

"A Snapshot of Cybernetic Models and Technologies"

by

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Arnold Toynbee in his Study of History has^{shown} that all great civilizations of the past have gone through a process of developing to great heights and then a period of disintegration. Ours is the first civilization to have the knowledge giving^{us} the capability of preventing the disintegration of our civilization. However we have not developed a way to use this knowledge to decisively attack the crises of our civilization.

In this series of three short notes, I aim to indicate the direction we can go in applying the concepts of Cybernetics to attack the major problem of maintaining a balance between freedom and stability in human civilization. Let us first examine the dictionary definition of "Cybernetics:"

"Comparative study of the automatic control system formed by the nervous system and brain and by mechanical-electrical communication systems."

Norbert Wiener envisioned a much broader definition. J. R. Pierce in Symbols, Signals and Noise (1962) discusses the problem:

"What is cybernetics? If we are to judge Wiener's book, it includes at least information theory, with which we are now reasonably familiar; something that might be called smoothing, filtering, detection and prediction theory, which deals with finding the presence of and predicting the future value of signals, and usually in the presence of noise; and negative feedback and servomechanisms theory,

We must, I think, also include another field which may be described as automata and complicated machines. This includes the design and programming of digital machines.

Finally, we must include any phenomena of life which resemble anything in this list or which embody similar processes. This brings to mind at once certain behavioral and regulatory functions of the body, but Wiener goes much further. In his second autobiographical volume, I Am a Mathematician, he says that sociology and anthropology are primarily sciences of communication and therefore fall under the general head of cybernetics, and he includes, as a special branch of sociology, economics as well."

I admire Norbert Wiener's vision of the scope of Cybernetics, but I think some practical restrictions are in order. Instead of classifying all social sciences as branches of Cybernetics, I perceive Cybernetics as an applied or engineering type of discipline which provides the common concepts and philosophy with which to integrate the pieces of the different physical and social sciences needed in organizing the evolutionary changes in society that are needed for our civilization to survive in a way that maintains respect for each individual human being.

In this short note I present a snapshot of the major models and technologies of Cybernetics without explanation, leaving it up to the curious reader to explore the references. In the next article, I plan to discuss how cybernetics can be used to coordinate the three methods: humanist-intuitive-poetic; abstract-mathematical-philosophical; and empirical-scientific in their application to aiding social evolution.

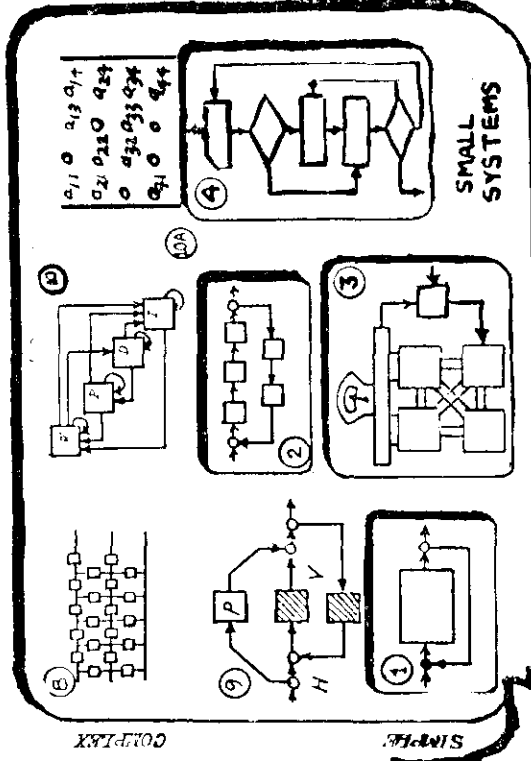
"A SNAPSHOT OF CYBERNETIC MODELS & TECHNOLOGIES"

- 11. INPUT-OUTPUT MATRIX OF ECONOMIC SYSTEM
- 12. FOLDING MATRIX WITH CAPITAL REQUIREMENTS OF SOCIALIST SYSTEM
- 13. INVERSE LEONTIEF MATRIX
- 14. ANALOG OF SOCIO-POLITICAL SYSTEM

- 15. LAISSEZ-FAIRE ECONOMIC MODEL
- 16. CENTRALLY PLANNED ECONOMY
- 17. DECOUPLED DECISION MAKING

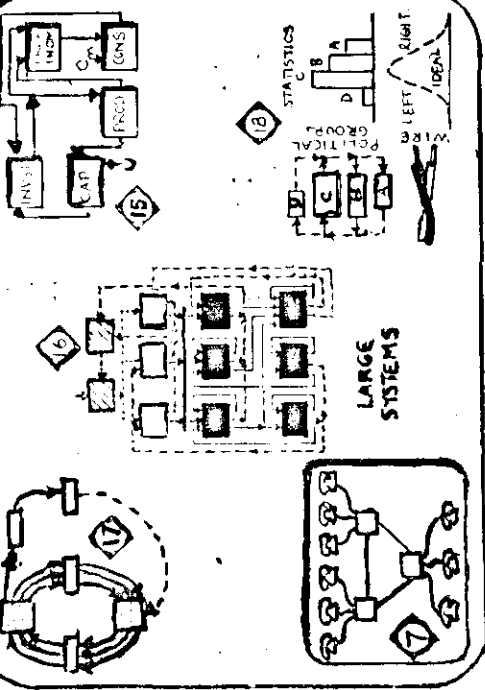
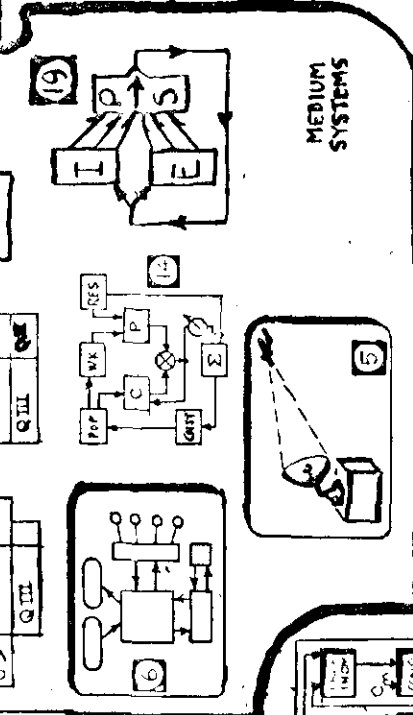
LEVEL OF COMPLEXITY

SMALL



SIZE OF SYSTEM

MEDIUM



FINE

MEASURE OF QUANTIZATION

COARSE

- 1. NEGATIVE FEEDBACK CIRCUITS
- 2. COMPLEX SERVO-MECHANISMS
- 3. HOMEOSTAT
- 4. COMPUTER LOGIC (SOFTWARE)

- 5. RADAR & PREDICTION THEORY
- 6. COMPUTING SYSTEM (HARDWARE)

- 8. DIFFERENTIAL EQUATIONS
- 9. CANONICAL FEEDBACK CIRCUITS
- 10. ANALOG MULTI-SECTOR SYSTEM
- 10A. MATRIX OF MULTI-SECTOR

- 7. NATIONAL TELEPHONE SWITCHING SYSTEM
- 18. COMMUNICATION ENTROPY MODEL OF SOCIOLOGICAL SYSTEM
- 19. RESPONSE MODEL OF A POLITICAL SYSTEM

DYNAMIC

SLOWLY-VARYING

TIME-AVERAGE

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This note is based on a paper presented at the Conference on 'Cybernetics and Society' held at Georgetown University, Washington, D.C., November 19-20, 1964.