

SOCIO-ENGINEERING PROBLEMS REPORT No. 91

Socio-Engineering Problems Reports are a series of manuscripts on the social relations of engineering and related philosophical questions dealing with the interaction of science and society. Distribution is limited to reviewers and discussion groups for criticism prior to consideration for possible publication.

FOUR PHILOSOPHICAL "TOOLS" FOR IMPROVING
OUR INSIGHTS REGARDING THE PROBLEMS
OF DISARMAMENT.

See SEPR No. 92-B for
further developments.

Abstract

Some hypotheses are proposed and discussed relevant to four philosophical "tools" of potential value in developing better insights regarding the problems of disarmament, namely:

- (1) A pseudo-Gaussian probability curve form of historical and future perspective for extending the concept of the Histomap;
- (2) A three-dimensional checking chart based on levels of natural phenomena / ranges of activity from basic science to applied science to education to decision making / and range of method from religious-intuitive to humanistic-poetic to scientific-logical;
- (3) A discrete channel partial model of a social system using the information-entropy metaphor to obtain a quantitative measure of the democracy in a social sub-system; and
- (4) A continuous channel model of a social system for obtaining qualitative measure of a concept of "dynamic-justice" in social-political sub-systems.

The above philosophical "tools" are proposed for helping us put the present problems of our civilization in suitable perspective in regard to the rise and fall of previous civilizations on our planet, the rapid development of science, new features of the present situation which make these crises at the beginning of the noosphere different from past crises, etc. The concept of "dynamic-justice" is developed in an attempt to gain some depth of insight into the role of political idea distributions in determining the feasibility of disarmament efforts.

Note: 'Tool' (4) is an extension of the concepts discussed in SEPR No. 88-B, "Negentropy and the Concepts of Freedom, Democracy and Justice."

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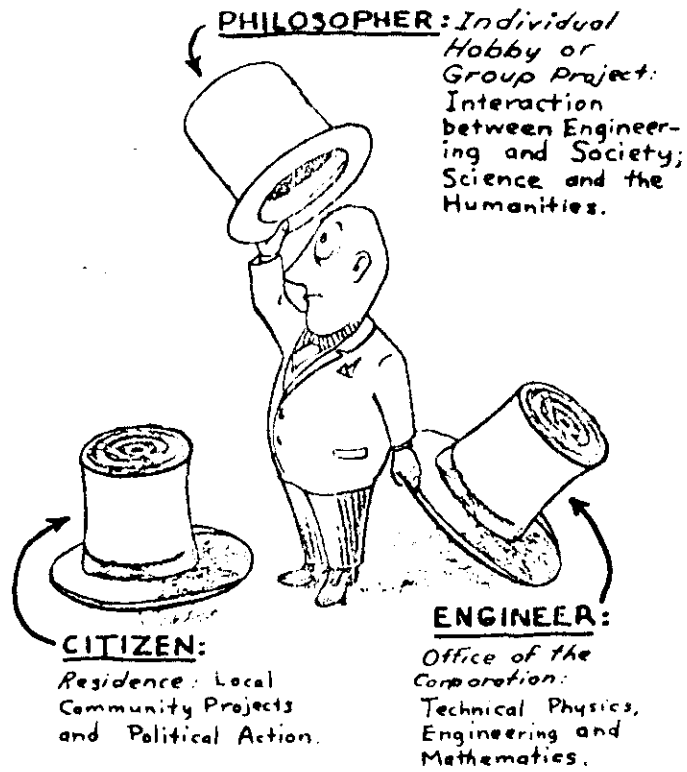
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Four Philosophical Tools for Improving Our Insights Regarding the Disarmament Problem

I. Introduction.

This paper is a progress report on the development of some philosophical tools which I think will be useful in gaining insights into the problems of disarmament. These tools are directed toward developing some perspective as to where we are in the evolution of human civilization and to give some clues as to whether the conflicting^{powers}/are at stages compatible with disarmament efforts. There have been times such as during World War II when it was obvious that it was the wrong time for disarmament efforts. These "tools" are aimed at finding a quantitative measure of the degree of democracy attained or stage of evolution a country has reached, and a qualitative measure of its present capabilities of advancing to a higher level of development. The method used in this study is to extend the "information entropy metaphor" by hypothesis and test the results for compatibility with known facts. To develop a suitable perspective in time an "earth civilization log time scale" is developed by analogy from a Gaussian probability distribution. The classification schemes of the founders of Sociology - Comte, Spencer, and Ward - are extended to develop a perspective in regard to the three dimensions of phenomena, types of study (humanistic-poetic to scientific-logical), stages of development (basic science, applied, education, and decision making).

The philosophical ideas presented here have been developed by me as a hobby on a project I call "Socio-Engineering Problems." The object of this arrangement is to clearly separate my independent philosophical studies from my engineering work. To illustrate this more clearly let us examine Slide 1.



Slide 1. An Engineer Changes Hats to Symbolize His Three Different Roles and His Attempt to Correctly Identify in What Role He Is at a Given Time.

As shown in Slide 1, I issue technical engineering reports through the publication department of the corporation for which I work. Philosophical studies are issued through Socio-Engineering Problems without review by the corporation, letters or statements containing political or religious views are issued from my residence address.

Some of the ideas in this report occurred in embryonic form while working in the M.I.T. Radiation Laboratory during World War II, while others developed as byproducts of my later work in computer-communication systems. I can recall that in 1946 I found a book by F.S.C. Northrup, The Meeting of East and West,⁽¹⁾ in which the need for a philosophical approach was more eloquently stated than in my own notes:

"The time has come when these ideological conflicts must be faced and if possible resolved. Otherwise, the social policies, moral ideas and religious aspirations of men, because of their incompatibility one with another, will continue to generate misunderstanding and war instead of mutual understanding and peace.

It is hardly likely that these sources of conflict can be faced and removed in practice within the halls of parliaments and the heated actions of the market place, where slogans are bandied about, special interests are at work, and passions are easily aroused, unless the problems raised are first traced to their roots and then resolved in theory within the calmness of the study where the meaning of words like "democracy" and "communism" can be darefully determined and the issues which they define can be looked at more objectively.. . . ." (pp.ix-x)

Dr. Northrup in his 500-page book did an admirable job of describing the different ideological backgrounds of the different parts of the world plus considerable detail on the different approaches to life in both the East and the West. However, I feel that few politicians, managers, and decision makers have taken time to study carefully books like the one produced by Dr. Northrup. This observation led me to deduce that we need some philosophical "tools" that can help people gain an insight into the total perspective of world civilization so that they can at least call in the best panel of experts on a given problem.

(1) Ref, F. S. C. Northrup, The Meeting of East and West. N.Y.: Macmillan (1946)

(3) (Histomap of Religions; Histomap of Civilization) Rand-McNally, Chicago // John B. Sparks, The Histomap of History. (1952)

(4) G. Gamow, The Biography of the Earth N.Y.: Viking Press (1941)

Perhaps we need something like Dr. Gannett's "Wicket Gate to the Bible"⁽²⁾ which was a little pamphlet prepared at the turn of the century which included diagrams and general descriptions of the state of our understanding of what light recent anthropological and linguistic studies shed upon the writing^{of} the books of the Bible. Some components of human history are displayed in a convenient form in the Histomap⁽³⁾ series. George Gamov in The Biography of the Earth⁽⁴⁾ developed some charts showing more of the physical events in the development of the earth and projected future physical events such as future ice ages. It is desirable that some unified means be developed to represent all past and projected future events on the same scale.

A second type of perspective chart needed is one that helps us determine how well we have covered the different approaches that might be relevant to a problem such as disarmament. There appear to be three dimensions of particular significance, namely types of phenomena; stages of activity from basic science to decision making; and a range of method from humanistic-intuitive to scientific-logical.

A third tool needed to help us gain perspective of the problems of our civilization is a measure of what stage of social development a country is at (or possibly a measure of the degree to which it has become democratic).

A fourth tool needed due to the third concept being static is some measure of what we might call "dynamic-justice" or the ability of the social structure to maintain the gains already made while evolving to a higher stage of development without having to go through a destructive revolution or retreat backwards.

(2) W. C. Gannett, A Wicket-Gate To The Bible, Boston: American Unitarian Association (1907), 35pp, includes charts: "Growth of the Hebrew Religion and the Bible, and The Bible Book-Case as arranged by higher criticism."

II. Construction and Testing of Hypotheses.

First we must inquire how the scientist decides to accept a particular hypothesis like the Einstein Special Theory of Relativity. In many fields of science we never have absolute proof of a law, but have to be satisfied with testing hypotheses and using the hypothesis which is most consistent with the known facts. Maxwell's equations haven't been derived from more fundamental laws, without assuming one relationship that comes from knowing Maxwell's equations. The special theory of relativity is an interesting example. It is one of seven competing theories listed in Fig. 2 which is based on Panofsky's lectures⁽⁵⁾. If one examines the status of agreement or disagreement of each theory with the thirteen experiments, one can easily see that Einstein's special theory of relativity is the only one of the theories that has no contradictions. Therefore scientists accept the special theory of relativity until someone finds some experiment which results in a contradiction. Professor Panofsky considers the validity of the special theory of relativity as follows:

"This outline(Fig. 2) of the experimental basis shows that experiment contradicts any reasonable alternative to the theory of relativity, rather than any single experiment proving the theory. The experiments outlined above(Fig. 2 on next page) present evidence that:

(1) The presence of an ether, either stationary or convectively carried, cannot be established.

(2) Modification of electrodynamics of the emission theory type is untenable. The conclusions then make it plausible to look upon the basic laws of mechanics as in need of modification.

In 1905 Einstein proposed as a solution, compatible with the experimental facts known at that time, the following postulates:

(1) All laws of electrodynamics (including, of course propagation of light with the velocity c in free space) shall be the same in all inertial frames, as are the laws of mechanics.

(2) It shall be impossible to devise any experiment defining a state of absolute motion or to determine a preferred inertial frame having special properties for any physical phenomena.

It is clear that if the laws of physics obeyed these postulates all the experimental facts outlined above (Fig. 2) would be in agreement with these postulates." ⁽⁵⁾

(5) W. K. H. Panofsky, Classical Electricity and Magnetism, Physics 210B, Univ. of Calif. Syllabus UG, Mar 1949, pp. 249-251.

EXPERIMENTAL EVIDENCE OF THE SPECIAL THEORY OF RELATIVITY ¹														
Experiments Theory		Light Propagation Experiments							Experiments from Other Fields					
		Abrams	Classen	Michelson-Morley	Trouton-Stobbs	Kennedy-Thorndike	Moving sources and mirrors	Doublet spectroscopic	Michelson-Vorley with light from the sun	Variation of Mass with Velocity	General mass-energy equivalence	Uni-polar induction with permanent magnet	Radiation from moving charges, e.g. cathode ray experiment	Meson decay at high velocity
Ether Theories	Stationary ether, no contraction	/	/	N	N	N	/	/	N	N	O	N	/	O
	Loosely contr. stationary ether	/	/	/	/	N	/	/	/	/	O	/	/	O
	ether attached to ponderable bodies	N	/	/	/	/	/	/	N	O	O	O	O	O
Emission Theories	Original source	/	/	/	/	/	/	N	N	O	O	O	/	O
	Ballistic	N	N	/	/	/	N	N	/	O	O	O	N	O
	Now Source	N	N	/	/	/	N	N	/	O	O	O	N	O
Special Theory of Relativity		/	/	/	/	/	/	/	/	/	/	/	/	/

/ = agrees N = contradiction O = does not apply

Slide 2. Experimental Evidence for the Special Theory of Relativity.

The philosophical "tools" of this report are presented as working hypotheses which may take some years to test. I feel that the problems of survival of our civilization are important enough to risk premature discussion of hypotheses which have not been thoroughly tested in order to make the ideas available to other people who may be better prepared to test the hypotheses than I. For a more recent series of papers on hypotheses in science, I refer you to some work of Professor Gerald Holton.(6)

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6. Gerald Holton, "Thematic and Phenomenic Hypotheses: Concepts for Re-evaluating Historic Stages in Physical Science," paper delivered at 10th International Congress for the History of Science, Cornell, Aug. 30, 1962. (See also similar paper at A.A.A.S. Meeting, Philadelphia, Dec 1962)

III. Four Hypotheses for Use in Developing a Better Perspective of the Problems of Disarmament.

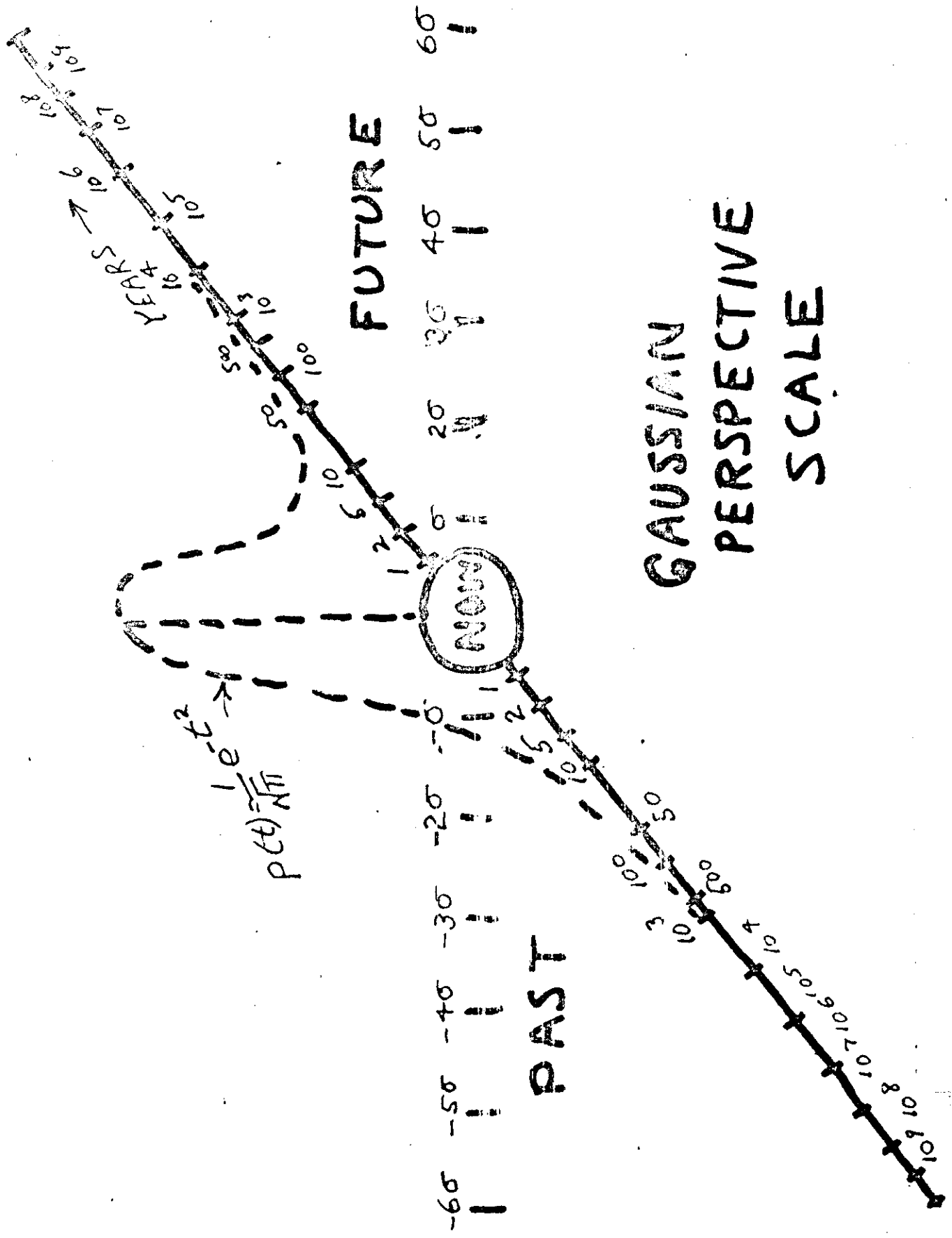
These four philosophical "tools" are presented as hypotheses for use in developing a better understanding of the potential paths that may be possible for arms control and disarmament.

A. A Gaussian Perspective Scale.

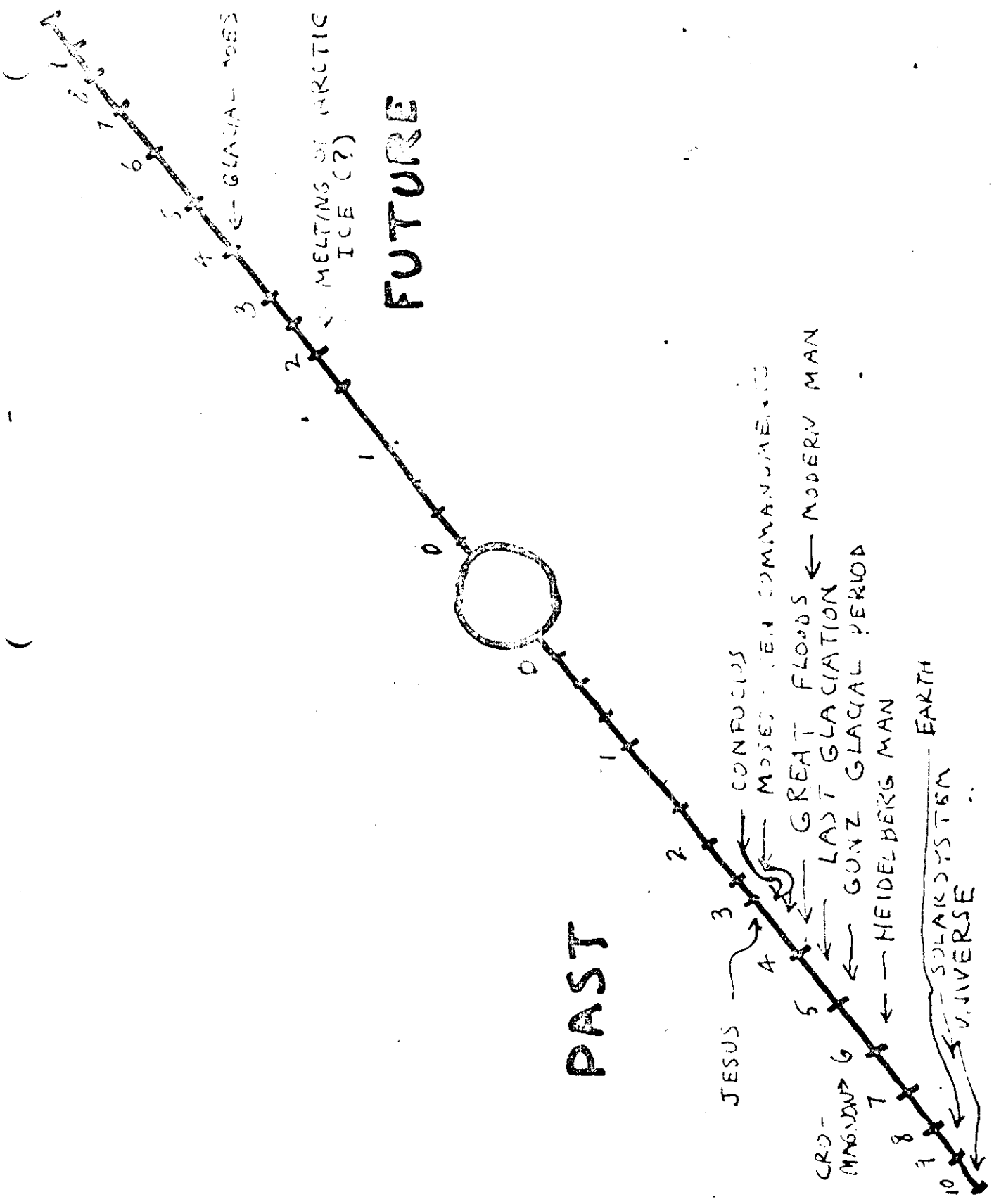
Slide 3 shows a Gaussian perspective scale covering a range of from minus 10^{10} years to plus 10^{10} years, which is sufficient to cover the longest time estimate of the age of the universe and the longest estimate of the future span of our solar system. This scale is similar to the probability paper on which gaussian probability integrals become straight lines. [A more precise definition will be inserted later, but before the formal presentation if accepted.] This type of scale combines two features: (1) the Histomap logarithmic scale for long time intervals, and (2) the inclusion of both the past and the future as is done in some of Dr. Gamov's charts.

Slide 4 shows the principal physical events in the history of our planet plus three of the great religious prophets. The inclusion of potential future problems such as the next melting of the arctic ice and the following glacial ages are useful to remind us that there can be deeper physical crises like the past glacial ages occurring again in the future. The numbers on this slide are logarithm to the base ten of the years.

Slide 5 shows the major stages in the development of mankind's mental abilities.



Slide 3. A Gaussian Perspective Scale.



Slide 4. Physical Events and Principal Religious Prophets on Gaussian Perspective Scale.

The principal stages on Slide 5 fall roughly near multiples of a standard deviation in earth-civilization-log-time*.

[* This needs to be defined more precisely]

These steps are summarized roughly as follows:

<u>Number of Standard Deviations</u>	<u>Stage of Development</u>
Minus one	Intelligence amplifier potentials of simulation of complex problems on computers became realisable.
Minus two	Organized scientific research became established.
Minus three	Superverbal abstractions of mathematics and the scientific method established.
Minus four	Man developed verbal communication.
Minus five	Pre-modern man developed subverbal communication.
Minus six	Beginning of our solar system.

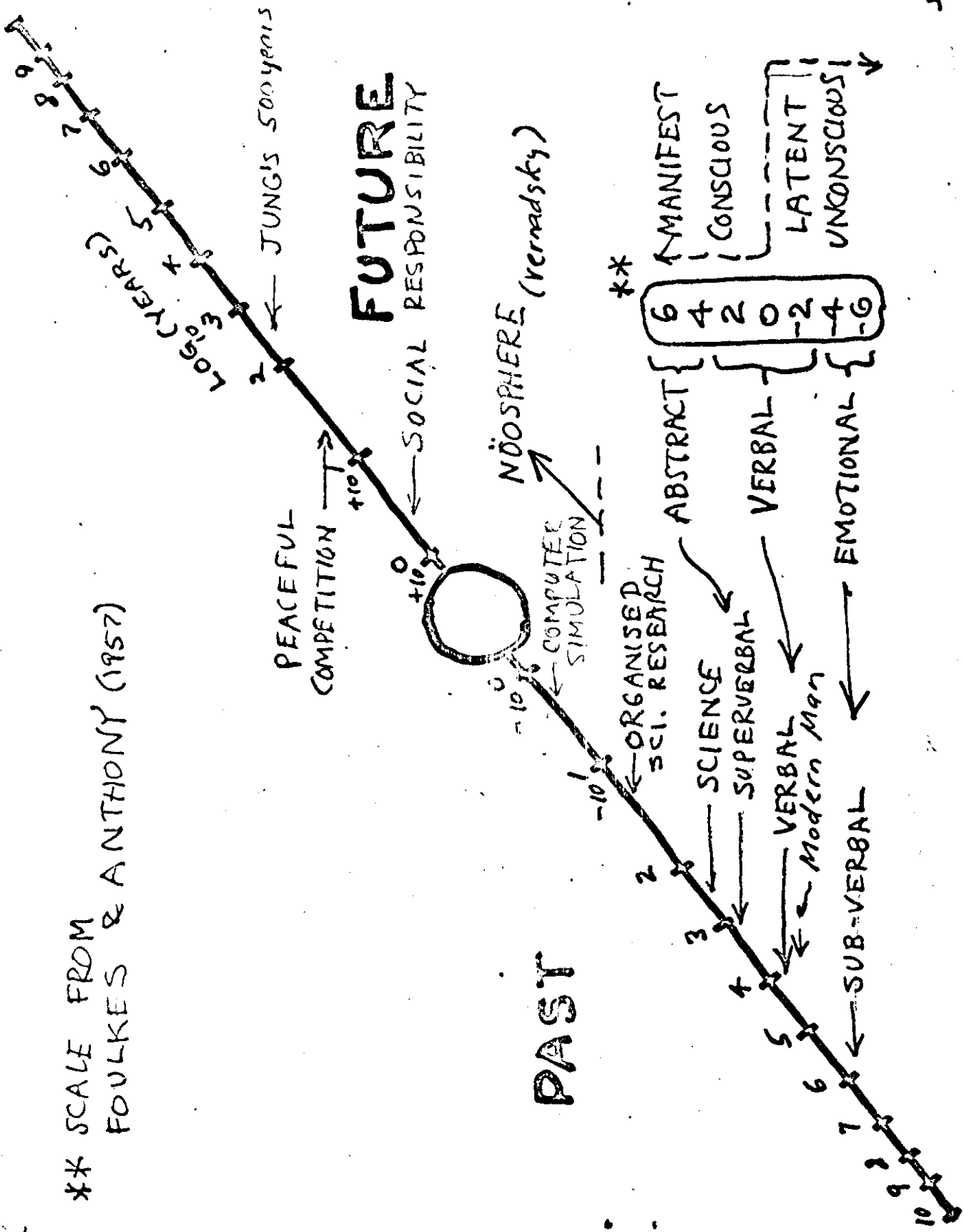
An estimate of the time span of the problems of arms control and disarmament lies in the domain of:

Plus two	Establishment of peaceful competition.
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It is estimated that a preliminary step required for a successful program of arms control leading to disarmament is the assuming of social responsibility by more individual professional people:

Plus one	Development of individual social responsibility.
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** SCALE FROM FOULKES & ANTHONY (1957)



Slide 5. Mankind's Mental and Social Development on a Gaussian Perspective Scale.

F. Checking Charts for use Similar to the Covering Theorems in Functions of Real Variable (Mathematics) and to the Completeness Theorems of Electromagnetic Theory.

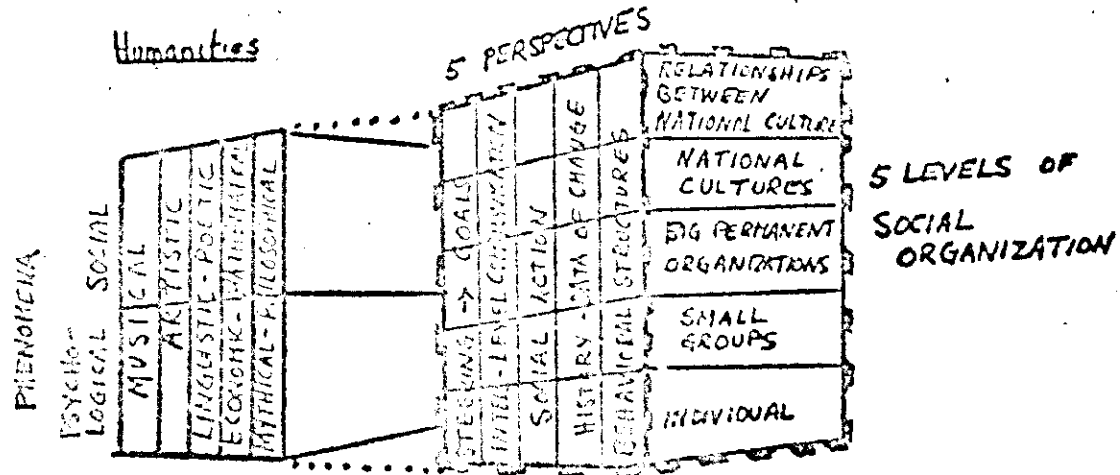
This part of the project is an inquiry as to what type of coordinate system or space can be used to relate different analyses of the major problems of our civilization. The three types of axes anticipated are:

- (1) The different phenomena which occur in nature,
- (2) The classes of human activity with respect to these phenomena, and
- (3) The different perspectives of significance in the study and use of knowledge, such as a range from humanistic-intuitionist to scientific-logical.

This type of investigation is an analog in the philosophy of science of the development of covering theorems in mathematics. It is intended to reduce the chances of omission of important insights, due to the following of a single approach to a problem.

A method of placing important teachings from the humanistic tradition on the coordinate system is shown in Fig. 6. Here the Ten Commandments of Moses are shown in the "action" column covering principally the phenomena levels of social and psychological. The Teaching of Jesus are shown principally in the "education" column, because they require more meditation to interpret for application to individual situations. The Wisdom of Confucius is shown overlapping both "education" and "action." Note that these blocks of teachings, wisdom and commandments are placed at the back of the coordinate system approximately over the "mythical-philosophical" region in Fig. 5.

As an example, a block has been added to Fig. 6 showing B. F. Skinner's organization of the knowledge of psychology(80) in the Science column to illustrate the potential interaction between the knowledge of science and the goals from religion to help mankind evolve a better society.

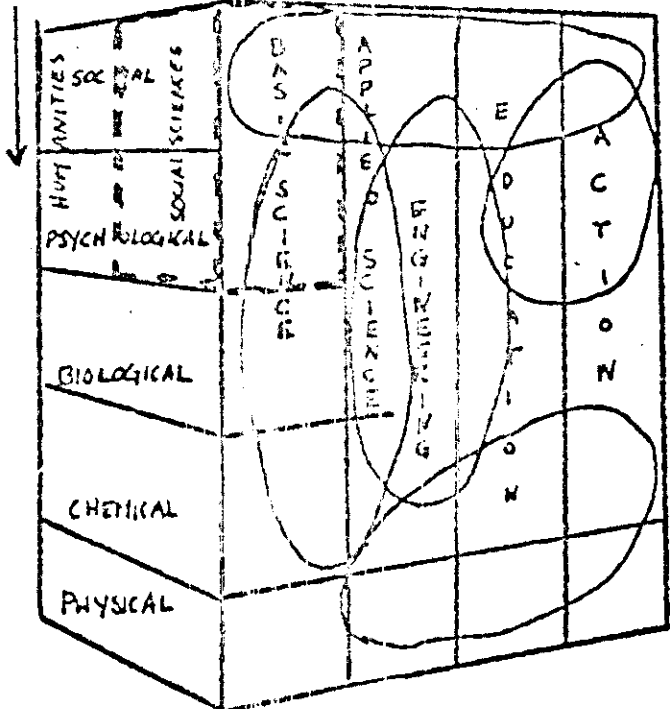


SOP No 1
(F.B. Wood)

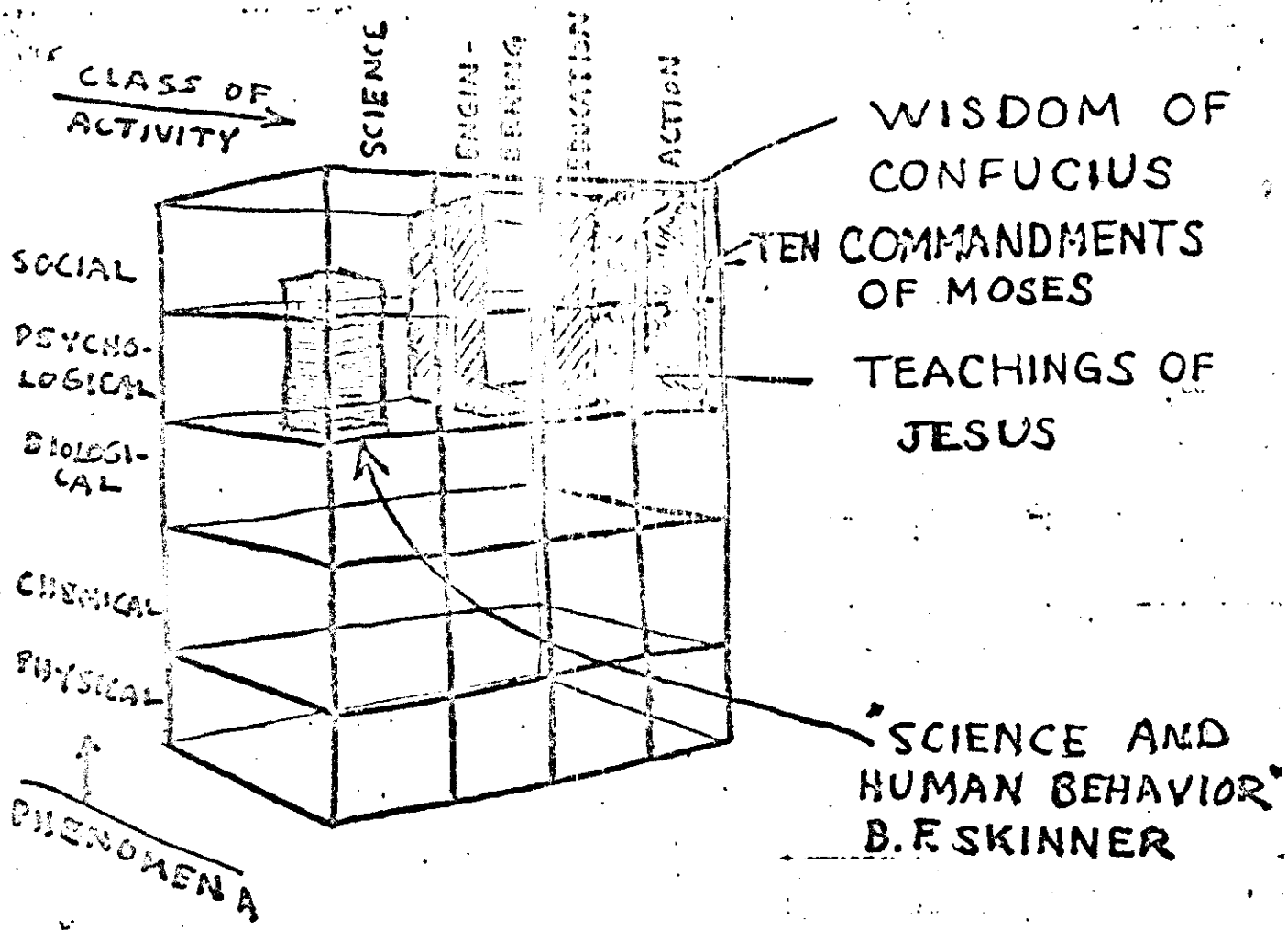
GENERAL SYSTEMS AND
THE SOCIAL SCIENCES
(S.A. RESISTANCE)
SOCIO-ENGINEERING
PROBLEMS (F.B. Wood)
No 22-A, 45

PHENOMENA

CLASSES OF ACTIVITY



Slide 6. Classification of Sciences and Humanities.



Slide 7. . A Location of the Work of Moses, Confucius, and Jesus on a Tentative Coordinate System Plus a Sample Location of the Knowledge of Modern Psychology.

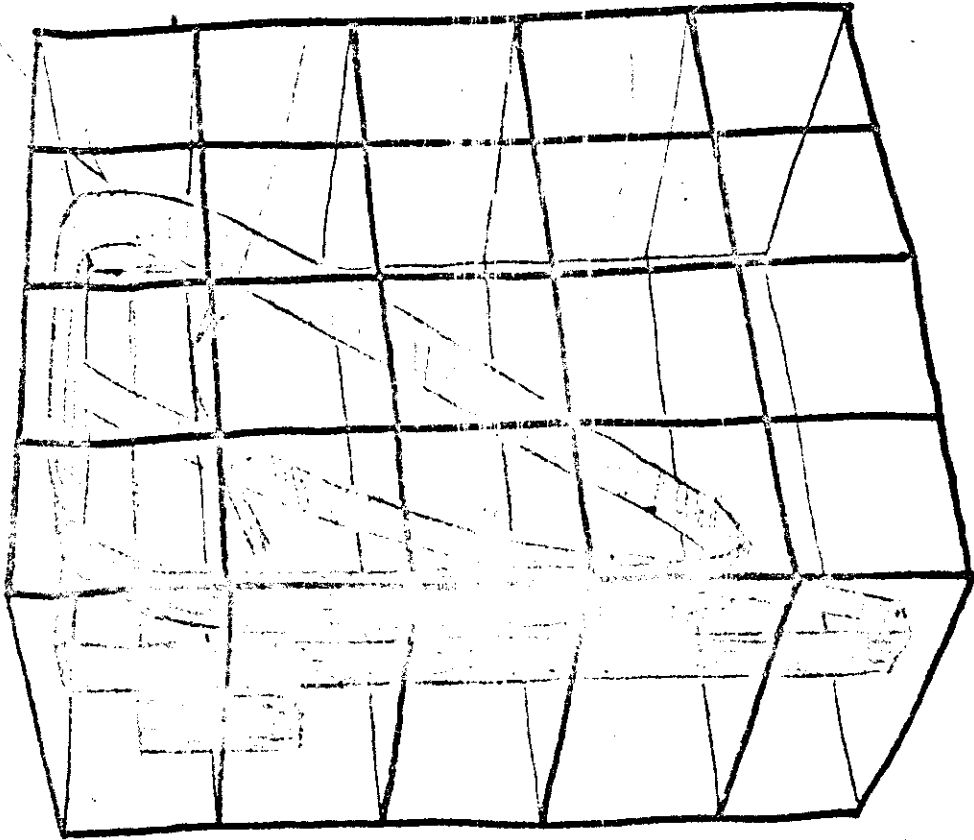
Further examples of the plotting of the range of coverage of different sociologists, philosophers, psychiatrists, anthropologists, and biogeochemists are shown in the following slides:

- Slide 8. A Comparison of the Domains of the Works of Auguste Comte, Karl Marx, and Lester Ward.
- Slide 9. A Comparison of the Domains of the Works of Freud, Jung, and Adler.
- Slide 10. A Representation of the Domains of the Work of the Soviet Academician Verdnasky and the Catholic Priest-Anthropologist Teilhard de Chardin.

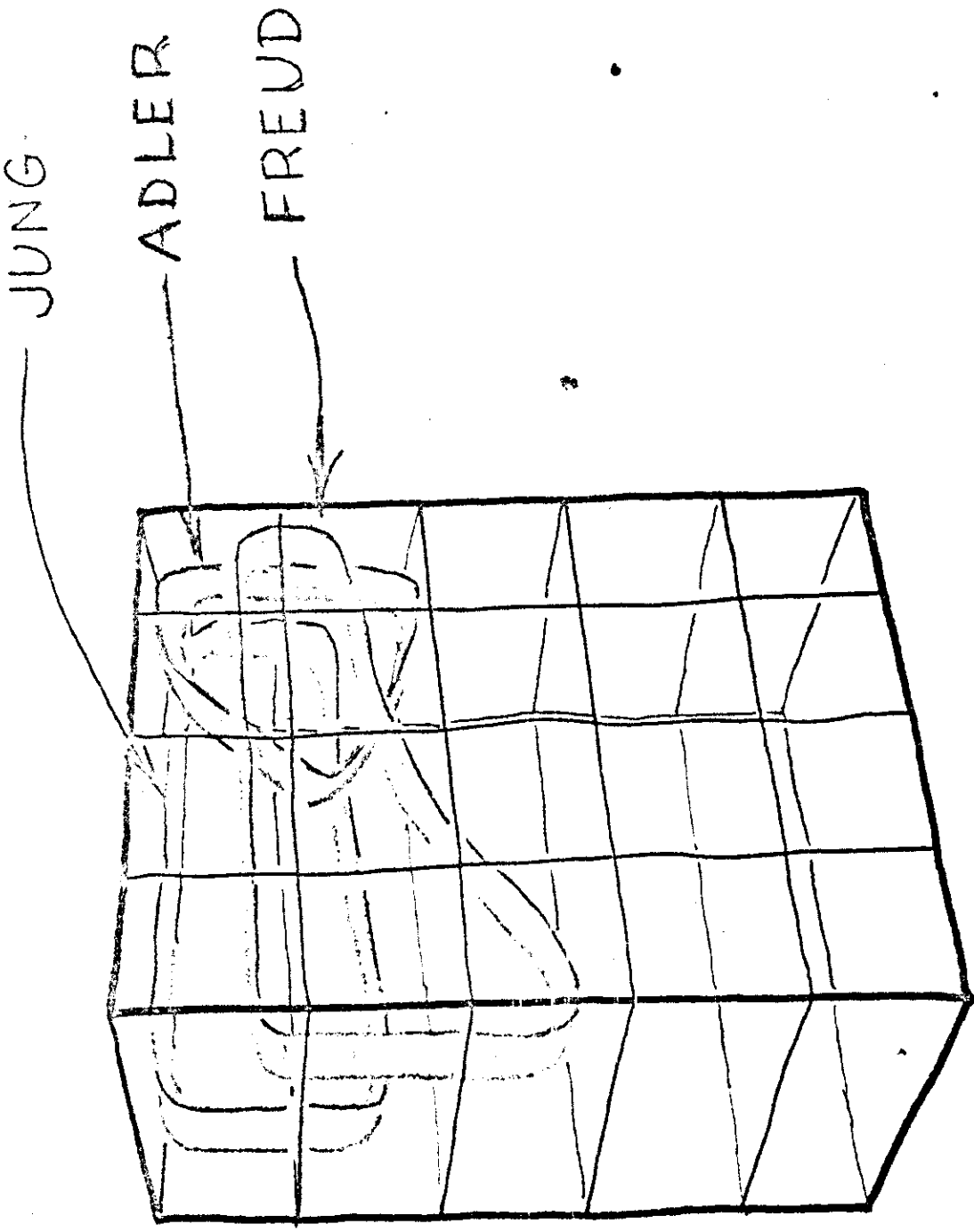
SOCIOLOGY OF
LESTER WARD

PHILOSOPHICAL
& ECONOMIC
THEORIES OF
KARL MARX

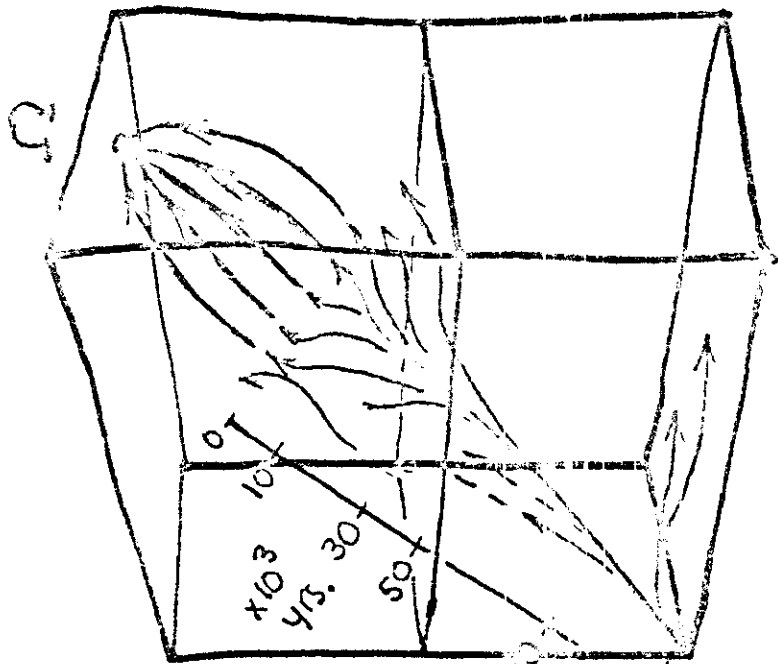
PHILOSOPHY AND
SOCIOLOGY OF
AUGUST COMTE



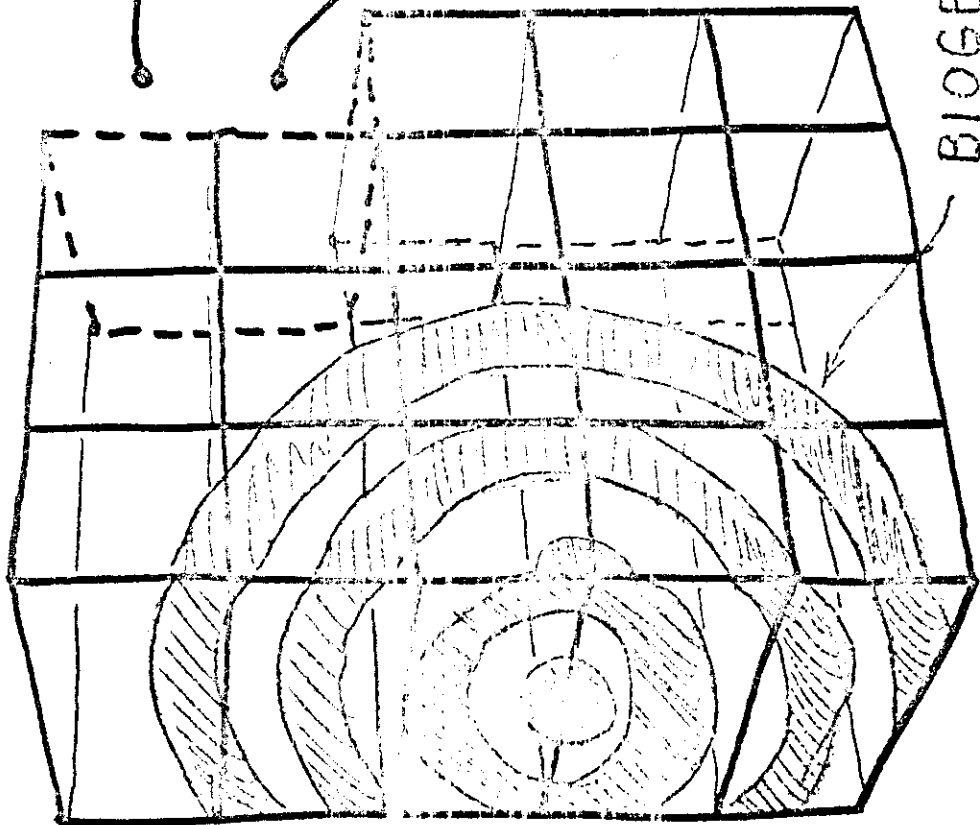
Slide 8. A Comparison of the Domains of the Works of Auguste Comte,
Karl Marx, and Lester Ward.



Slide 9. A Comparison of the Domains of the Works of Freud, Jung, and Adler.



THE NOOSPHERE OF
Teilhard de Chardin



BIOGEOCHEMISTRY OF
VERNADSKY

Slide 10. A Representation of the Domains of the Work of the Soviet Academician Vernadsky and the Catholic Priest-Anthropologist Teilhard de Chardin.

C. A Measure of Democracy Based Upon the Information-Entropy Metaphor Using a Discrete Channel.

In a paper scheduled to be given elsewhere I have developed a measure of "democracy" using the concept of information or negentropy from Information Theory.(7) The results are summarized below.

The entropy of the set of messages is defined as:

$$I = \sum_{i=1}^n p_i \log p_i \quad (1)$$

where p_i is the probability that the i -th message will be sent.

Since the probability p_i is a positive number between zero and one,

$$\log p_i \leq 0,$$

we can define the negentropy as minus the entropy,

$$H = -I, \quad (2)$$

or

$$H = - \sum_{i=1}^n p_i \log p_i \quad (3).$$

The choice of the base of the logarithm to the base two is arbitrary. For this study eq. (3) becomes:

$$H = - \sum_{i=1}^n p_i \log_2 p_i = \sum_{i=1}^n p_i U_i \quad (4)$$

where $U_i = - \log_2 p_i$ is sometimes called the "uncertainty."

To assign a numerical value to "freedom" is a difficult task. There are many kinds of freedom, some of which are more valued than others. The ideal way to start this section would be to get some social psychologists to determine the relative weights to different types of freedom. Since such information is not presently accesible to me, I shall assume the following ten kinds of freedom to have equal weight in order to obtain some trial

7. F. B. Good, "Negentropy and the Concepts of Freedom, Democracy and Justice." Paper to be presented at the Society for General Systems Research, Cleveland, Ohio, December 27, 1963. (Manuscript SEPR No. 38)

calculations.

I shall assign to each person a unit of "freedom" $F_i=1.0$. If he is deprived of some of his freedom his F_i becomes less than one and the person or persons interfering with his freedom have F_i 's greater than one. For example if a dictator reduces the freedom of his subjects to 0.5 and there are 100,000 people under his control then the dictator's freedom is $F_i=50,001$. To obtain a measure of freedom that behaves like a probability function, we define a normalized "freedom" function,

$$G_i = F_i / n \quad (12)$$

where n is the population of the country or sub-system.

In the above case the normalized freedom for each subject becomes $G_i = 0.5 \times 10^{-5}$ and that of the dictator $G_i=0.50001$, i.e. the dictator has 100,000 times the freedom of a subject of his.

In these sample calculations, the measure of freedom is arbitrarily between the following components of freedom (Slide 11),

- | | | |
|------|--|-----|
| (1) | Freedom of speech | 0.1 |
| (2) | Freedom of religion | 0.1 |
| (3) | Freedom to print, broadcast, televise and
to listen to same | 0.1 |
| (4) | Freedom to find sexual partner | 0.1 |
| (5) | Freedom to obtain education | 0.1 |
| (6) | Freedom from job discrimination on
account of race, religion, or
national origin | 0.1 |
| (7) | Freedom to build or buy own home | 0.1 |
| (8) | Right to vote | 0.1 |
| (9) | Right to trial by jury | 0.1 |
| (10) | Freedom to establish small business or farm | 0.1 |

Slide 11, Assumed Components of Freedom, $\sum F_{ij} = \underline{\quad\quad\quad} 1.0$

This analysis is a test of an hypothesis as to the analogy between "negentropy" and "democracy." We wish to see, if replacing the probabilities of a set of messages by the normalized measure of freedom of the individuals in a social system will give a value of negentropy for the system which is a reasonable measure of the amount of democracy in the social system. If such a procedure gives a higher measure of democracy to a dictatorship than to an obviously democratic society, the hypothesis will have to be rejected. If however the resultant measures of democracy fall into relative positions consistent with common sense concepts and with the more sophisticated analyses of political scientists and sociologists we can accept the hypothesis until another hypothesis is found that gives better agreement with the available facts.

Using eq. (4), replacing p_i by G_i , and H by D , we have:

$$D = - \sum_{i=1}^n G_i \log_2 G_i \quad (13)$$

with the restraint that:

$$\sum_{i=1}^n G_i = 1.0 \quad (14)$$

The subscript stands for a single individual unless otherwise noted. When a group of individuals are treated as a class without regard to individual performance, such as job discrimination on account of color, the subscript will refer to the group or class as a unit instead of to an individual.

The negentropy measures of "democracy" for each of the six hypothetical countries have been plotted as a bar graph in slide 12 for comparison.