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SOCIO-ENGINEERING PROBLEMS

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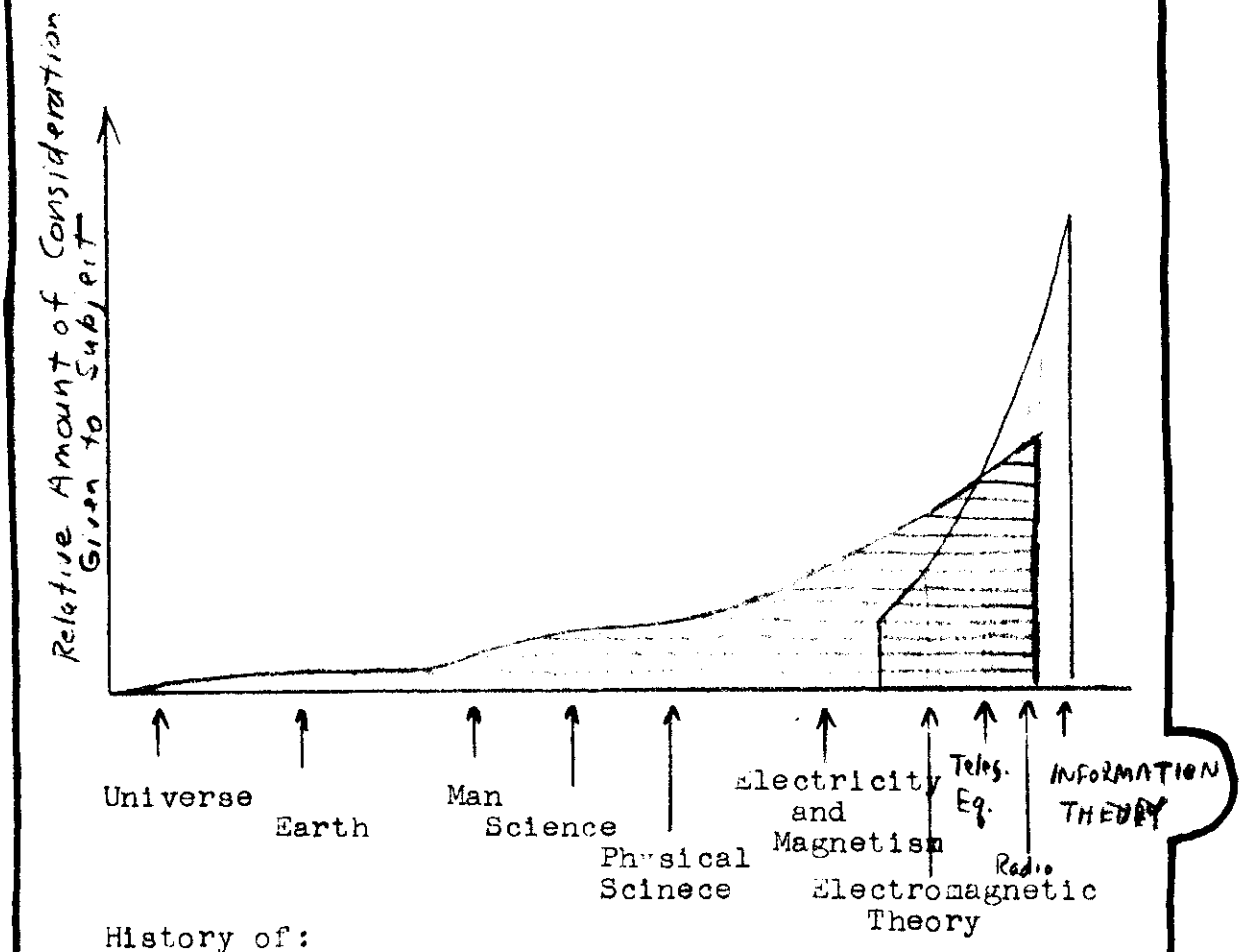

Subject Matter Arranged from More General on Left to More Specific on Right.

Approximate Distribution of Emphasis

JAN-MAR
1960
No. 9

Revised
Nov. 8, 1960

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SOCIO-ENGINEERING PROBLEMS

A series of working paper drafts on the subject of the social relations of engineering. My objective at this stage of the series is to make available for discussion various ideas that have occured to me in the past, but which were unpublished or had very limited distribution. In the present format no formal publication is intended, since many of these notes are fragmentary ideas that may be of more value when other details are filled in.

Frederick B Wood

This series is oriented toward fulfilment of the first part of the following definition from the Engineers' Council for Professional Development:

> "The engineer may be regarded, therefore, as an interpreter of science in terms of human needs and a manager of men, money, and materials in satisfying these needs."

Most problems of this series are more detailed developments of the first problem:

Problem 1.1: How can engineers develop some kind of perspective to give them a synthesis of the specialized fields of science needed for them to fulfil their function as an interpreter of science in terms of human needs? The mention of "human needs" raises many sociological questions.

At this stage of the series it seems appropriate to take a deeper look at why these problems come up.

Problem 9.0: What is the significance of this drive I have for establishing some perspective of the development of civilization and my seeking an understanding of the relationship of my engineering work to the culture in which I live?

Many times in the past while working on mathematical or engineering problems the formal structure of the mathematical space has suddenly appeared to me also as a representation of some human problem, such as the striving of the common people the world over for a peaceful solution to the international problems of the day. Thus the study of a covering theorem in mathematical set theory may suggest the existence of an equivalent covering theorem in dealing with the problem of world peace.

Similarly the study of the channel capacity of telephone lines for data transmission suggests that we have not paid adequate attention to the channel capacity of human beings--
--ourselves. Perhaps different philosophical systems in human society play a role similar to different modulation systems in electrical communication. Probably the rate at which information is thrown at most people in our complex society

exceeds each individual's channel capacity. Then each individual must filter the information to keep within his capacity. This in turn results in specialization which may leave many important problems unattended in our society. The exploration of new philosophical systems in human society might make a better match between the problems and the human channel capacity to deal with the problems of our civilization.

Sometimes the emergence of ideas like these appears to block my engineering work as if I was struggling with some ethical problem. People have advised me to be less sensitive to human needs, to become tough and shove away such humanitarian feelings. On the other hand, when I have succeeded in communicating these derivative ideas to qualified social scientists who can pursue them, I have noticed that for a while my completion of physical engineering problems is greatly accelerated. An understanding of what is going on would be of great value to myself. Perhaps it is difficult to correctly understand, because unconscious factors may be highly significant.

Thanks to some of my friends raising questions about some of my notes and symbols which are gathering dust, I have started to review some old notes which I had laid aside in the past. Furthermore, on my last trip, I picked up a copy of Psyche and Symbol, A Selection from the Writings of C. G. Jung (1) at the the airport book stand. The following quotation from the preface is particularly significant:

> "The instinct to survive is aroused as a reaction against the tendency to mass-suicide represented by the H-bomb and the underlying political schism of the world. The latter is clearly man-made and due to rationalistic distortions. Conversely, if understood by a mature mind, the archetypal praeformations can yield numinous ideas ahead of our actual intellectual level. That is just what our time is in need of. Herein, it seems to me, lies an additional motivation to pay attention to the unconscious processes which in many persons today anticipate future developments." (2)

Also the following comments of Violet de Laszlo from the introduction are very significant:

> "Much of Jung's interest, like that of Paracelsus, has been devoted to the teaching of the medieval alchemists. From the vantage point of modern psychiatric and psychological observation, the core of their endeavor has come to reveal itself as a search for the wholeness of the personality and for the indestructible essence of the soul which they expressed in countless images and symbols ranging from the elixir of life and the philosopher's stone to the image of the hermaphrodite. Even the transmutation of base metals into gold, which is commonly assumed to have been the object of their practical labors, had its transcendent counterpart, for the gold itself became a symbol of the pure indestructable

1. Violet S. de Laszlo, Psyche and Symbol. Garden City, N.Y.: Doubleday and Co.(1958)

2. ibid., pp. xvi-xvii.

essence whose sun-like color reflected the immortal quality of the psyche. The stages of transformation which the alchemist believed to have observed in the vessels of his laboratory were transposed in his imagination into the animated personification of the various elements and substances which he was trying to synthesize into a new wholeness. According to Jung's conclusions the medieval alchemical symbolism represents a powerful upsurge on the part of the unconscious in the spiritual history of Western Europe." (3)

Further my recent reading of Jung's "Five Chapters from: Aion: Contributions to the Symbolism of the Self" (4) has given me some valuable insights into my own mental and emotional processes.

The consequences of these developments is that I now realize that many years ago I partially worked out these problems of the relationship of my engineering work to the society in which I live, but I had dropped the ideas before completion after running into hostile criticism. Further examination reveals that the periods during which I have been able to concentrate in depth successfuly on specific engineering and mathematical problems corresponded closely to periods of time when I have succeeded in maintaining some perspective relating my engineering work to an important ethically desirable goal.

Problem 9.1: How can mankind's search for a "moral law" be formulated in a generalized way that can help people all over the world check for themselves whether their own endeavors are constructive contributions to the welfare of the human race?

Back in 1937 I gave some thought to the role of the engineer in society, but found that there was little in print in the way of interpretation of the high-sounding aims given in the constitutions of the major engineering societies. I thought that possibly taking a philosophy course would help answer some questions. When I suggested to my faculty advisor that I take a philosophy course, he said "Philosphy - - there's nothing in it." Since I didn't take any philosophy courses or other courses in the humanities, I had to figure things out for myself with some help from talks and discussion groups at church and YMCA activities.

The chart on the cover of Socio-Engineering Problems No. 1 Aug. 1958, is a reproduction of a chart I made in August 1940 to help organize my thought in planning some meetings for a college religious group.

3. ibid., p. xxvi.

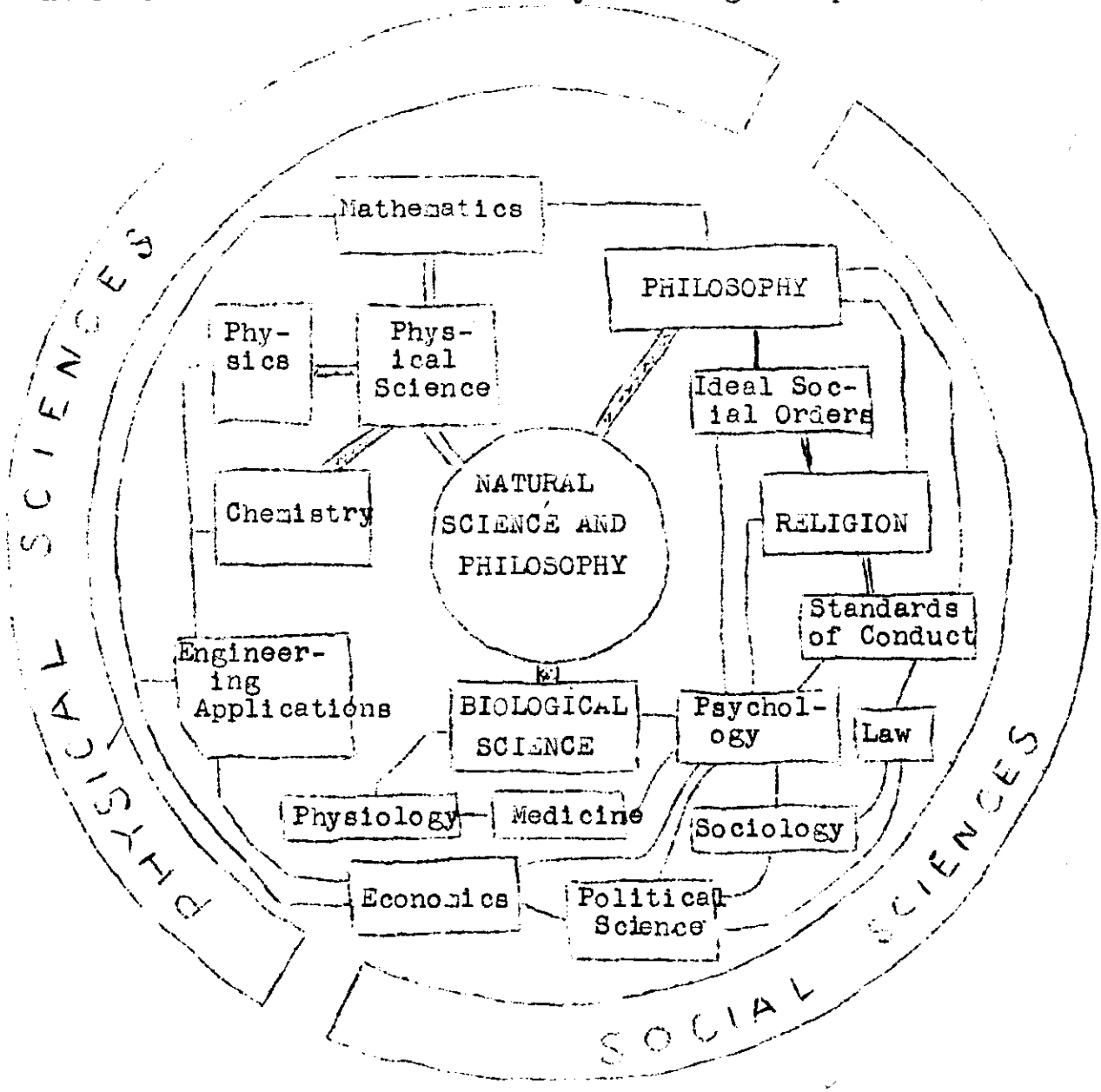
4. ibid., pp. 1-60.

A W O R K I N G P A P E R D R A F T

SOCIO-ENGINEERING PROBLEMS

No. 1 August 1958

"The engineer may be regarded, therefore, as an interpreter of science in terms of human needs and a manager of men, money, and materials in satisfying these needs." --- from E.C.P.D.
The mention of"human needs" raises many sociological questions.



A preliminary attempt to organize a synthesis of the specialized fields of science to assist the engineer in deveioping an interpretation of science in terms of human needs.

Frederick B. Wood, 2346 Lansford Ave., San Jose, California, U.S.A.

During World War II there was a common goal - - the struggle of the democratically oriented countries against Fascism. At times such as following particular victories or setbacks, I would sometimes wonder what would happen after World War II was over. Were prepared with suitable attitudes and techniques of cooperation that would be needed after the War?

When I did contemplate the post war problems, it was usually within the framework of my previous church experiences. For example, the following notes which I wrote in 1944 and 1945 respectively: "The Moral Law," and "Our Responsibility" can be recognized as a paraphrasing of more traditional statements commonly used in religious services. I think that these statements represent a drive to integrate my concept of science, as it existed before World War II, as a serach for truth with the ethics from the Hebrew-Christian base of Western Civilization.

Perhaps a simpler statement would be AlbertSchweitzer's principle "Reverence for Life."

Problem 9.2: In what direction should my own work be directed to make a better contribution to the meeting of human needs? Should I change to some field of social science such as sociology, or should I develop some perspective of the relationship of my work to the rest of mankind which would make it easier for me to specialize in my special field of electrical engineering?

The following note written in 1945 indicates the trend of my early thoughts on the question. At that time I felt that a change to the social sciences might be more useful, but I sensed the possibility that remaining in electrical engineering and helping develop communication between physical scientists and social scientists might be a more substantial contribution in the long run. The possibilities of extending the usefulness of electronic computers in the field of engineering and ultimately more generally in the social sciences are scarecely explored areas. For my earlier thoughts refer to pages 9-11, "What Shall I Do About It?" (May 13, 1945)

In October 1945, I prepared a memorandum "Proposed Social Engineering Research Program," 9 pages. Figures 1, 2A, and 3 A Three-Dimensional Chart, Astrophysics, andAlternative Form of Relationship of the Arts and Sciences of Socio-Engineering Problems No. 1, Aug 1958 are from the above mentioned 1945 memorandum. In December 1945, I added a method of denoting the stage of development of any nbes in the series to prevent preliminary hypotheses from being confused with final conclusions. The classification of stages A through T is described in the note "Why a Working Paper Draft" in Socio-Engineering Problems No. 3, pp. iii-iv.

THE MORAL LAW

There exists moral law in this universe even though it may not be as clearly understood by man as physical laws. Many of the world's great religious leaders have seen these laws in varying degrees of clarity and translated them into the language of their time and social group. Even though each man's interpretation is somewhat different, we find two fundamental laws verified by many leaders in many groups.

The first is that one must love the truth with all his heart and all his mind. While the second follows that one must love his neighbors as himself. On these two laws can be constructed the detailed moral laws proclaimed by the prophets of many different religious and ethnic groups.

In our dealings with our neighbors whether they be next door or on another continent and regardless of what religious faith they may hold, we have in these two fundamental laws, a scale by which to measure the validity of our decisions and actions. We should examine our actions in business, politics, and international relations by comparision against these moral laws. From history and current experience we have seen and are seeing that even though a few may temporarily profit through violation of these laws, that the loss to humanity is greater than the gain to the transgressors.

Frederick B. Wood
November 3, 1944

OUR RESPONSIBILITY

We must love the truth with all our hearts and with all our minds; we must respect that which is known today of the natural law, but we must not be insensitive to new discoveries. Secondly, we must love our neighbors as ourselves. Of the two laws, the second is as necessary as the first, but does not suffice without the sustaining strength of the first. With these two foundations we build on the good of the past toward the awakening horizon of the future. Emerson H. Wood, May 4, 1945

ALBERT SCHWEITZER ON "REVERENCE FOR LIFE"

The following quotations from Albert Schweitzer are of interest to me in looking into the future potentialities of information theory in guiding mankind's search for a fuller and more ethical life.

I Live for Other Life [1]

Ethics is nothing else than reverence for life. Reverence for life affords me my fundamental principle of morality, namely, that good consists in maintaining, assisting and enhancing life, and that to destroy, to harm or to hinder life is evil. Affirmation of the world, that is to say, affirmation of the will-to-live which appears in phenomenal form all around me , is only possible for me in that I give myself out for other life. Without understanding the meaning of the world I act from an inner necessity of my being so as to create values and to live ethically, in the world and exerting influence on it. For in world- and life-affirmation and in ethics I fulfil the will of the universal will-to-live which reveals itself in me. I live my life in God, in the mysterious ethical divine personality which I cannot discover in the world, but only experience in myself as a mysterious impulse. (Ethics, p. xvi)

The Driving Force of the Ethical [1]

Thought must strive to find a formula for the essential nature of the ethical. In so doing it is led to characterize ethics as self-devotion for the sake of life, motivated by reverence for life. Although the phrase "reverence for life" may perhaps sound a trifle unreal, yet that which it denotes is something which never lets go its hold of the man in whose thought it has once found a place. Sympathy, love, and, in general, all enthusiastic feeling of real value are summed up in it. It works with restless vitality on the mental nature in which it has found a footing and flings this into the restless activity of a responsibility which never ceases and stops nowhere. Reverence for life drives a man on as the whirling, thrashing screw forces a ship through the water. (Ethics, p. 256)

1. Charles R. Joy, editor. Albert Schweitzer - An Anthology

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WHAT SHALL I DO ABOUT IT?

As the struggle toward "The Brotherhood of Good Men" on this world progresses, the foremost needs of the day change. In 1917 the need of the day was for military action and the need was filled by the entry of the United States into World War I. When the armistice came in 1918 some people understood the need of the day for international cooperation, but this need was not understood by enough people, so the need was not filled.

The failure of the League of Nations to solve the international problems arising between 1932 and 1939 indicated that the people of the world had not yet learned how to put into practice the commandment "Thou shalt love thy neighbor as thyself" which had been preached for over 1900 years.

In 1939 the situation reached the point where problems could be solved only by military action or by universal passive resistance. Since passive resistance was not adopted by sufficient people at the right time, the situation changed to conditions that required military action for solution. The United States was slow to comprehend the international situation, but finally responded to the need in 1941 by entering World War II after being attacked by Japan.

As the European War is nearing the end, and the toughest part of the Pacific War is about to start, we have a United Nations Conference on International Organization which gives hope of providing something much more successful than the old League of Nations.

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Even though the hopes for a world organization look bright now, there are many social problems which must be solved in order to guarantee continued successful operation of the United Nations organization. A part of the need for military action is the need for developing and designing new devices for the use of the armed forces. The need has been met and is still being met by the concentrated attack upon these problems by the scientists of the United Nations.

Although we still have a war to finish I am giving some thought to the situation after the Pacific War is over. Rapid advances have been made in recent years in physics, chemistry, biology, physiology, and related fields. Comparatively more complex fields such as psychology and religion have farther to go to make possible the proper use of the new inventions that man can use either for war or peace.

I question whether I can adequately do my part in solving the social problems of the day, if I continue specializing in electrical engineering and physics, leaving the social problems to my spare time. I am considering doing some study after the war on the problem of establishing the "Brotherhood of Man" in our time. This resolves itself into two parts. The first is the philosophical approach to establish the interdependent relationship of all men to one another in this world. The second is to study, propose, and try out improved practical techniques of cooperation between men so that people can really say that they love their neighbors as themselves.

When the Pacific War is over, I propose to do some studying[1] on two inter-related subjects. The first would be more theoretical, consisting of research in some special combination of physics, chemistry, zoology, biology, physiology, psychology, and religion. The second part would be more practical, comprising research in the field of economics on the problem of utilizing that which is gained in the first problem for the benefit of man. This plan may be too comprehensive for any one person to handle, but I believe that I could make some progress along organizing and liaison work between experts in the various fields after becoming more familiar with the fields of knowledge mentioned in the first part for which I am not specifically trained.

Frederick B. Wood
May 13, 1945

[1] Note: Combination of certain undergraduate courses in social sciences with graduate study in fields for which I am qualified.

I circulated some of these notes cautiously to a few people in 1945 and early 1946. I was suprised to find that people thought that these ideas which come logically from the traditional religious ideas of our civilization and from my response to the development of science were 'radical ideas.' Some people raised the question as to whether I had been reading communist literature. Since I hadn't been reading radical literature, this criticism made it necessary to get some samples of the literature of various radical groups so I would know what these critics were talking about. I was more deeply shocked to find that a distinguished professor of history considered people who read Communist literature as the scum of the earth. How can people prepare arguments

to refute one's opponents, if one does not read their arguments? I saw engineers afraid to even tough literature that came in the mail to them which they thought might be radical political literature.

I became acquainted with some sociologists, and to my disappointment found that they were usually looking for non-controversial problems to do research on, while urgent problems of world peace lay untouched by the experts whose training came closest to that required for these problems. These experiences led me to seek a way to remain in engineering and to establish some perspective of the relationship of my work to the society in which I live.

Problem 9.3: How can engineers develop a practical perspective of the relationship between engineering and science and society?

In 1946 I devoted considerable thought to this subject. A seminar paper on the history of electromagnetic theory summarized my thoughts as of that date.(1) Since the manuscript was never published, and the abstract is out of print I am reproducing the abstract in this issue of Socio-Engineering Problems. Although there are many points which are now out of date, the basic thesis is still relevant to the problems of our civilization.

1. Frederick B. Wood "The History of Electromagnetic Theory." Unpublished seminar paper, University of California, Berkeley, 59pp, Jan 10, 1947. Copy on file in University of California Library.