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"HISTORICAL PERSPECTIVE OF CYBERNETICS
AND INFORMATION THEORY"

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Historical Perspective of Cybernetics and Information Theory

Both Information Theory and Cybernetics started an avalanche of papers in 1948 following Shannon's paper (5) and Wiener's book (11). The output of papers, in the general of Communication Theory averaged 200 papers for two years and then jumped to 300 and on to 500 per year as is shown in Fig. A. A book was counted as ten papers. The number of general or basic articles in Scopus bibliographies rose up to an average of 100 per year by 1956. The philosophical articles rose to 20 per year and then averaged off to ten per year.

In the Soviet Union Cybernetics was initially denounced as a "reactionary bourgeois science," but about 1953 the Information Theory-Cybernetics articles in the Soviet Union began increasing. In the last few years a new spectacular rise in the number of Russian articles on Cybernetics has occurred. The new feature of the current rise in articles is that they deal in many instances with philosophical, sociological, economic, educational, and special applications.

The slow methodical spread of American and Western European books on Cybernetics and Information Theory through different levels of phenomena and different activities is shown in Fig. B. The apparent jump of the Soviet articles into the education column of activity is also shown in Fig. B. To properly evaluate the

significance of the recent Russian work we need to utilize the third dimension indicated in Fig. B, namely METHOC: Experimental Science/ Abstract Models(Philosophical)/ Religious-Intuitive-Poetic. In Fig. C, Section W2, Wiener's discussion of analogies of cybernetics

in social and political systems is shown tilted back into the philosophical method in the psychological-phenomenal level and into the intuitive-poetic method for social phenomena. Similarly Weaver's discussion of the technical, semantic and effective levels of Information Theory are distributed through these three levels of Method in Fig. C.

A brief examination of the recent Soviet Cybernetics innovations indicates much of their work in the psychological-social-phenomenal levels belongs in the abstract-philosophical or intuitive-poetic methods range. The apparent weakness in the empirical science level of some of these Soviet studies may not necessarily be weakness, but possibly signs of a developing insight on how to match these methods together.

For more specific developments in the application of "maximizing negative entropy" see the following working papers:

SEPR No. 88-B, "Negentropy and the Concepts of Freedom, Prosperity, and Justice," 12/27/53, 26pp. text, 14pp. tables and figures.

SEPR No. 91, "Four Philosophical 'Tools' For Improving Our Insights Regarding The Problems Of Disarmament," 11/10/54, 23pp. text, 14pp. figures.

SEP No. 2, "SAN JOSE 2003 A.D. (Social Configuration) "The City That Has A Heart" A pioneer city in the use of atomic energy; random access accounting; social production; in brotherly love. 9/30/57-11/10/58, 18pp.

The application to city planning has been covered more fully in the following book:

Richard L. Meier, A Communication Theory of Urban Planning, Boston: M.I.T. Press (1962)

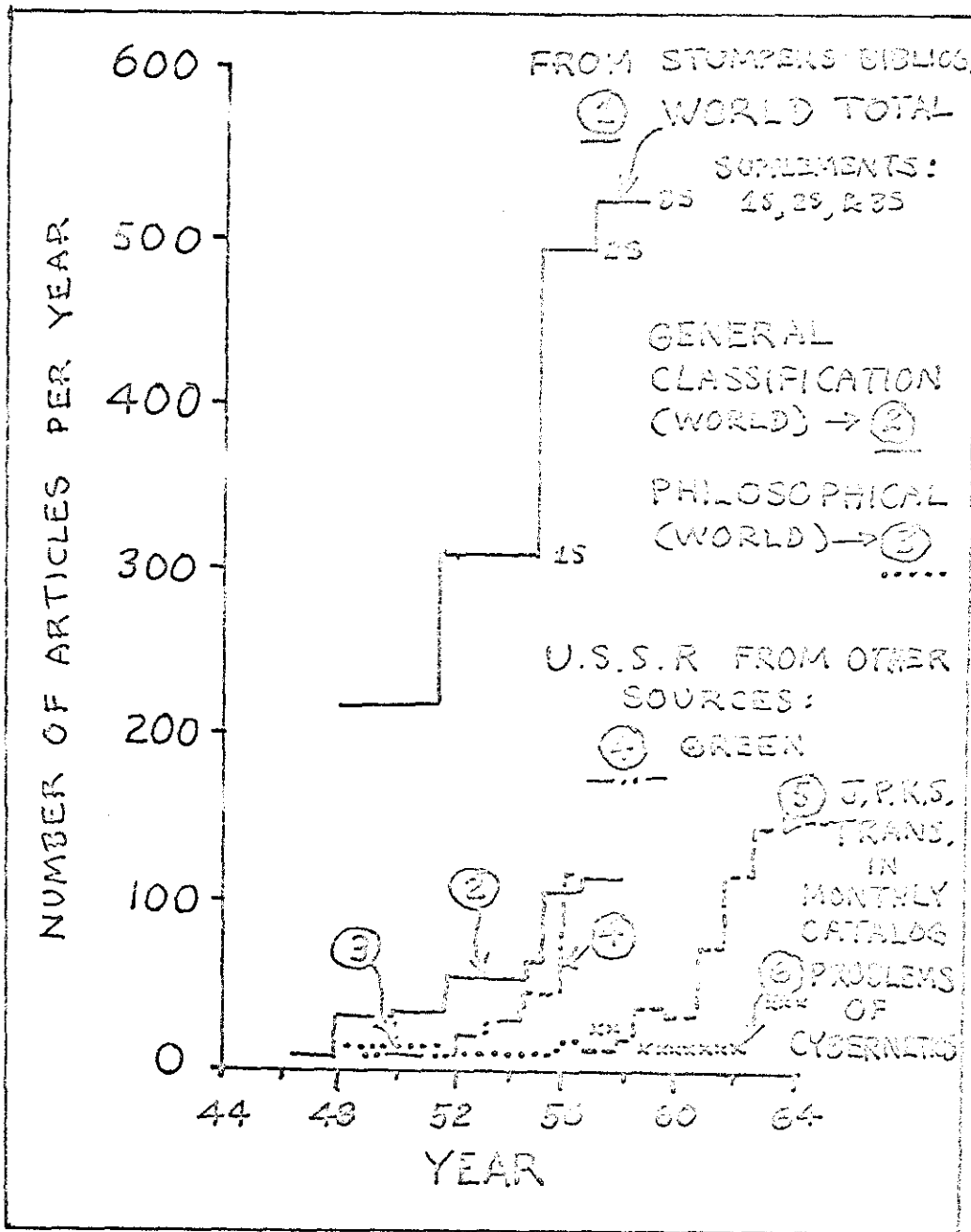


Fig. A. Plot of Number of Articles on Communication Theory, Information Theory, and Cybernetics Published per Year.

*Note: Books counted as an equivalent number of articles.

TABLE AB: Key to References in Figures 1 & 5.

- A = Asby, Aspects of the Theory of Communication
- B = Beer, Cybernetics and Man
- C = Shannon & Weaver, The Mathematical Theory of Communication
- DI = Wiener, Cybernetics
- DR = Wiener, The Human Use of Language
- DT = Wiener, Intelligence and the Mind
- EV = Gajdowski, Cybernetics and the Human Mind
- F = Folsom, Engineering Cybernetics
- AC = M.I.T. Radiation Laboratory
- CONF = Conf. Proc. "Philosophy of Cybernetics" (Moscow, 1951)

also "Cybernetics at the Service of Communism," (Moscow, 1951)

- G = Shannon, Modern Information Theory
- H = Co. Olson, Information Theory
- I = Sussman, The Theory of Circuits
- JK = Jullien, Information Theory
- L = Lathi, Information Theory
- M = Feinstein, Communication Theory for Secrecy Systems
- N = Khinchin, Mathematical Foundations of Information Theory
- Y = Yockey, Symbols, Signs and Semiotics
- AT = Attneave, Information Theory and the Psychology of Language

D = Deutsch, Nationalism and Social Communication, (1953), pp. 64-80.

STUMPERS = Stumpers, "Bibliography of Communication Theory- Cybernetics- Information Theory," MIT RLE Report (1953) and Supplements IRE Trans. on Information Theory.

GENERAL = General section of Stumpers Bibliography.

PHILOSOPHICAL = Philosophical section of Stumpers Bibliography. (Books were counted as equivalent to ten papers.)

GREEN = Bibliography by Green in WESCON Conv. Record (1957) and supplement in PGIT on Information Theory in the U.S.S.R.

J.P.R.S. TRANS. = Translations on Cybernetics listed in Monthly Catalog, U.S. Superintendent of Documents, Washington, D.C.

PROB. CYBER. = Problems of Cybernetics (Moscow, 1951)

The major books in each of these fields are listed with their approximate areas of coverage. The books are listed in order of increasing complexity of phenomena dealt with. The books are listed to be selected for future work in the field of cybernetics and the philosophy of cybernetics.

INFORMATION THEORY: A study of the mathematical theory of the efficiency of communication systems. The theory is based on the concept of entropy and is applied to the study of communication systems, coding, and the theory of error-correcting codes.

CYBERNETICS: Comparative study of the theory of communication systems. The theory is based on the concept of information and is applied to the study of communication systems, coding, and the theory of error-correcting codes.

BASIC
TYPES
OF
PHENOMENA.

CLASSES OF ACTIVITY

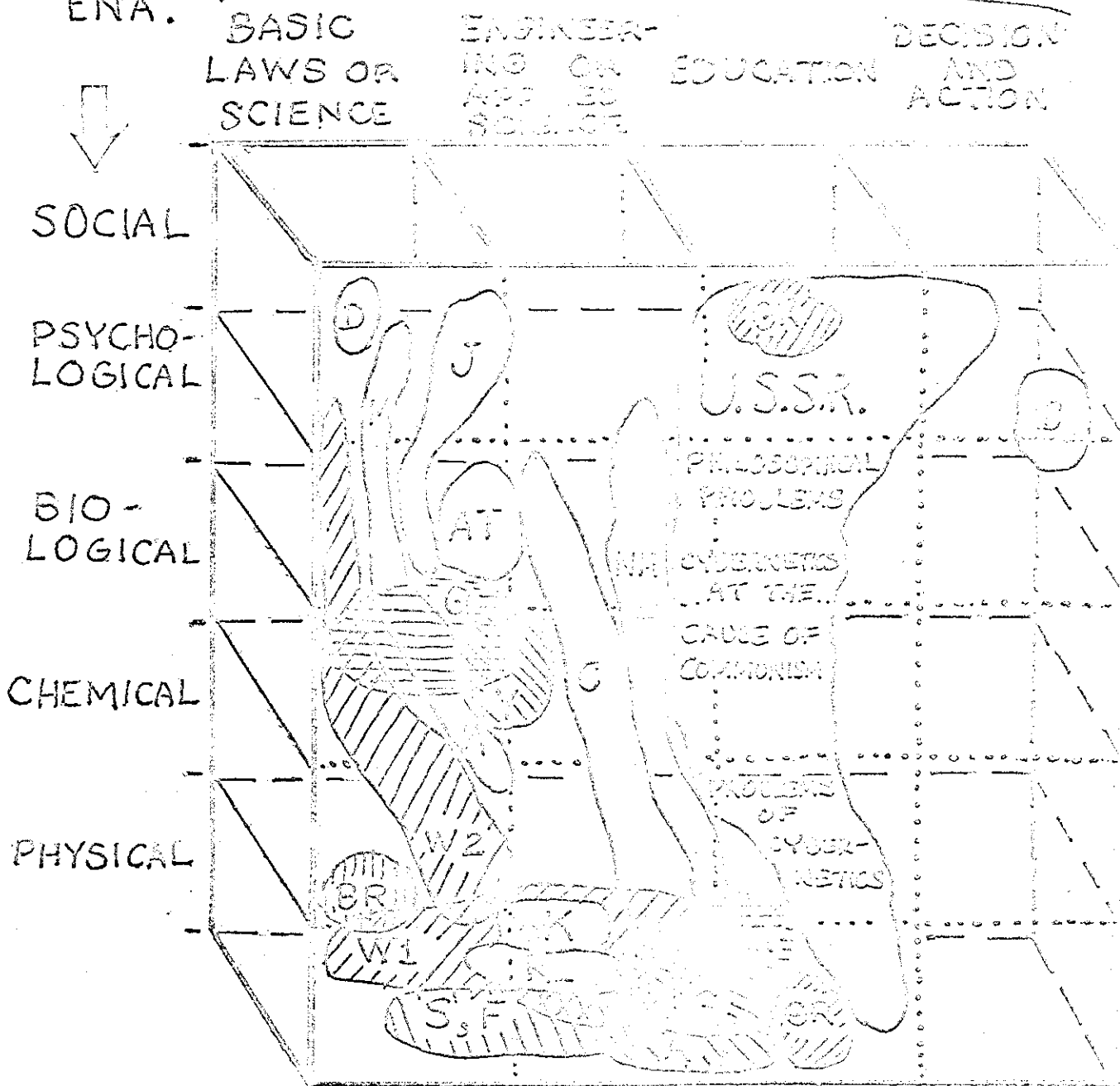


Fig. 8. Plot of Coverage of Books on Cybernetics and Information Theory on an Activity Class vs. Phenomena Type Grid System.

Encyclopedia of Cybernetics, Vol. 131, Technipunk Center, N.Y. Headline Book Co., 1963

BASIC TYPES OF PHENOMENA:

CLASSES OF ACTIVITY

BASIC LAWS OR SCIENCE ENGINEERING OR APPLIED SCIENCE DECISION AND ACTION

INTUITIVE (C) ABST. PHILOSOPHICAL (A) EMPIRICAL SCIENCE (B)

SOCIAL
PSYCHOLOGICAL
BIOLOGICAL
CHEMICAL
PHYSICAL

METHODS

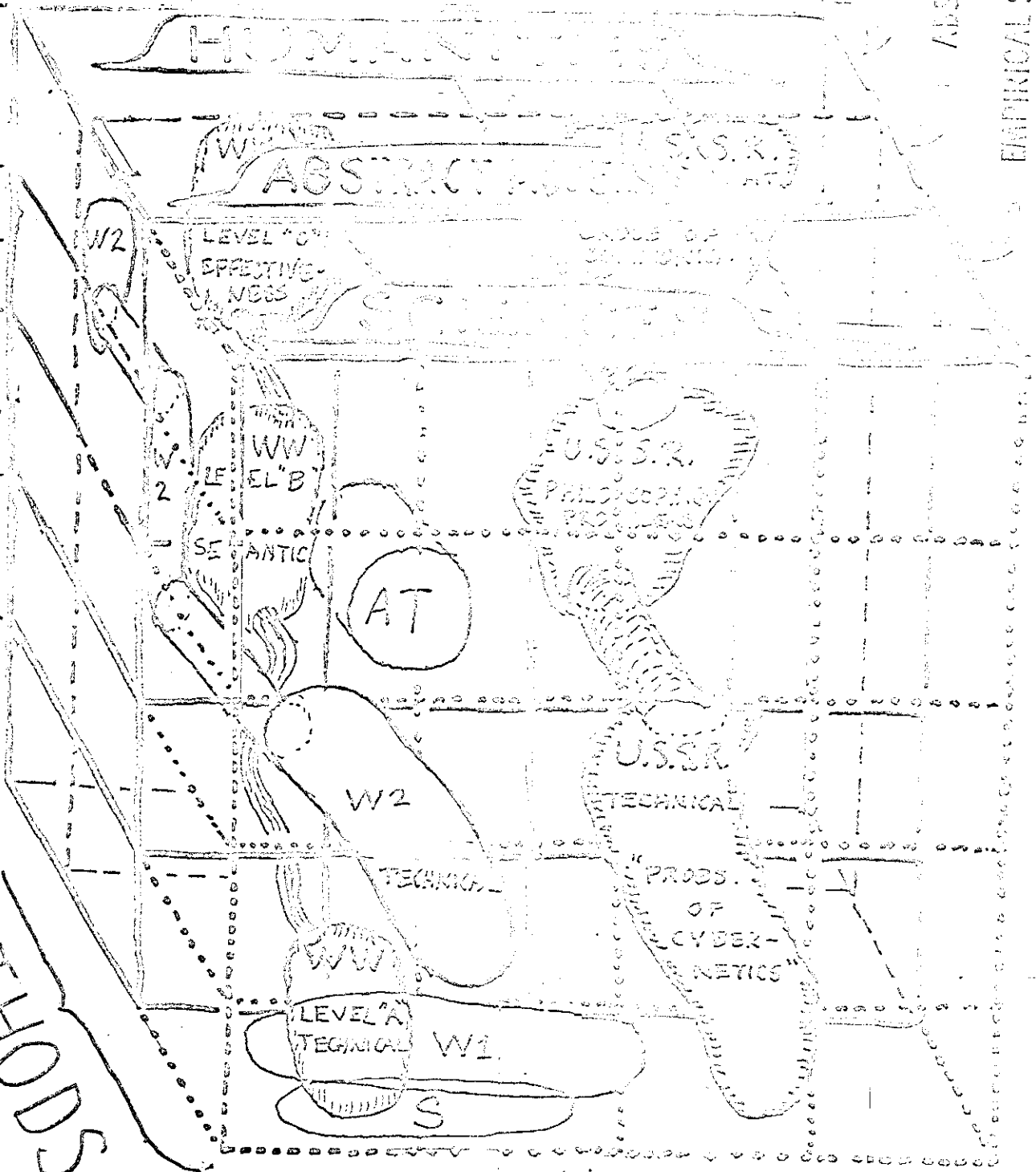


Fig. C. Sample Analyses Which Cross Through the Three Different Methods.

Supplement to SEPR No. 90-A:

In the USSR there appears to be more emphasis on programming algorithms than on computer hardware. In the USA we concentrate on the hardware development and then work on the programming system to utilize the advanced hardware. This makes it difficult for us to evaluate at what stage in the overall development of computer applications the USSR is nearly at. Perhaps they can compensate for less advanced hardware through more advanced programming techniques.

The Soviet publications Philosophical Problems of Cybernetics and Cybernetics at the Service of Communism, Vol. I, both indicate long range plans to simulate the Soviet economic system on a computer to automate most of their economic planning. If this should be successful, it would give the socialist cause a great boost; but if the Russians eliminate the hierarchy of human feedback loops needed for non-linear corrections to the systems as it functions, the system could be a colossal failure.

It is valuable to see what Soviet thinkers have to say on the social consequences of cybernetics. E. Kol'man has written:

(Abstract)"The real dangers differ in social and capitalist countries. In capitalist nations the greatest ^{danger} real is that cybernetic technology will result in mass unemployment or economic crises which may lead to war. In socialist countries the real danger is that cybernetic technology will bring such a reduction in physical and mental labor that physical and moral degeneration may result."(10)

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10. E. Kol'man, "Cybernetics Raises Questions," 7 Feb 60, 6pp. JPRS; 12235 (OTS 60-15771); Trans. of Nauka i Zhizn'(USSR) 1961, v. 28, no. 5, pp. 43-45. (Abstract in TECHNICAL TRANS. v. 7, no. 10, May 30, 1960)