THE QUESTION OF PROFESSIONALISM AND THE PROPOSED PROGRAM TO ACHIEVE UNITY FROM THE VIEWPOINT OF ENGINEERS IN RESEARCH ACTIVITY

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INTRODUCTION

My engineering experience has been principally in research and in advanced development work. The views I am expressing are my own, being based principally on my own experience at the MIT Radiation Laboratory, the University of California, and International Business Machines Corporation. I am a member of both AIEE and IRE and am a member of C.S.P.E.

DEFINITION OF ENGINEER

Of the definitions of engineering that are available, I prefer the definition given by the E.C.P.D. in the pamphlet "Engineering as a Career."

> 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.

ORGANIZATION OF RESEARCH

Emphasizing the role of the research engineer as

"an interpreter of science in terms of human needs,"

let us draw a chart to roughly indicate the nature of the cooperation with other professions required in research (Fig. 1). I shall show in horizontal rows the principal subdivisions of the phenomena involved, and in vertical columns the stages from left to right in the "interpretation of science..."

The boundaries between physics and engineering are not rigid in research. The leadership may come from the physicist (or mathematician) or from the engineer. In many cases such as radar, the predominate drive for invention and development has come from physicists.

The physicists may get an experiment to prove feasibility of some device more quickly by using improvised equipment. For example at the MIT Radiation Laboratory, the physicist built a V-beam radar antenna quickly by using a merry-go-round from an amusement park as the turntable for the experiments.

It has been my experience that physicists often have more imagination in thinking of ways to test some new idea by using available equipment. However, the teamwork of electrical, mechanical, and sometimes civil engineers are needed to safely set up some experiments. For rapid progress in research, it is my opinion that the boundary between the scientist and engineer must be kept informal and flexible.

In some cases a mathematical-physicist will show theoretically that some new device is possible--such as the Bethe-hole directional coupler. In such cases the m-p is the inventor, leaving to the engineer the working out of the production design. In other cases, the engineer may through his understanding of physics come close to the basic science area in developing new concepts, calling in physicists or mathematicians as consultants.

Some subjects like Information Theory which are needed in the design of new communication systems are given as courses in the mathematics or statistics departments of some universities.

I have been talking about how teams of scientists and engineers develop new devices. There is another question concerning "human needs." For the engineer to define the problem, he needs some information on "human needs." Usually, these needs of society are translated by business management experts and economists into more specific problems. When engineers develop some new device that has, say, an "improved" keyboard, how do we know that human beings can use it easily. In such cases we may call in engineering psychologists to see if the device is really simpler for human beings to use.

NEED FOR FLEXIBILITY

The nature of research requires som flexibility in the division of responsibility between physics and electrical engineering. On each project the particular division point depends upon many circumstances. See Fig. 2 for a graphical illustration of the overlapping. The IRE has a procedure for associate membership of scientists and physicians who belong to their own professional societies to become associate members of the appropriate IRE professional groups such as:

Engineering Psychology

Medical Electronics

Information Theory, etc.

The AIEE has committees on special subjects which help circulate new technical information which helps research efforts.

The National Joint Computer Conference is an example of joint IRE-AIEE-ACM action in the interest of promoting prompt circulation of non-confidential research results.

PROFESSIONAL REGISTRATION

I am in favor of promoting engineering registration in the long run, but do not want to see compulsory registration pushed until the full implications of the flexible boundary between physics and electrical engineering is reviewed. Due consideration must be given to the concept of cooperative effort between engineers and basic scientists as an important aspect of professional status of engineers. A truly "professional" engineer must understand his relationship to the basic fields of science from where he must draw basic knowledge. The concept of "professional engineer" must be expanded to include the engineer's relationship with other specialists.

The practical way to promote this may be to encourage the NSPE to consider an associate status that recognizes the engineering nature of some physicists and psychologists. Perhaps some grandfathers clause is needed to provide recognition to senior members or fellows of IRE and AIEE, although not registered in the state professional engineering societies.

WHICH PLAN

The requirements of the research engineer for flexibility and for cooperative effort with other professions to me implies the AIEE Functional Plan is the best at present.

The functional plan would allow the gradual solution of these problems through the cooperation of the existing engineering societies.

The AIEE and IRE can cooperatively serve the technical needs of electrical engineering research with the assistance of EJC.

The ECPD can deal with educational problems, particularly the introduction of the mathematics needed for new topics such as information theory, plus a way to prepare engineers better for cooperation with basic scientists in both the physical and social sciences.

In parallel, the NSPE can be reviewing the professional status of engineers and the engineer relative to the basic sciences.

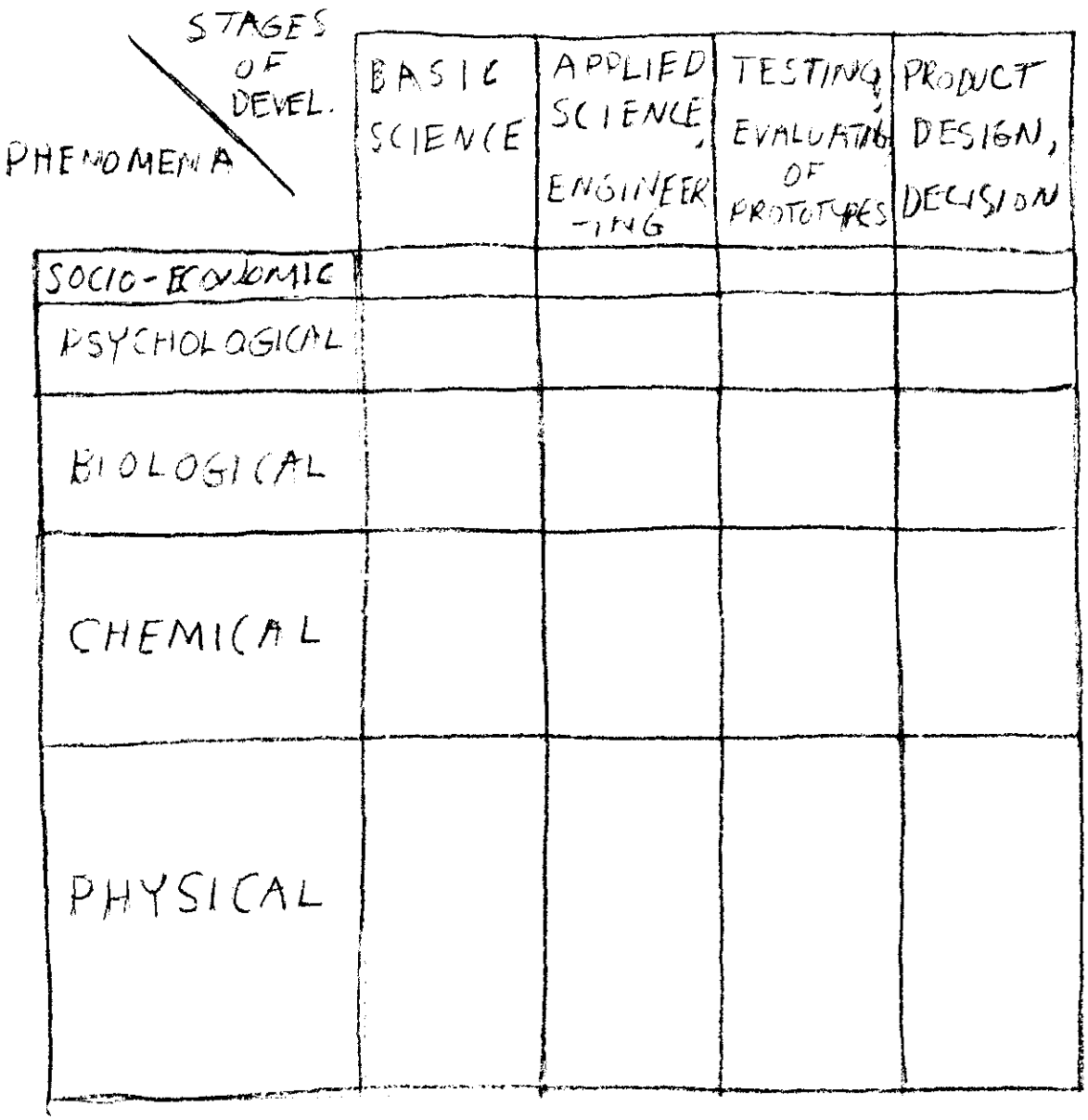

Fig. 1. A Chart for Reviewing the Cooperation Required between Engineers and Other Specialists in Research and Development

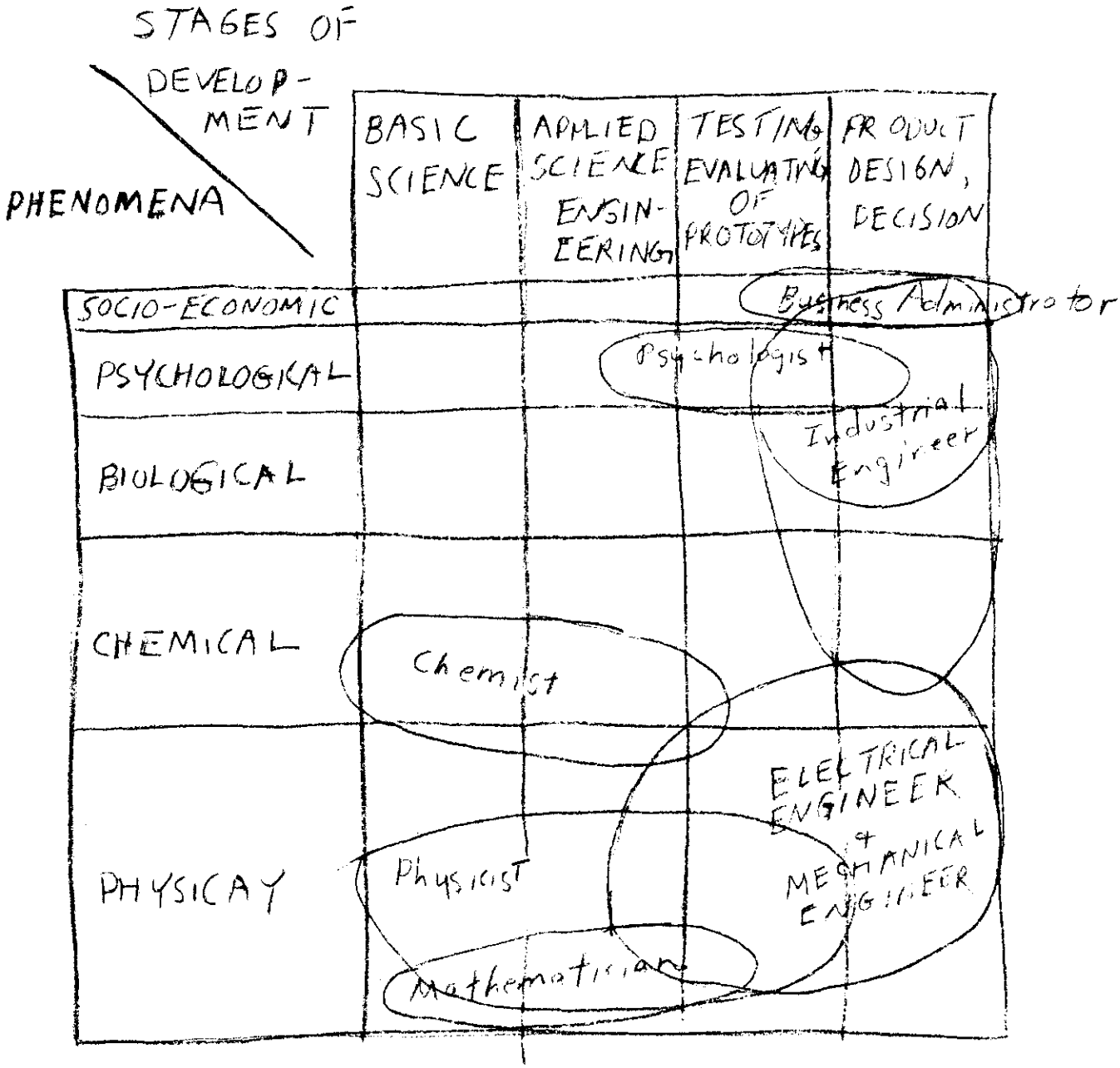

Fig. 2. A Sample Use of the Chart to Indicate The Flexibility of the Division of Responsibility between Engineers, Physicists, and other Specialists.