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COMMUNICATION THEORY in the CAUSE of MAN

VOL. I NO. 1-2
8/30/70 Revision of Version of 7/12/70.

Notes on the application of Cybernetics, Information Theory, and related fields of Communication Theory to the strengthening of democratic institutions on our planet.

Frederick Bernard Wood, Ph.D., Publisher
P.O. Box 5095, San Jose, Calif. 95150
U.S.A.

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CONTENTS OF THIS ISSUE

'CTCM' COMMUNICATION THEORY in the CAUSE of MAN 'CTCM'

This periodical is scheduled to be published monthly and is planned so that each issue will constitute a section or chapter of a proposed book of the same title, "CTCM." The object of the proposed book is to provide some tools from the mathematical and engineering theory of communication, and in particular from Cybernetics and Information Theory, to help the layman find some ideas by which he can more easily determine his course toward a more democratic society.

Each page will be labelled with the volume and issue numbers of CTCM and with a "File Number." One may rearrange the pages of the cumulated issues by file numbers to put the sections in the order of the proposed book.

Frederick B. Wood

Now Published Quarterly.

NOTE ON REVISIONS AND ADDITIONS:

This first issue of CTCM has had a hard birth. A few copies of alternate sample issues were circulated privately for comments during the last year. Five copies of modification '5' were distributed in June'70. Feedback from these issues led to further revisions. Twenty-five copies of modification '6' were distributed in July 1970. Feedback from these led to a seventh modification being prepared in August 1970.

The '5' in File No. 100-F-5 indicates updating to June 7, 1970.
The '6' in File No. 100-F-6 indicates updating to July 12, 1970.
The '7' in File No. 100-F-7 indicates updating to August 30, 1970.

ERRATA:

File No./page/par/line	Correction
100-F-6/iv/3rd/6th	.....strategic place
214-F-5/1-2	(delete) New version being prepared.

ACKNOWLEDGEMENTS:

(Space reserved for acknowledgements when quotations are used from other publications.)

This issue of CTCM, originally printed in June 1970 has been reprinted in Nov 1971 with a change in format:

The color of the pages now indicate the type of material.

WHITE paper indicates introductory notes, preface, table of contents, and discussion of questions.

GREEN paper indicates general descriptive material of Series I intended for the layman.
YELLOW paper indicates more specific applications to social problems(Series II).
PINK paper indicates Series III material of a more technical, scientific, and mathematical nature.

This issue has been reprinted again in August 1973 with the following deletions of material covered in later issues:

Item deleted:	Updated version in:
I/1-2 p. 3 Cover/Title page	II/3 p. 5 100-F-17 p. i
I/1-2 p. 4 Frontispiece	II/3 p. 9 100-F-17 p. ii
I/1-2 pp. 9-10 Outline of proposed book	I/3-4 pp. 3-4 101-F-8 pp. 1-2 I/4X pp. 2-4 99-F-9 pp. 2-4 II/3 pp.11-22 101-F-17 pp. 1-12 II/5 pp. 7-10 101-F-19 pp. 1, 3-4
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I/1-2 page 4 is blank

1970 PREFACE to the FIRST ISSUE of the Magazine:

COMMUNICATION THEORY in the CAUSE of MAN

I am an electrical engineer struggling to maintain a degree of individuality in a world civilization that tries to turn each individual into a tool of the party, the corporation, the multiversity, or the nation-state. The principal device used to castrate individual conscience among scientists and engineers in my country is the concept of specialization. We are trained to restrict our public comments to the special fields in which we are accepted as experts. This specialization was necessary for the development of science to protect young branches of science from conflict with religious and political autocrats in the early days of science. Science has now developed to the stage where similarities are becoming apparent between some features of physical, biological, and social systems. It is now possible for a scientist or engineer using general systems concepts and some special concepts from information theory and cybernetics to understand a spectrum of phenomena in several fields of science.

This means that concepts of efficiency of physical systems have some relationships to concepts of stability in biological systems, and optimization of the balance between order and diversity in social systems. When investigated thoroughly on a deeper level it turns out that these physical concepts lead to perceptions of social systems which give us glimpses of how human individuality and diversity can be nourished and protected in a hightly organized mass civilization.

In 1948 Claude Shannon published his paper "The Mathematical Theory of Communication" in the Bell Systems Technical Journal and Norbert Wiener published the first edition of his book Cybernetics in Paris. There was a great flurry of interest in applying cybernetics to biological, social and political problems. As work in cybernetics simmered down to a practical program, lesser goals were pursued that were within the range of sponsoring institutions. This left an open question as to who was pursuing the applications that might benefit

Replaces page marked "File No. 100-F-5"
with other identification numbers the same.

mankind as a whole --- i.e., cybernetics was being applied in the cause of better communication between banks, better communication in military command systems, better communication within government agencies, etc. Could it be possible that the most important applications which are crucial for the survival of human civilization are being overlooked? Ancient Greece and Rome had the most advanced technology for their eras, yet they collapsed after a certain stage of development. Could we be focusing a gigantic effort to apply cybernetics to the control of missile systems in a two-nation game, while neglecting the potential application of the concepts to understanding the total systems stability of human civilization on the planet Earth?

My interest in these questions goes back to my childhood, when my father read to me after supper. He read to me from Hendrik Van Loon The Story of Mankind (Garden City, N.Y.: 1921). I learned that our culture was only one of many different cultures in the world and that the major religions of the world were founded by Moses(1300 B.C.), Zarathustra(1000 B.C.), Buddha(600 B.C.), Confucius(500 B.C.), The Greek Philosophers(400 B.C.), Jesus Christ(30 A.D.), and Mohammed(622 A.D.). I remember the pictures of layers of ruins of cities of past civilizations in which each new civilization built upon the ruins of earlier cities.

As various crises hit our civilization such as the 1929 stock market crash, the rise of Hitler in Germany, the Spanish Civil War, etc., I wondered how our problems could be compared with ancient Greece and Rome. Were we approaching similar crises that came before Rome collapsed? I could not get definitive answers to such questions. While in high school I decided that the strategic place to be able to observe the right phenomena to help answer such questions would be somewhere at the interface between the physical sciences and the application of physical science to practical problems. Partway through my senior year in high school I decided more specifically that electrical engineering was the optimum vantage point from which to observe and interpret social change.

In college I majored in electrical engineering and tried to include some philosophy and social science courses. Since my ideas of including philosophy in engineering didn't go over well with my faculty advisor, I tried a less formal method. I made a survey of what was happening in the social sciences by attending seminars at the student YMCA and YWCA.

While working on radar test equipment at the M.I.T. Radiation Laboratory, I organized a discussion group correlating ideas brought up at different meetings of a youth group at the Arlington Street Church in Boston. This correlation of ideas led to a classification scheme for tracing general systems concepts through different levels of phenomena.

As I shifted into the computer industry, I found a number of analogies between electrical communication theory and social systems. I found that I was developing a method of "technological meditation," which I will describe in one section of this series.

The over-specialization of our academic, industrial, and governmental organizations conceals the simple general concepts from us. What I want to do is to show the younger generation how to use a general systems viewpoint to pull the special concepts needed from (1) the scientific method, (2) the feedback analysis of cybernetics, and (3) the concepts related to information transmission properties in information theory and cybernetics in order to apply them in a simple way to bring about constructive discussion of the problems of human civilization.

This material is organized in three volumes. The first volume is intended for the layman who wants to know what cybernetic tools are available for the people to use to steer civilization in the direction people would like it to go. The second volume is devoted to applying the concepts to a number of problems. The third volume contains important technical details for the scientists and engineers that the people might call in as advisors.

These techniques should be useful to American youth to fight the capitalist bureaucracy, to Soviet youth to fight the socialist bureaucracy, to the Chinese youth to keep their government moving toward their ideals, to the youth of Cuba to help check how they are moving toward their goals, to the youth of the developing African countries

to evaluate their progress, and for the youth of Israel and the Arab countries to evaluate how their governments are living up to their ideals.

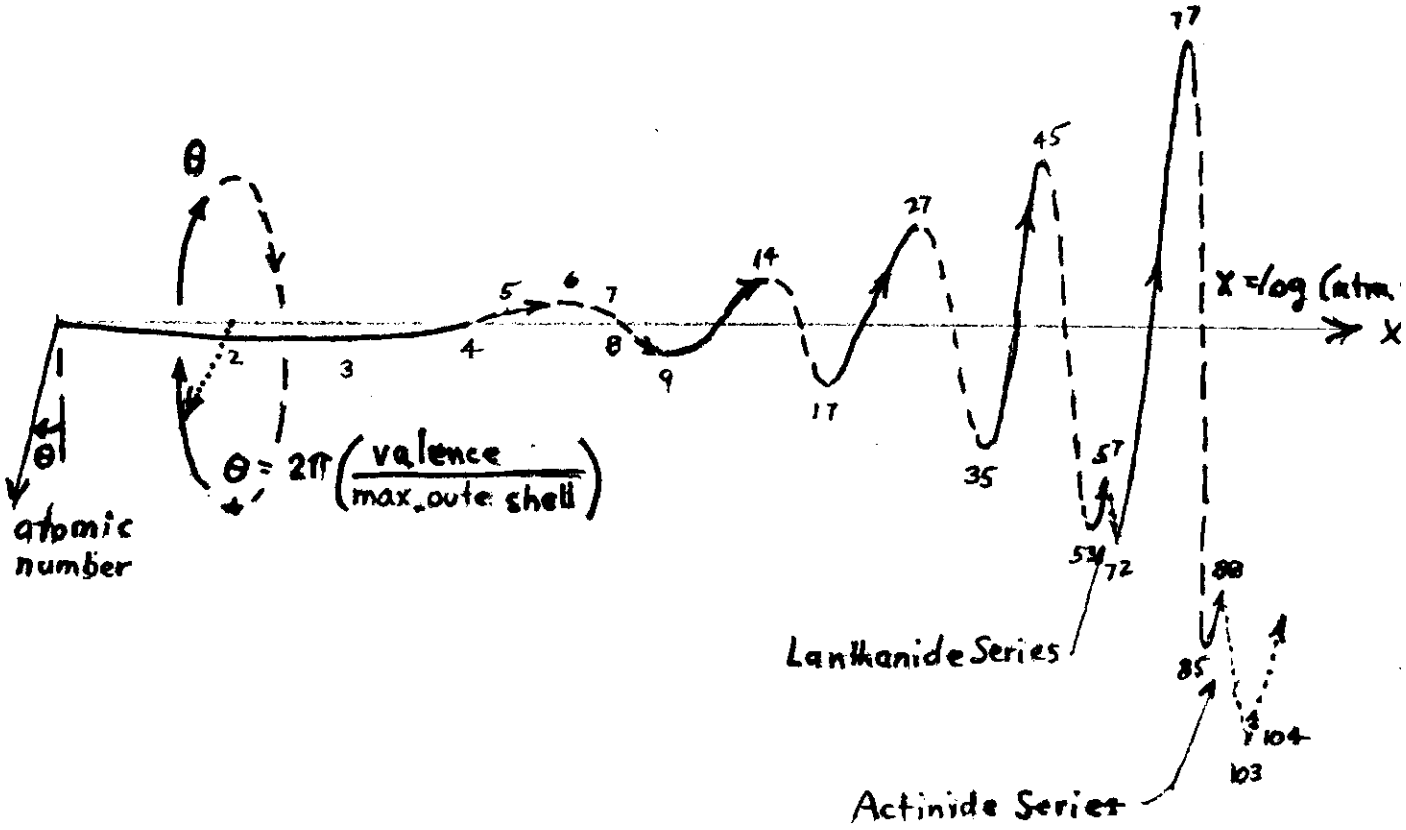
I shall refer to Norbert Wiener's fundamental books: Cybernetics and The Human Use of Human Beings; Shannon and Weaver's The Mathematical Theory of Communication. I shall also refer to H. S. Tsien's Engineering Cybernetics(not the Chinese edition published in Peking, but the American edition in English); E. A. Guilbaud's What Is Cybernetics?(France); D. A. Bell's Intelligent Machines(England); Henryk Greniewski, Cybernetics Without Mathematics(Warsaw); Colin Cherry, On Human Communication(London); Jagjit Singh, Great Ideas in Information Theory, Language, and Cybernetics (New Delhi); and A. I. Berg, Cybernetics at the Service of Communism (Moscow).

Now I am writing this book for the layman, so you don't have to look up the above references to understand this material. To understand more details of Volume One, you will find more specific examples in Volume Two. To determine how to test the validity of the examples in Volume Two, refer to the technical details in Volume Three.

I aim to show how one can use analogies from cybernetics in the analysis of social systems to protect human freedom. I also wish to point out that ancient philosophies such as the Chinese I-Ching fit into such analogies for the stage of civilization at which they were developed, and even have important lessons for later stages of civilization.

The publication of this series constitutes a test of some concepts specified ten years ago in a paper at the Western Joint Computer Conference on "The Social Responsibility of Engineers and Scientists" which is reprinted as Chapter 2.3.1. This series is also a test of a warning given by Dr. Donald N. Michael in his pamphlet "Cybernation: The Silent Conquest." Also the publication of this series is relevant to the test of a hypothesis of A. A. Berle and Andrew Hacker in The Corporation Take-Over that the large corporations of America have unintentionally incapacitated the functioning of democratic institutions. This series presents some evidence on this hypothesis and supplies aids to understanding and correcting the process.

Although this series is intended for the layman, I plan to include sections on the scientific bases for some of the material developed, so that one can check on how I am testing my hypotheses. One fundamental concept that will recur in these series is the search for fundamental forms, concepts, and processes that cross the boundaries of traditional science. For example we will examine the periodic table of elements in physics and chemistry, and then inquire as to whether there are similar tables of biological and social evolution. As an indication of the proposed use of general systems theory, I show a spiral form of the periodic table of the chemical elements below, followed by a spiral representation of the stages of biological evolution.



Logarithmic Spiral Form of the Periodic Table of the Chemical Elements

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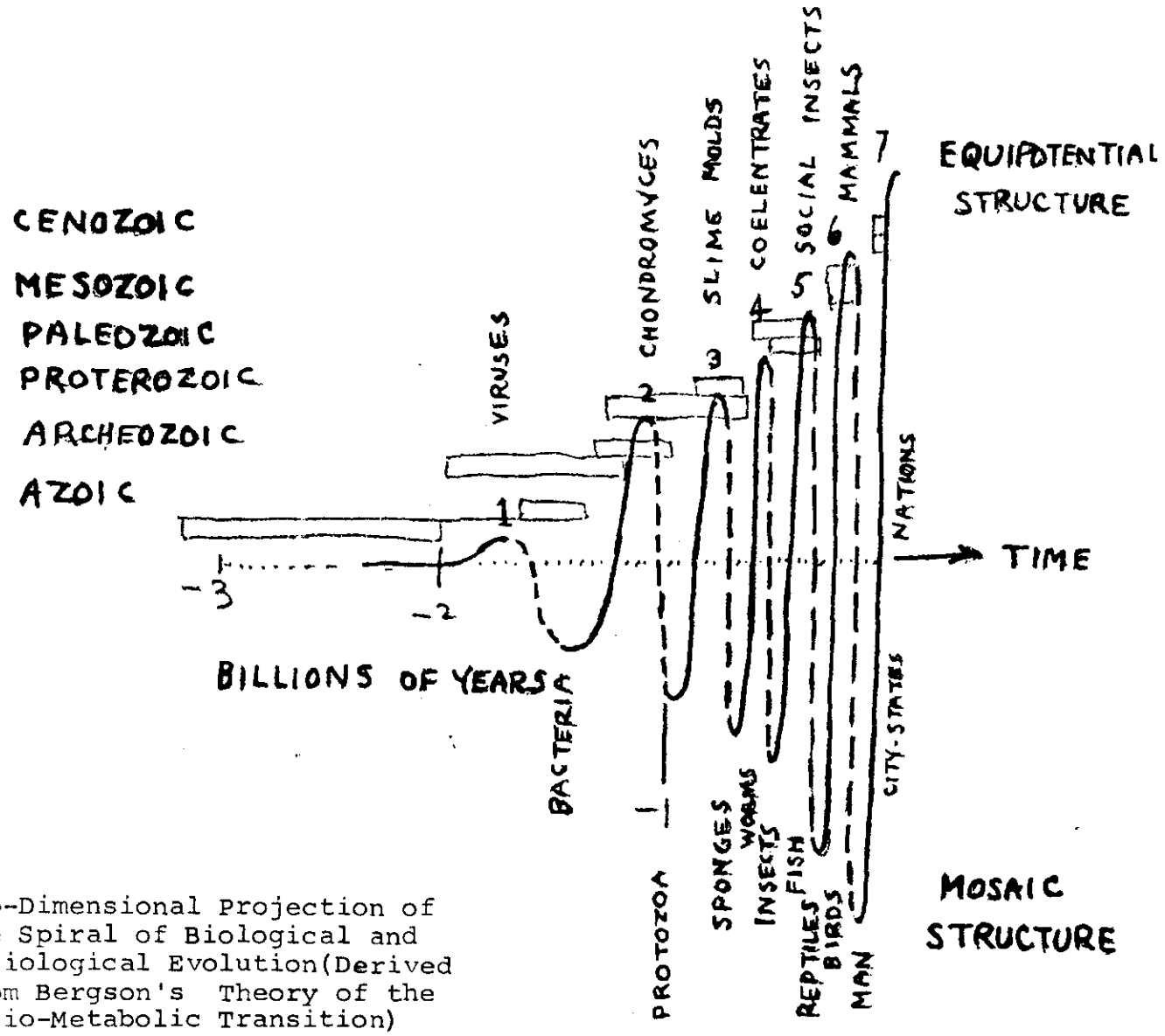


Two-Dimensional Projection of the Spiral of Biological and Sociological Evolution(Derived from Bergson's Theory of the Socio-Metabolic Transition)

The use of the above spiral curve of evolution will be indicated in the supplementary note added after the outline.

Frederick Bernard Wood
P.O. Box 5095, San Jose
California 95150, U.S.A.

June 1, 1970

* I now prefer "Communication Era" instead of "Information Era."

Supplementary Note: Example of the Use of Evolutionary Spiral Curve to Promote Better Understanding of Social Problems.

This edition prepared for a supplement to the Bulletin of the Unitarian Church of San Jose, California.

SEPR No. 226-B
April 25, 1970
Revised May 4, 1970

"A PERSPECTIVE OF THE DIALOGUE BETWEEN JAY PENDLETON AND CHARLIE BASS ON THE SUBJECT OF SOCIAL CHANGE"

The recent dialogue between Charlie Bass and Jay Pendleton at the San Jose Unitarian Church reminds me of a sermon I heard in 1941 by Rev. W. Waldemar Argow of the Baltimore Unitarian Church. He was talking about how ancient Greece and Rome and most other large civilizations rose to a zenith and then collapsed. Rev. Argow said that our civilization was the first one to have the knowledge and the capability to use the knowledge to find how to evolve to the next stage in civilization, instead of collapsing.

I have plotted some of Sorokin's research data on the number of scientific discoveries and technological inventions per century in Fig. 1. These curves illustrate how Greece and Rome failed to make the social adjustment needed at the higher technological level of development. Will our civilization make the adjustment needed for the transition from the 'Power Era' to the 'Information Era'?

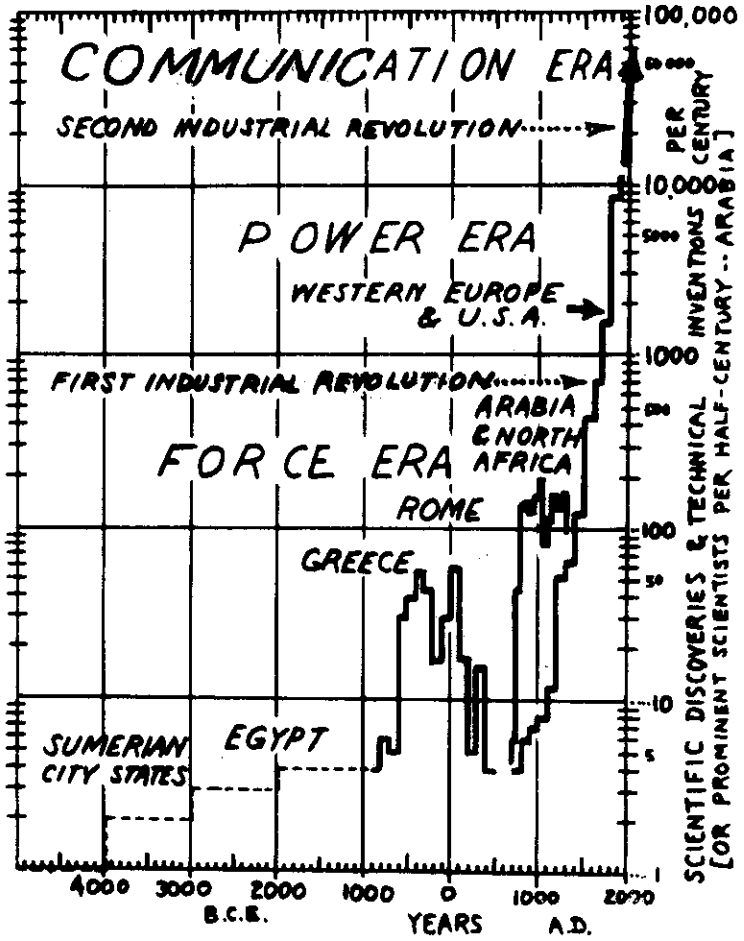


Fig. 1. Discoveries and Technological Inventions per Century.

Both Jay Pendleton and Charlie Bass have important, but different parts of the knowledge needed for our civilization to make the transition from the 'Power Era' to the 'Information Era.'

Social scientists may not complete their testing of hypotheses on the nature of social evolution until our civilization has collapsed like Greece and Rome. Therefore I am using the best hypotheses I can find as a guide until better hypotheses are developed. A helical spiral representing biological and social evolution is shown in Fig. 2. This is the best approximation I can find that is consistent with the philosophy of general systems theory.

In Fig. 3, I have duplicated the last spiral shown in Fig. 2 with the current views of Charlie Bass and Jay Pendleton marked as arrows indicating the direction I interpret they are advocating. For reference I have also put the views of Dr. Clark Kerr of ten years ago. Dr. Kerr's views correctly fitted the era 1950 to 1960, but didn't anticipate the correct required path of social evolution of our country and the University of California after 1960. Now the present views of Jay Pendleton account for the curvature in the path that Clark Kerr missed(as of 1960), but may not make adjustments fast

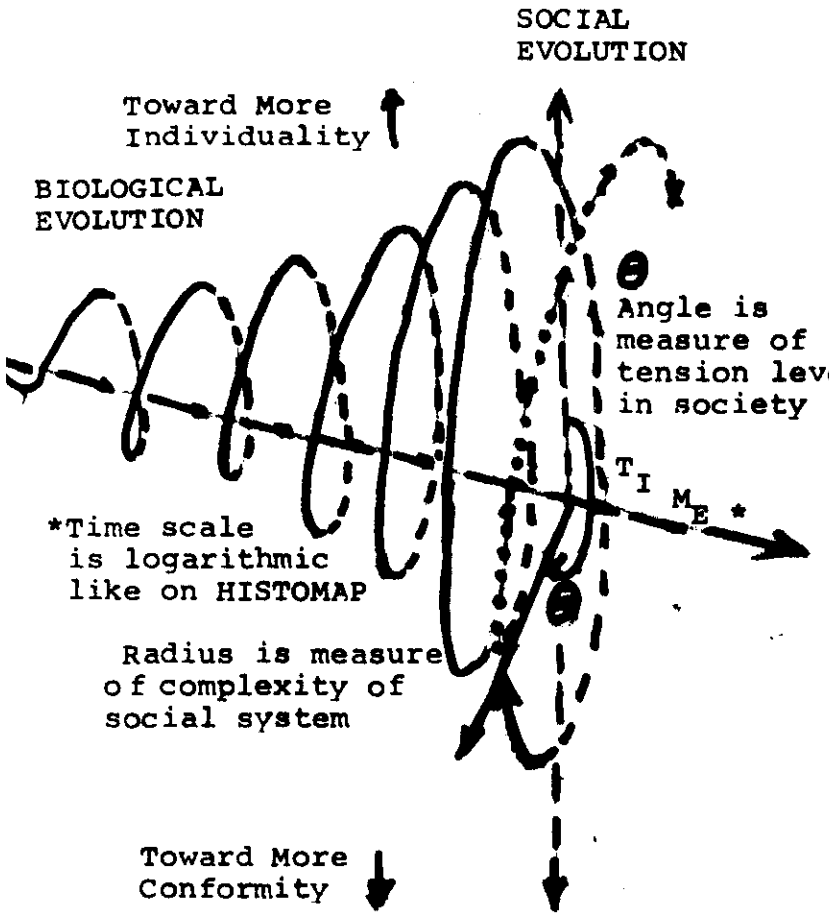


Fig. 2. The Helical Spiral of Biological and Social Evolution. (Based on a theory of Brian P. Bergson)

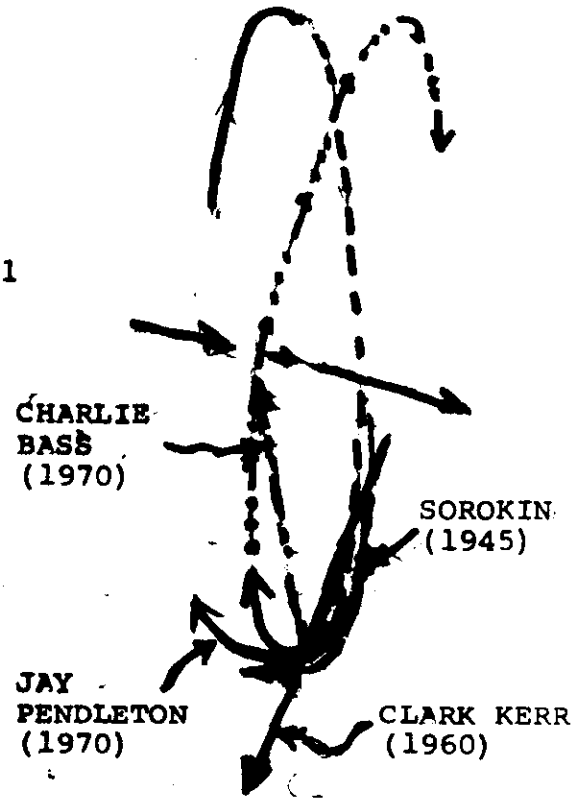


Fig. 3. The Current Spiral in Social Evolution.

enough to push our civilization along a succesful evolutionary path. On the other hand Charlie Bass's curve points toward the necessary corrections, but appears to make an abrupt turn which no civilization in the past has succesfully made. When Greece and later Rome fell, other civilizations in turn filled in the gap. Modern science and technology has changed the situation, in that a collapsing civilization can destroy almost all human life on the planet by irresponsible use of nuclear weapons.

We have a similar, but much more complex problem, to that of the astronauts in Apollo 13, where they had to apply a certain correction to their path in order to avoid death in outer space. We are on spaceship "Planet Earth." We have to determine the safe paths of social evolution. Jay Pendleton and Charlie Bass have complementary approximations to such a path, but each needs some of the concepts and knowledge of the other in order to come closer to a practical path.

Frederick Bernard Wood

REFERENCES:

Pitirim A. Sorokin, Society, Culture, and Personality. N.Y.(1947)
Ludwig von Bertalanffy, General System Theory. N.Y.(1968)
Gray, Duhl, and Rizzo, General Systems Theory and Psychiatry. Boston(19
Clark Kerr, Industrialism and Industrial Man. Cambridge, Mass.(1960)
B. P. Bergson, The Theory of Socio-Metabolic Transition. 15000 Jeanette Lane, San Jose(1969) 4pp.
Frederick B. Wood, Cybernetic Aspects of Social and Technical Processes That Endanger the Ecological Balance. San Jose(1969) 14 pp.
Jay Pendleton, "Reply to Charlie Bass." Bulletin Unitarian Church, for April 26, 1970, San Jose, Calif.

A good starting point from which to examine multidisciplinary concepts is to start with the objectives of the Society for General Systems Research.

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 co-operation 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;

Material on More Specific Applications of Series II Reprinted On YELLOW Paper, November 1971.

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).

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

"Technological Meditation"

by

Frederick Bernard Wood, Ph.D.

I used to go up in the hills frequently to meditate upon the social problems of our civilization. Recently I became aware of the fact that I have discontinued going out alone in the wilderness to meditate except on rare occasions. I have been thinking about whether this is desirable or undesirable. It appears that I have substituted a different kind of meditation. Since November 1969 I have been working on a data compression project in the computer industry. Just prior to th I was working on an experimental computer-communication system, where I designed the first stage electronic interface logic and the programmir software to be compatible with the experimental electronic logic. On the second stage I designed the software Input/Output program, while another engineer designed the hardware(electronic) logic to go with it.

On the third stage, after the project was shifted, I designed the software for another computer-communication system interface to obtain data for the research on the fourth stage, namely testing different compression algorithms. The future fifth stage will be the design of electronic hardware to carry out the compression which was found to be suitable by simulation with real data. So the computer simulation research leads back to electronic hardware.

In accordance with the Code of Ethics of the National Society of Professional Engineers, I do not disclose any specific details of the problems I am working on that might prematurely release data on the research and development strategy of my employer. However I

can refer to a paper of mine on a related problem which contains some material on the information content of images.(1)

After November 1st I was working on the simulation of compression algorithms. I found that I was automatically thinking of the sociological analogs of the same algorithsm at the same time I was developing and debugging the computer programs for the compression algorithms. During the regular working hours of the day I concentrated on the official job assignment of compression algorithms for certain types of data sets. Although ideas of the social analogs occured in conjunction with these, I deferred the elaboration of the social analogs until evenings.

I have recently reviewed what has been happening the last two months. I find there are similarities with other periods in my past. For example in 1960-1961 I was working on a number of aspects of computer-communication systems, and more specifically on image compression in 1961-1962. In November 1961 I drew a diagram to illustrate how my thoughts spiraled between the electro-mechanical, mathematical, and sociological problems.

On another accasion, 1965, I was first working on information retrieval problems, then some computer-communication systems problems, and next on image compression problems. During that period, I became more aware of the social analog of compression coding in relation to political ideology. I described these concepts in a talk to the Unitarian Laymen's League in Berkeley, October 8, 1965.

During November and December 1969 I have been pushed to my capacity to document the sociological analogs in the evening derived from the engineering work I do during the day. This has resulted in neglecting correspondence and other business matters.

I have been thinking of how to define the thought processes which have been going on. I think that "technological meditation" may be an appropriate label. However where this type of meditation is organized around a theoretical framework, some testing of hypotheses is necessary. My present thoughts on testing is that particapation in Esalen-type encounter groups, psychodrama groups, etc., are appropriate techniques to develop test procedures.

1. P.D. Dodd & F. B. Wood, "Image Information, Classification and Coding." IEEE 1966 International Convention Record, Part 7, pp. 60-71.

I am aware that a group at University of California Medical School is doing reaearch on people's brain wave activity during Yoga meditation, and other interesting conditions. Therefore I know of a facility where it would be possible to test the physiological significance of "technological meditation," if it were deemed desirable.

What is more important, I think , is that we cultivate and protect the scarce resources that can aid us in solving the critical problems of our civilization. I feel that there are insights into the problems of our divilization that are much more easily perceived through a process of technological meditation, However the organizati of our universities and industrial research laboratories tends to remove technological meditation from the very environment in which it can be most successful. Therefore the technological meditators have to develop a kind of passive resistance and in some case guerilla warfare tactics in order to survive in way useful to society.

The optimum conditions for developing cybernetic insights into society by technological meditation may not necessarily at a university. The conditions may be in some balance between part time working in an industrial laboratory where the conditions for technological meditation are greatest and part time in a university of community action organization where conditions are optimum for communication of the results. It is not yet known what are the optimum conditions. For example it might be that working four days a week in an industrial research and development laboratory and one day a week on a community action project or university teaching might be a first approximation to such a balance.

"Ethics and the Thermodynamic Imperative."

by

Frederick B. Wood, Ph.D.

Although parts of the religious teachings from the Hebrew-Christian tradition of Western Civilization require modification as science advances, the more fundamental rules of ethics remain valid. With the need for cooperation between the countries of Western Civilization other cultures, it becomes important to recognize the common ethical concepts underlying all the different religious traditions. Perhaps Albert Schweitzer has laid the base for global cooperation in his principle of "Reverence for Life."

A formulation of "maximizing the negative entropy" from Information Theory (or Cybernetics) could possibly put Dr. Schweitzer's "Reverence for Life" on a more universal basis so that scientists in the U.S.S.R., who might be hostile to organized religion could understand the ethics distilled from the major historical religions. A scientific base might also appeal to Chinese scientists.

To establish a closer contact with Christian philosophy, it is useful to go back to Immanuel Kant (1724-1804) and his "categorical imperative" in his "Transition from Popular Moral Philosophy to the Metaphysic of Morals."

> "There is therefore but one categorical imperative, namely, this: Act only on that maxim whereby thou canst at the same time will that it should become a universal law." *

Accordingly the practical imperative will be as follows:

> "So act as to treat humanity, whether in thine own person or in that of any other, in every case as an end withal, never as a means only" #

*Immanuel Kant, Britannica Great Books, vol. 42, p. 268.
Ibid., p. 272.

R. B. Lindsay* points out that certain hypothetical ethical precepts can be set up, as for example, the Golden Rule, Kant's categorical imperative, or the more specific commandments of the Decalogue.(p. 413)

* Bernard Baumrin, editor, Philosophy of Science - The Delaware Seminar, vol. 2, (1962-1063). N.Y: Interscience Publishers(1963) pp. 411-448. "Physics, Ethics and the Thermodynamic Imperative."

He asks "Where do the imperativess or commands of an ethical theory come from?" ....."It may seem somewhat surprising that we shall turn to thermodynamics in our search for an ethical imperative..... .....energy.....entropy...." (p. 428)

Life then may fairly be said to consume entropy, since with the transition from disorder to order, the entropy of the universe decreases. ..... entropy consumption and reproduction..... .....thermodynamic imperative:

> "All men should fight always as vigorously as possible to increase the degree of order in their environment, i.e., consume as much entropy as possible, in order to combat the natural tendency for entropy to increase and for order in the universe to be transformed into disorder, in accordance with the second law of thermodynamics" (p. 440)

It is interesting to note that R. B. Lindsay's formulation of the "thermodynamic imperative" is a more fundamental form of the principle of "maximizing the negative entropy" which I have developed in my Cleveland 1963 paper and in my London 1964 paper. What my papers do is to bring some engineering models to use to develop measures of how mankind is doing in following the "thermodynamic imperative."

Further consideration of the implications of the concept of "entropy" in respect to social systems is developed in section 3.3.0. There we will see that the concept of "entropy" used in the Thermodynamic Imperative is only one of sixteen variables of prime significance in analysing a system of nations. The thermodynamic imperative only becomes an ethical principle when the other fifteen parameters remain constant. When these other variables are not known to be constant, the principle of "maximizing negentropy" becomes an "ethic-coordinating principle" rather than a basic ethical principle.

Dr. Lindsay later published a book with a chapter on the "thermodynamic imperative." This later reference is The Role of Science in Civilization(Harper & Row, 1963). Here Dr. Lindsay goes into more details of the background of information theory and thermodynamics and then develops the same definition:

> "All men should fight always as vigorously as possible to increase the degree of order in their environment, i.e., consume as much entropy as possible, in order to combat the natural tendency for entropy to increase and for order in the universe to be transformed into disorder, in accordance with the second law of thermodynamics.(p. 212.)

The above thermodynamic imperative is illustrative of the kind of ethical concept that can be derived by analogy from the science and mathematics at the base of our technological society. However I feel that Professor Lindsay, in translating the word entropy into order for the layman, has lost part of the meaning. When one uses a communication theory model to impliment Lindsay's thermodynamic imperative, it becomes apparent that "increase the degree of order" should be replaced by "optimize the order-diversity balance", and that after disorder in the second from the last line, one should insert "and diversity to be transformed into conformity," Thus the use of an electrical communication theory model makes the thermodynamic imperative a more useful hypothesis.

Frederick B. Wood

A fundamental problem requiring the cooperation of more than sixteen engineers, physical scientists, and social scientists is proposed as a fundamental aid to the promotion of interdisciplinary research. A Chapter in Charles R. Dechert, The Social Impact Of Cybernetics (Notre Dame, 1966), pp.189-190, refers to an ethical principle similar to Immanuel Kant's categorical imperative, which has been proposed by a physicist, R. B. Lindsay as the "thermodynamic imperative:"

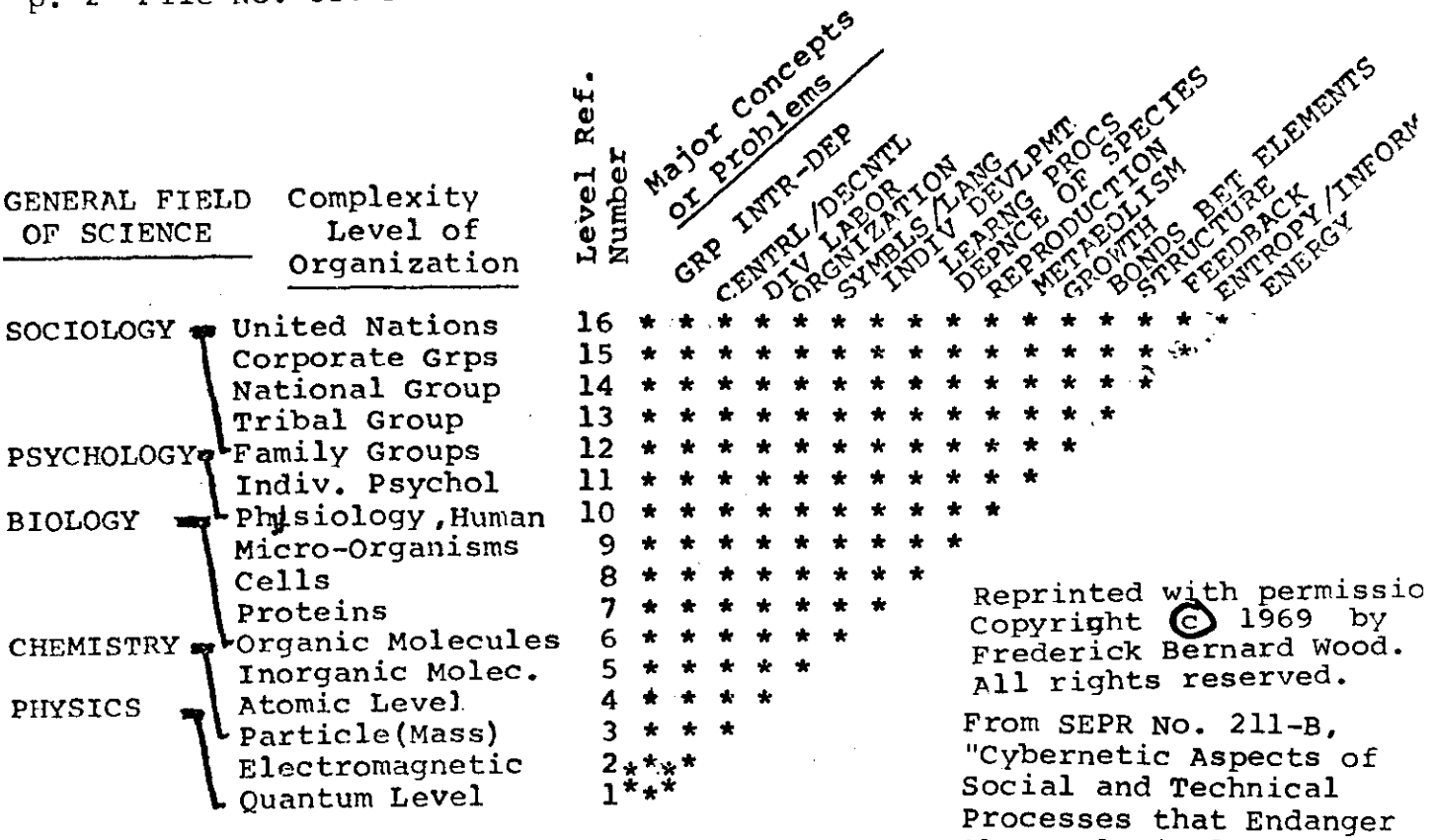
> "All men should fight as vigorously as possible to increase the degree of order in their environment, i.e., consume as much entropy as possible, in order to combat the natural tendency for entropy to increase and for order in the universe to be transformed into disorder, in accordance with the second law of thermodynamics. (Lindsay, "A Scientific Analogy: The Thermodynamic Imperative," The Role of Science in Civilization (N.Y.: Harper & Row, 1963)"

I think that future historians of science will conclude that Lindsay made an important contribution, but that carrying a concept from physics through chemistry, biology, psychology and sociology requires a number of refinements.

By the time the concept of entropy is carried from physics up through many levels of increasing complexity through sociology, it and its companion concept order(or disorder) acquire subtle distinctions. Therefore it is better to speak of "communication entropy" in respect to sociological phenomena, and the maximization of communication entropy no longer can be simply translated as "order," but it represents a more subtle balance between "organization or order" and "freedom or diversity."

the rigorous testing of Lindsay's "thermodynamic imperativ would require the cooperation of specialists from approximately sixteen special fields of science. This is not likely to occur in the near future, because even the most advanced interdisciplinary researc institutes are only attempting to bring specialists from three or four special fields together on current projects. There is an organization which reports annuall on what progress has been made on interdisciplinary and multidisciplinary studies where general systems concepts have application in several special fields. These reports are issued by the Society for General Systems Research, Joseph Henry Building, 2100 Pennsylvania Ave., N.W., Washington, D.C., as the Yearbook: General Systems.

Material of a More Technical, Scientific, and Mathematical Nature of Series III Reprinted on PINK Paper, Nov. 1971.



From SEPR No. 211-B, "Cybernetic Aspects of Social and Technical Processes that Endanger the Ecological Balance."

Fig. 1 - Levels of Organization on the Planet Earth, Related Fields of Science.

The problems of our complex ivilization multiply at the same ate or faster than the research rogress made by organizations such s S.G.S.R. Therefore we need to ind shortcuts to applying concepts f Cybernetics to crucial problems rior to the rigorous verification f theory. To find such shortcuts, e need a mathematical model of ɔme important features of the ɔcial system. Here we can use ıe communication channel first escribed by Claude Shannon in ıe Mathematical Theory of ɔmmunication (Univ. of Illinois, 949). Shannon applied concepts : entropy and information which :e rigorously related on Level (Quantum Level) ın Fig. 1 to the ıalysis of the efficiency of sets : telegraph messages (Level 2) ıd also developed a similar analy- .s of the words in a language (Level 12). This analysis of language only dealt with features which could be counted or numerically described for entry into computer analysis.

When we speak of applying Information Theory to higher levels in Fig. 1, it can only be in the form of a tool that can help maintain better channels for human communication. This theory doesn't deal with the content of the messages between human beings, but examines whether there are efficient channels for the existing human groups to exchange messages.

The people who learn to understand these concepts will have the lead in determining the future direction of human civilization.