

lems of vocational adjustment, including placement and training, in conformity with the individual's proclivities and talents. In other directions, also, the psychological point of view is coming to be more frequently taken, with promise of leading to better mutual understanding and more co-operative relations throughout industry.

Wholesome as such a point of view may be in approaching questions of human relations in industry, it will not carry the manager far toward practical solutions of his difficulties unless he has at hand the necessary appropriate techniques for problem solving. This brings us to the third way in which psychology has influenced American industry; through its method.

Psychology as method. The main methods of psychological research are two: experiment and statistics.

The task of any natural science may be stated in most general terms as the determination of the relationship between variables. The variables with which psychology deals include the environmental forces and conditions which influence behavior, as well as the innate capacities, habits and attitudes of individuals in interaction with the world in which they work and live.

It is sometimes said that the biological sciences, of which psychology is one, differ radically from the physical sciences in that the variables with which they have to deal are more numerous, complex and difficult to control. Wherever all the variables, or all but one, can be controlled, the ideal method is that of experiment. Here the ingenious investigator can test his hypothesis by setting up a crucial situation and making observations or measurements which are decisive as to the manner in which the independent and the dependent variables are related. If, however, there are independent and uncontrollable variables which make impossible the resort to experiment, the scientist has recourse to the method of statistics. This is a method which, thanks to Pearson, Spearman, Thorndike, Kelley, Thurstone and others, has been developed extensively in its application to psychological data. It has proved to be an invaluable complement to the methods of the experimental laboratory.

The refinements of statistical procedure evolved in connection with psychological research have been slowly finding their way into industrial per-

sonnel studies. If, before the war, one talked to American business men about correlations, scatter diagrams, regression lines, central tendencies, standard deviations, or measures of reliability and validity, they listened with amused tolerance, if at all. Today these concepts are fairly well recognized as a necessary part of the mental furniture of anyone who undertakes to deal precisely with the data of human behavior. They have found their place in the thinking and writing of many who are undertaking to understand the more fundamental aspects of human relations as they exist in industry.

The method of the controlled experiment on the other hand, although simpler to understand and often more decisive in its findings, has unfortunately not been as generally adopted by industry. To be sure, there have been innumerable so-called experiments tried in industrial relations. But most of these have not been carried out according to the canons of science. A manager has decided, for example, to try the experiment of changing his method of remuneration. In place of an hourly wage he has introduced a straight piece rate; or instead of piece rate he has tried one of the currently popular task-and-bonus systems. But in most instances he has introduced at the same time several other variables. He has changed foremen, or improved the routing of materials, or insisted on a more thorough coaching and follow-up of new employes, or installed a better ventilating system. So when, after several months, his accounting department reports a decided lowering of unit labor costs, it is still a matter of opinion whether these economies are to be credited to the new method of payment by results. Industrial management cannot hope to reap the full benefits of the scientific method as applied to the study of the human problems of the factory, until it is ready to make a larger number of genuinely scientific experiments.

Psychology has demonstrated the usefulness of the methods of experiment and of statistics in solving some of the complicated problems of human relations. It has developed refinements of technique which are readily carried over into industrial research. Responsibility rests with the individual investigator, however, to furnish the penetrating insight and the ingenuity which alone can formulate brilliant and industrially significant hypotheses for scientific study.

Psychological techniques have sometimes been borrowed by industrial engineers, as in the case of recent fatigue studies, earlier investigations having failed because the effects of suggestion were not controlled. In other instances, the psychologist has been borrowed as well as the technique, as when Thorndike helped carry out the research of the New York State Ventilation Commission, which established the primary importance of air movement. The Society for the Promotion of Engineering Education has repeatedly called into its councils such psychologists as Seashore and Thurstone. And so the general methods and specific techniques of psychology, as well as its point of view and its subject matter, are gradually being appropriated by industrial engineering.

Agencies for Furthering Industrial Psychology

A sketch of the influence of psychology on fundamental relations and conditions in American industry would not be complete without mention of certain agencies which have been carrying forward psychological research and slowly spreading throughout the texture of business and industry some familiarity with psychological content, method and point of view.

Chief among the agencies which have been furthering psychological developments are the *universities*. Every university has its psychological laboratory for research. It also offers courses of instruction which are taken by great numbers of students. While many of these courses are general in nature, some of them treat specifically the psychological problems of business, such as advertising and selling, and also touch upon applications of psychology to vocational selection, learning, fatigue, incentives, group relations in industry and other problems of management and of individual adjustment. These courses of instruction in applied psychology are for the most part elementary, and broad in scope rather than intensive. During the past twenty years they have served to introduce many thousands of young people to the basic principles of industrial psychology as first outlined by Münsterberg and as formulated from time to time in the books of Scott, Hollingworth, Poffenberger, Swift and others. Such books have had some circulation among mature business men as well as students. Unfortunately the readers have often, especially since the war, been so intrigued by the

chapters dealing with mental tests and other devices for the measurement of individual differences that they have overlooked the relatively more fundamental psychological considerations which alone can give to mental test procedures their true significance.

In a few universities there exist also centers for advanced training and research in industrial and commercial psychology. Among the foremost at the present time are the University of Michigan in Ann Arbor, the University of Pennsylvania in Philadelphia, Columbia University in New York, and the University of Chicago. Stanford University in California, Northwestern University in Evanston, the University of Pittsburgh, the University of Minnesota in Minneapolis, the University of Iowa in Iowa City, the University of Ohio in Columbus and some of the other state universities are hospitable to such research. Promising developments are now taking place in the Harvard Graduate School of Business Administration in Boston, and in Yale University in New Haven. Curiously the emphasis in many of these centers has been on the psychological problems of commerce rather than of industry. Curiously, too, the great *engineering schools* or institutes of technology have completely neglected psychological research. The outstanding exception to this sweeping generalization is the Carnegie Institute of Technology in Pittsburgh, where was established under the writer's direction in 1915 the first Division of Applied Psychology in any American institution, and later, the first *Bureau of Personnel Research*, and where, for eight years, a notable group of psychologists were engaged in research on problems of importance to co-operating industries and business concerns.³ Kenagy and Yoakum's book on "Selection and Training of Salesmen," Strong and Uhrbrock's "Job Analysis and the Curriculum with Special Reference to the Printing Industry," and Craig and Charters' "Personal Leadership in Industry" record some of the more enduring products of these studies. One outgrowth of this movement at Carnegie Institute of Technology was the establishment in 1917 of the *Research Bureau for Retail Training*. This Bureau, now permanently endowed and affiliated with the University of Pittsburgh, has recently

³An historical account of this development was published in the *Scientific Monthly*, February, 1923, pp. 142-159. A bibliography of publications of the Division of Applied Psychology up to that time contained 63 titles.