMARKS of SEPTEMBER 25, 1965

The objectives of general systems research have been established by the Society for General Systems Research as follows:

1. To investigate the isomorphy of concepts, laws, and models in various fields, and to help in useful transfers from one field to another;

2. To encourage the development of adequate theoretical models in the fields which lack them;

3. To minimize the duplication of theoretical effort in different fields;

4. To promote the unity of science through improving communication among specialists.

It is important to consider what further applications general systems research might have in our civilization. To explore this question, we first examine a somewhat broader range of applications than communication between specialists. There are roughly four major areas to consider:

Multidisciplinary Research: Research being pursued by one scientist, who must learn the concepts of two or more fields of science due to the problems he is concerned with not fitting within the narrow boundaries of traditional special fields. (1)

Inter-Disciplinary Research: Scientific research where specialists work as a team on projects crossing the normal field boundaries.

Managerial Decision Making: General systems theory gives promise of helping decision makers and managers in business and government to develop a better understanding of the systems they are managing.

Citizens' Discussions in a Democracy: General systems research contributions to the unity of science may be of potential help in making it easier for the citizen to acquire a perspective of the interplay of science and government so that he may be better prepared to elect competent representatives.

It appears that different types of organizing perspectives of the status of general systems research are required for these different types of activities. In multidisciplinary research where one scientist is pursuing a problem through several fields, a perspective based upon three coordinates: phenomena, method, and activity appears the most generally useful. The range of these coordinates is:

Phenomena:	Physical, Chemical, Biological, Psychological, and Sociological;
Method:	Intuitive, Abstract, and Empirical;
Activity:	Science, Engineering, Education, and Decision-Making.

When more extensive problems are encountered involving inter-disciplinary cooperation between a number of specialists, the above perspective becomes somewhat cumbersome. Then a tracing of the usage of concepts through different fields and by different scientists becomes more practical. O. R. Young (2) has prepared some excellent tables of the usage of concepts in different fields with the following classes of categories:

1. SYSTEMIC AND DESCRIPTIVE FACTORS: open and closed systems; organismic and non-organismic; subsystems; state determined systems; equifinality;

boundaries; field; isolation and interaction; interdependence; integration and differentiation; centralization and decentralization.

2. REGULATION AND MAINTENANCE: stability; equilibrium, feedback; homeostatsis; control; negative entrophy; repair and reproduction; and communication.

3. DYNAMIC AND CHANGE: adaptation; learning; growth; change; teleology; goal; and dynamics.

4. DECLINE AND BREAKDOWN: stress; disturbance; overload; positive entropy; and decay.

While the above classification provides a convenient perspective for inter-disciplinary research, still another type of perspective appears needed to help the decision-makers and the citizens. It is possible to organize models and technologies on the following coordinate system:

1. Size of System (Small to Medium to Large)
2. Complexity of System (Simple to Complex)
3. Degree of Quantization (Gross Parameters down to Fine Detail)

The degree of quantization is closely related to another possible coordinate -- namely Time Relationship (Static to Slowly Varying to Dynamic).

The Size-Complexity-Quantization coordinate systems can be used to develop a perspective of mathematical models of value to the decision-makers. It can also be used as a reference system for illustrating the physical systems such as control systems, computers, radar systems, and telephone networks for better understanding by the citizen.

Dr. Donald N. Michael (3) has predicted that in 1982:

"There will be a small, almost separate, society of people in rapport with the advanced computers. These cyberneticians will have established a relationship with their machines that cannot be shared with the average man any more than the average man today can understand the problems of molecular biology, nuclear physics, or neuropsychiatry. Indeed, many scholars will not have the capacity to share their knowledge or feeling about this new man-machine relationship."

Now I predict that vigorous general systems research will make possible better communication between multi-disciplinary and inter-disciplinary scientists and decision makers and citizens so that democratic instutions can function, and that Dr. Michael's dire predictions need not come to pass.

References

1. W. Gray - Letter to the Editor on multi-disciplinary and inter-disciplinary studies. Science, 1964, 144, No. 3620, May 15.

2. O. R. Young, "A Survey of General Systems Theory." General Systems,* Vol. IX, pp. 61-80 (1964). [* P.O. Box 228, Bedford, Mass. 01730]

3. Donald N. Michael, "Cybernation: The Silent Conquest" A Report to the Center for the Study of Democratic Institutions, Box 4068, Santa Barbara, California, January 1962, pp. 44-45

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