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SOCIO-ENGINEERING PROBLEMS No. 24-A

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A CHECKING CHART FOR THE USE OF COMPUTER ENGINEERS IN DEVELOPING SOCIAL RESPONSIBILITY: PART II.*

*See SEP No. 23-A for Part I.

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ABSTRACT

Some recent papers on the social responsibility of computer scientists and the social problems of automation are reviewed. A classification of the sciences derived from the work of early sociologists is used to develop a simplified perspective for the engineer. This classification table is transformed into a "checking chart" for use by engineers in determining the extent to which the social problems relating to their work are being covered. This leads to a limited concept of social responsibility that is believed to be easier for the average engineer to take on as an obligation. Namely, the social responsibility of the engineers is to be a kind of coordinator to make certain that the social problems related to his physical engineering work are being studied and that there are provisions made by our society to explain the basic principles and significance of science to the voters in our democracy.

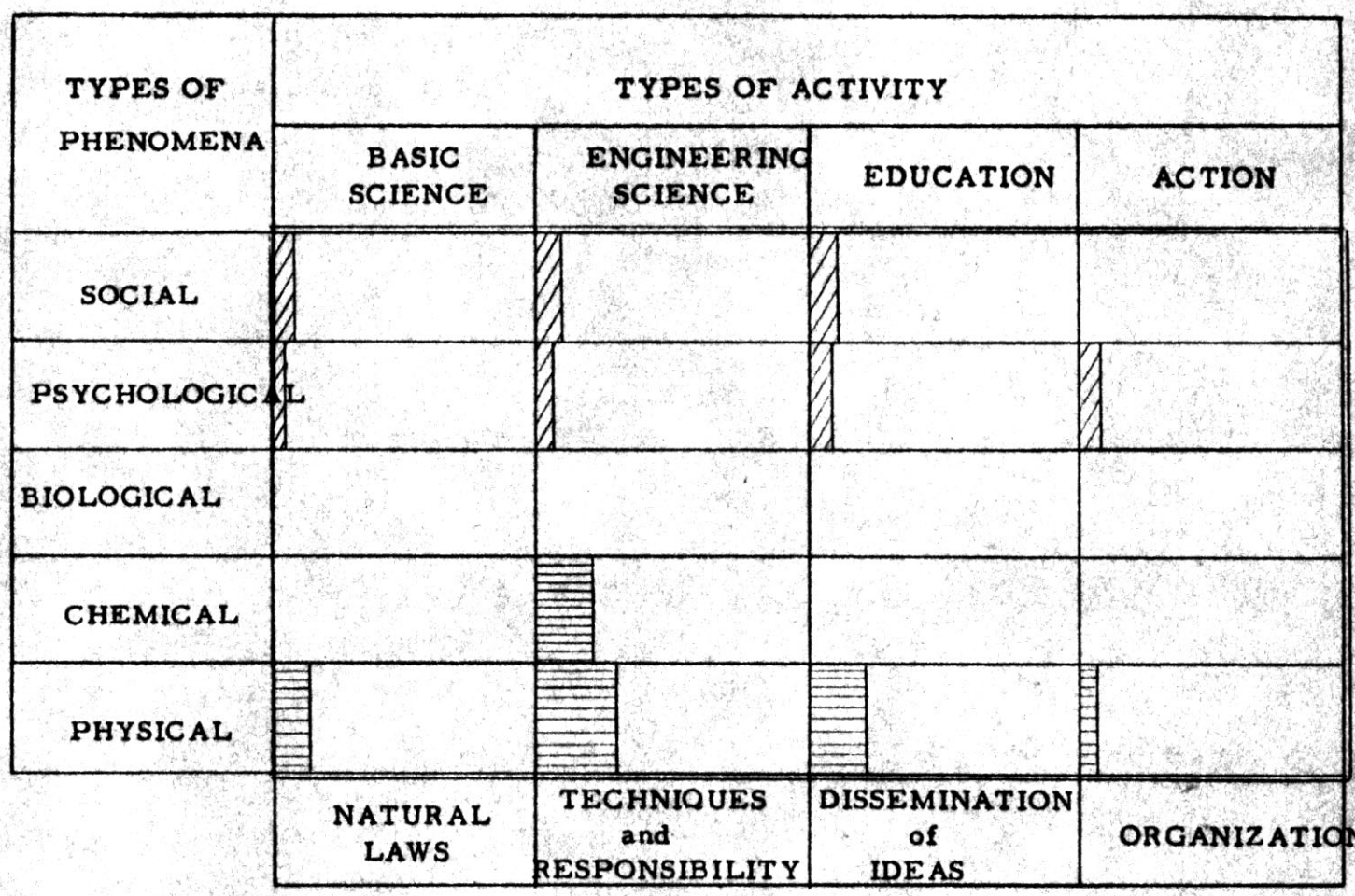

Figure 1. Checking Chart Designed to Indicate the Extent to Which a Particular Analysis Covers the Possible Phases of a General Problem.

Example of 1958 WJCC Panel on Social Problem of Automation

Consider the panel on the social problems of automation at the 1958 WJCC. Here we have an example of cooperation of specialists from the computer industry, the social sciences and labor.

Dr. H. D. Lasswell of the Yale School of Law proposed the development of "Social Planetariums" where analog models and digital simulation programs for different representations of economic, political, and social problems could be tested. He further stated that political models are needed for the survival of popular government. Dr. Lasswell also warned us of the inward pressure for conformity in our industrial society. He said that we may want to maintain freedom so that we will allow novel ideas to develop.*

Mr. E. J. Schaffer of the Oil, Chemical and Atomic Workers Union said that trade union people feel that scientists may forget the people. He feels that scientists can establish a climate in which workers can trust scientists and vice versa. Mr. Schaffer stated that the basic labor union policy of pressing for higher wages is based on a theory of maintaining the stability of our economic system through balancing production and purchasing power. He pointed out some examples of dislocation and hardship in the introduction of automation in the oil industry.

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*The references to statements of the speakers at the 1958 WJCC are to be checked for accuracy with the speakers quoted or with the printed proceedings when they become available. The present draft is based upon incomplete notes taken at the WJCC.

Dr. C. C. Hurd of International Business Machines Corporation pointed out that if we define automation as restricted to information processing, then given appropriate foresight, automation extends man's thinking and results in no serious social problems. He states that the humanistic and social sciences are being extended by computers.

At first there appear to be conflicts in the viewpoints of the three panel members. Let us try to represent these views on a "checking chart" as a way to see what contributions the different speakers made to the overall problem and see if constructive use can be made of any conflicts. In Fig. 3 the computer industry is placed on the level of physical phenomena with some overlap with chemical phenomena partly under basic science and partly under engineering science. Dr. Lasswell's proposal of "social planetariums" is placed under basic science on the levels of psychological and social phenomena with some overlap with engineering. The conflict in economic theories between the oil industry and the oil workers union is illustrated by the two boxes under education and action on the social and psychological phenomena levels. Dr. Lasswell's proposed social planetariums offer a way of testing the hypotheses of the oil industry and the oil workers union. Although the realization of social planetariums may be many years in the future, the plotting of these ideas on the checking chart helps the engineer and scientist in the computer industry see both the potential social problems that will be created in society when automatic computer control systems

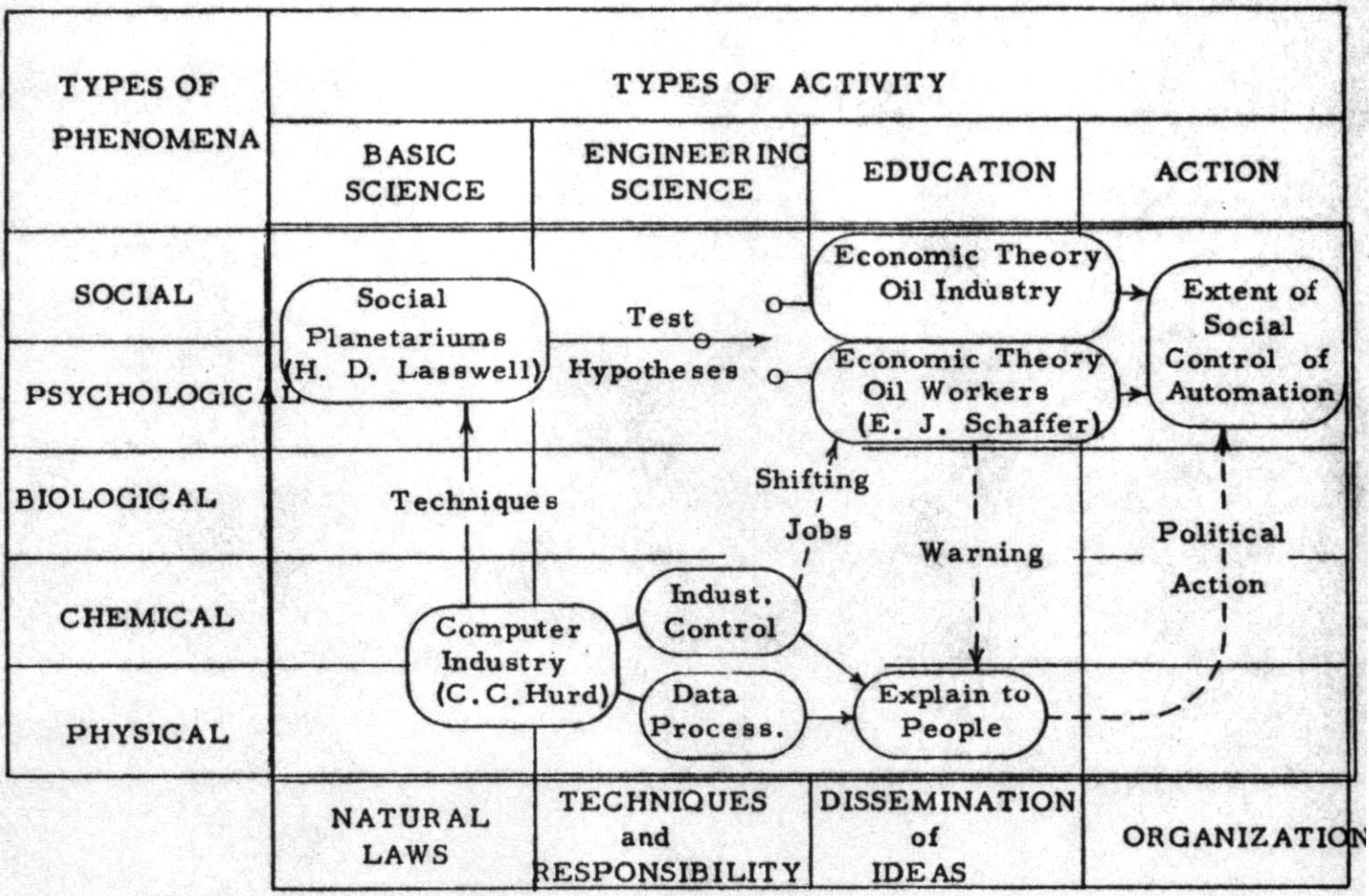

Figure 3. Example of Checking Chart Used to Show Coverage of the Panel on Social Problems of Automation.

are extended deeper into industry and the potential directions in which the computer industry can help the social scientists obtain the tools needed to solve the new social problems.

The extent to which the social problems of our complex industrial society are solved will determine how free the voters leave existing business institutions to continue. Mr. Schaffer offered the important warning that in a democracy a climate must be established where there is mutual trust and understanding between the people and the scientists. If the people in a democracy do not develop an understanding of what computer scientists are doing that influences the problems of our civilization, they might be pushed into unwise political action in an attempt to establish some social control of automation.

With the help of the checking chart we have seen how the three speakers at last year's panel pointed the way to future cooperation in the constructive use of computers and automation in our complex industrial society. The data processing industry represented by Dr. Hurd offers the possibility of extending scientific and engineering techniques to develop Dr. Lasswell's concept of social planetariums. In turn, Dr. Lasswell's concepts offer a potential way of testing the validity of Mr. Schaffer's theory of economic development and stability.

Potential Use of Checking Charts by Ordinary Engineers

People may argue that Steinmetz was a genius and one cannot expect the ordinary engineer to deal with both the engineering and the sociological aspects of his work. Furthermore, some people point out that Steinmetz was a bachelor without family responsibilities. Again, the ordinary engineer will rarely have the opportunity to participate in a strategic panel like the one we have just reviewed. So let us see how the checking chart can be used by the ordinary engineer to help develop a reasonable amount of social responsibility.

My thesis is that any new discovery in science or invention in engineering has far-reaching implications throughout all human activity. Further I claim that the ordinary engineer, who does not have much spare time on account of his basic engineering work and his family responsibilities, can find short cuts to understanding the social implications of his work through devices such as the checking chart of Fig. 1. I have faith that the engineer can fulfill his social responsibility to help make the results of his work be utilized in tune with mankind's highest aspirations.

To fulfill his social responsibility the engineer must understand that it is a responsibility he shares with many people both inside and outside his profession. He may not need to devote a tremendous amount of time and energy to the social implications of his work. The key to success lies in developing a fruitful perspective of the relationship of his work to the

society in which he lives. The checking chart of Fig. 4 is suggested as an aid to each engineer in developing his own perspective. The ordinary engineer need not expect his activity to encompass the range of Steinmetz marked on Fig. 2 nor to have as comprehensive a coverage as the panel illustrated in Fig. 3. He may have a group of friends and correspondents who cover different areas of the checking chart or he may maintain contact with different organizations which cover different areas of the chart. A sample chart is shown in Fig. 7 which illustrates the case of an electrical engineer who has established a network of communication channels which enable him to discharge his social responsibility with a minimum of effort. In this example of an hypothetical engineer, he does not by himself cover the whole area, but has friends who cover parts of the area and share with him their understanding of the problems of our complex industrial civilization.

In this example shown in Fig. 4 our electrical engineer belongs to his technical society: American Institute of Electrical Engineers or the Institute of Radio Engineers. These are shown in Fig. 4 on the physical phenomena level under education and action. If he considers the following definition of an engineer given by the Engineers Council for Professional Development:(15)

> "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,"

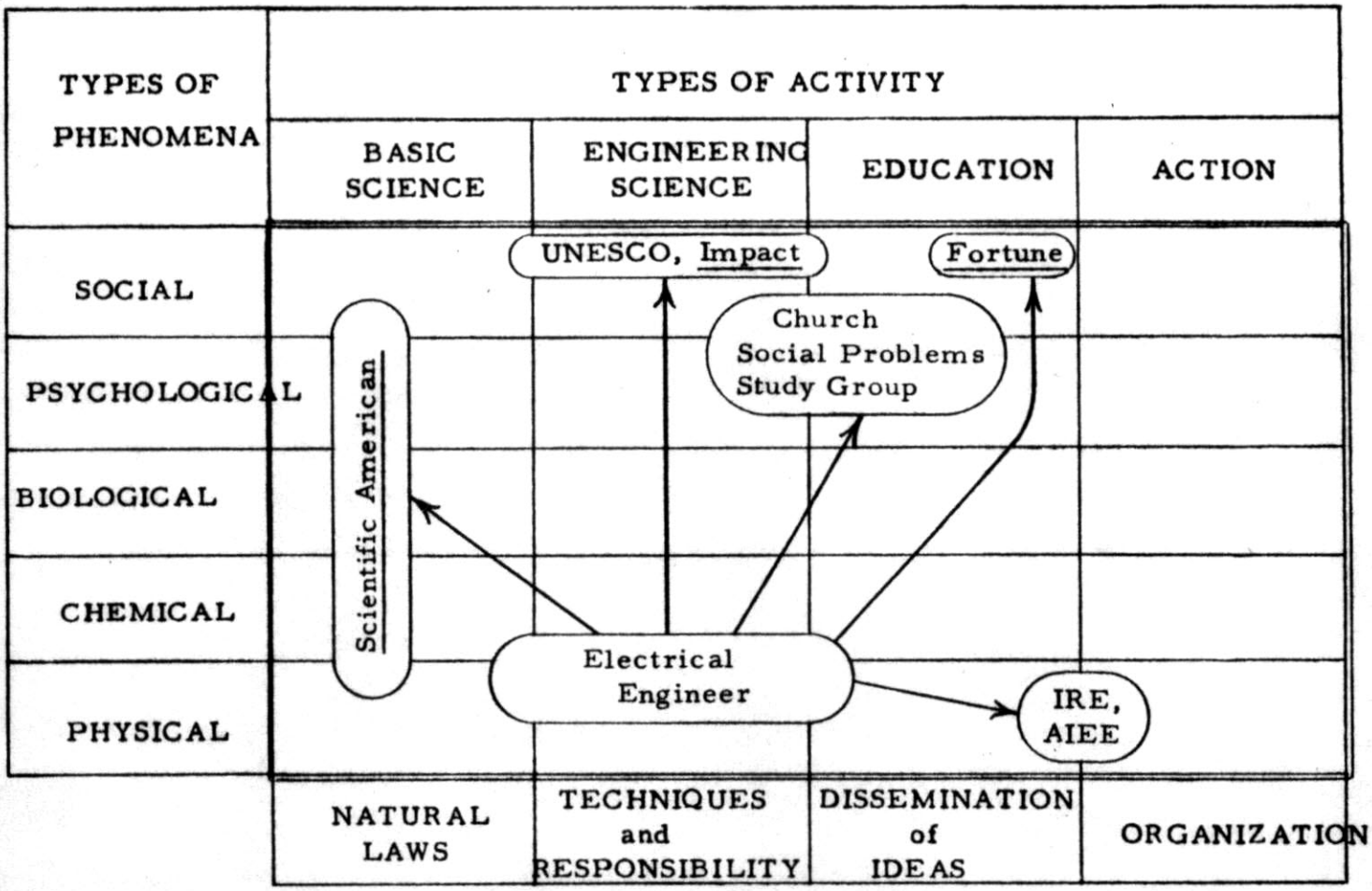

Figure 4. Example of Checking Chart Used to Show Coverage of the Areas of Social Responsibility.

some narrowing down is required to develop a reasonable area of activity. The second part of the definition, namely "a manager" depends upon his own development and the opportunities in his particular specialized branch of engineering. The first part "an interpreter of science in terms of human needs" can be split into two parts:

(1) the specialized engineering work of his job, and

(2) the more generalized interests he may take up as hobbies.

In his specialized engineering work he has acquired through education and experience the portions of basic science that are most useful in his particular engineering assignment. The human needs on his job assignment have been evaluated by other people so that the human needs have already been translated into engineering objectives. To fulfill his role as "interpreter of science in terms of human needs", he needs some more direct contact with both science and with human needs. He can read some magazine such as the Scientific American, which has popular articles on all levels of phenomena, as a way of keeping abreast of developments in science. This is shown in Fig. 4 as a partial coverage of the basic sciences. To obtain a more direct contact with human needs, he can participate in a church social problems study group. This is shown as overlapping the psychological and social phenomena levels in the engineering and education columns.

In order to develop a better understanding of the busi-

ness world in which the results of his engineering work are used, he can read a magazine such as Fortune. He can develop a better perception of the social effect of science on a world scale by following the activities of the United Nations, Educational, Scientific, and Cultural Organization (UNESCO) by reading one of their bulletins such as the quarterly Impact of Science Upon Society.

Conclusions

I have implicitly accepted the following hypothesis in preparing this analysis:

> There is a danger to the existence of our civilization on account of existing social institutions having too long a time lag in making the social adjustments to wisely utilize the latest technological advances.

The recent discussions of the social problems of automation at the WJCC and the discussions of the possibility of the destruction of civilization in Computers and Automation are a healthy sign that some engineers are developing a perspective of how their special field relates to the activities of mankind in general. Engineers need some kind of a framework or coding scheme to present an abstract but significant view of human activity to which they can correlate their own work.

Consideration of the different levels of phenomena from physical and chemical through social phenomena as discussed by the early sociologists leads to the conclusion that there are ways in which engineers and scientists can, with a small effort, contribute significantly to the protection and orderly growth of our civilization. This can be carried out in two parts:

(1) By insuring that our country supports research in the fields of art and science that are needed to solve the social problems accompanying the rapid technological advances.

(a) By developing an understanding of the limitation of their own areas of specialization.

(b) By establishing contacts with other specialists.

(c) By using the above two items to determine the adequacy of the coverage of the social problems related to one's special work.

(d) By taking educational and organizational steps to obtain coverage of parts of problems that are not being adequately studied.

(2) By developing the mathematical and engineering tools needed by social scientists, such as suitable digital computer programs and special analog computers needed to develop "social planetariums".

The "checking chart" is proposed as a way individual engineers may evaluate the completeness of the coverage of social problems related to their work so that it will be easier for them to carry out their social responsibilities as outlined above.

I do not suggest that the engineer should be responsible for solving the social problems of automation. The engineer's responsibility is more of a coordinator to alert the people of our country to the status of our coverage of the problems. If the engineer finds that a social problem relating to his engineering work is not being adequately investigated, he has a responsibility to refer questions to management, social scientists,

government agencies, and to the citizens at large to stimulate the investigation of such problems.

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*Note to Editor: While abstract only is available, institutions of participants are to be listed as shown. When Proc. of WJCC are available this reference is to be changed to refer to Proc. in standard style.