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EMPLOYMENT PSYCHOLOGY



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EMPLOYMENT PSYCHOLOGY

THE APPLICATION OF SCIENTIFIC METHODS TO THE SELECTION, TRAINING AND RATING OF EMPLOYEES

BY

HENRY C. LINK, PH.D.

WITH AN INTRODUCTION BY

EDWARD L. THORNDIKE, PH.D.

New York

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INTRODUCTION

Science finds that individuals differ, and differ widely, in any trait or combination of traits. They thus differ in their fitness for certain studies in school, games at play, and jobs at work. Industrial practice finds that a large fraction of this variability remains within a group willing to do a given sort of work at a given wage per hour.

Consequently if there are ten applicants for a certain job there will commonly be a large advantage to the employer who selects the most fit rather than the least fit of the ten. Also if an individual has the choice among ten jobs of equal wage there will commonly be a large advantage to him if he selects the job for which he is most fit rather than the one for which he is least fit. Other things being equal, both the employer and the employee gain in proportion as men work at a job for which they are more fit than any other men are, and as each man is given the job for which he is better fitted than for any other job. The country as a whole, of course, gains very greatly as such a double fit is approximated.

If sufficient ability and effort are expended it is possible to measure the comparative fitness of any number of men for any one given job, or the comparative fitness of any one man for any number of different jobs. These are the tasks of scientific personnel work, the former being the special work of the employment manager and the latter being the special work of the vocational counsellor.

In some cases a direct trial at the job itself is still the best way to measure fitness; but usually the scientific

employment manager has some principles of selection which operate in advance of an actual trial. Among these means of provisional selection or limitation of the numbers for actual trial, objective measurements of the candidate's abilities and achievements and aptitudes are being adopted rapidly by progressive employers. Among such objective measurements, those devised by psychologists have recently attracted special attention by their promise of special usefulness. They seem destined to save time, trouble, and money in many cases.

Dr. Link's book is important because it gives an honest, impartial account of the use of psychological tests under working conditions in a representative industry. He has the great merit of writing as a man of science assessing his own work, not as an enthusiast eager to make a market for psychology with business men. Indeed the story of his experiments is distinctly conservative, for in many cases he could have obtained an even better prediction of success at a given job than he did obtain, by applying the technique of partial correlations and the regression equation so as to obtain a weighted composite score from a team of tests.

Dr. Link's book also gives much valuable detail concerning the practical arrangements for investigating the merits of tests and for putting satisfactory ones into operation. It will be read with interest and profit by students of psychology and of business and industrial efficiency.

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PART I

PSYCHOLOGICAL TESTS

PART I

PSYCHOLOGICAL TESTS

The practical possibilities of psychological tests are now generally conceded, both by the professional psychologist and the industrial layman. Thus far, however, the applications of these tests to industry, particularly in respect to employment, have been fragmentary and intangible. Before industrial leaders will commit themselves to any definite psychological program they demand a concrete account of the tangible results arising from a thorough and comprehensive application of psychological tests to typical industrial problems.

Part I is devoted largely to such an account. It describes the results obtained from the application of psychological tests to employment problems under typical industrial conditions. Moreover, it describes the method by which these results were obtained. Results in themselves are of little value unless they are secured by a method which will produce similar results when applied elsewhere. For that reason special pains are taken to make clear the steps by which the results were reached. The psychologist not familiar with shop and office conditions will find these steps very valuable when he attempts to make his own applications to industrial problems. The industrial layman who is not familiar with the exact methods of psychology will find them a practical guide in estimating the value of attempts made to install psychological methods in his special domain.

The immediate future is likely to see a very extensive application of tests to industry, and the methods by which this extension will be made is therefore of utmost importance to all those interested in the problems of employment.

I

EMPLOYMENT PSYCHOLOGY DEFINED

Few words in the English language have been more frequently used and more often misused during the past few years than the word *psychology*. The term psychology is on almost every tongue and page. It is impossible to talk or read for more than a few minutes before running into a reference to the "psychology of this" or the "psychology of that". No problem to-day but has its psychological solution, at least in the minds of psychology's ambitious friends. A new soprano electrifies her audience with the beautiful art of her song; the musical critic on the following morning attributes her success to the *psychic* quality of her voice. The speaker of the evening wishes to explain a social phenomenon which to most people, including himself, is an unfathomable mystery; he succeeds very nicely with an allusion to the *psychology of the mob*. An enterprising newspaper wishes to solve one of the most vexed questions of the day, the question of prohibition; it calls upon psychologists to discuss what it is pleased to term: "Alcohol—a *soul* hunger". A well-known poetess writes a doggerel on "achievement" and calls it "The Psychology of Action". The nature of the problem matters little. Be it financial, political, military, or social, when all other explanations have failed, the psychological solution is the final and hopeful appeal.

Professional psychologists should feel complimented at this wholesale advertising, this widespread confidence

in their profession. No doubt they do. However, many a psychologist to-day, while standing in complacent satisfaction at the greatness of his medium, can not help wondering what all the fuss is about. And not a few must feel like the fisherman of the Arabian Nights tale when he uncorked the flask and let out the genii. They must be wishing the thing had not escaped them quite so fast. This illustration, however, is a misleading one. According to the story, the genii of the flask was an accommodating spirit who did anything which his master required. But psychology will not do everything which the psychologist could require of it. Far from it. Only those who know least about psychology can make it solve every problem and perplexity. As a consequence, professional psychologists are put in an embarrassing position in the eyes of the world. In the face of a prevailing impression that the powers of psychology are unlimited, the psychologist knows full well that his science, like every other science, can do some things particularly well but can by no stretch of the imagination accomplish everything.

How psychology came to be regarded as the panacea for all ills is difficult to explain. We may attribute it to the great American virtue of advertising, or to that other well-known trait, credulity. If Barnum were living to-day, he would undoubtedly have a side show of psychological wonders. However, it has been characteristic of people from times past to put all their eggs into one basket. Five thousand years ago, astrology was the cult which could solve all human ills. The astrologer was succeeded by the philosopher, and for many centuries more, philosophy was regarded as the touchstone of the sciences, and the philosopher as the wisest of the wise. To take things

philosophically was to solve all the problems of life. The mathematician and physicist also had their day. Archimedes could have pried the globe out of its orbit if he had had the necessary fulcrum. Medicine was a universal remedy for all maladies of the flesh and spirit long before it had passed the blood-letting stage. All of these panaceas, however, survived their initial greatness, and to-day are contributing their modest bit to the collective progress of the race.

Psychology, too, when the furor of its début is over—if one may speak of it in such frivolous terms—will settle down into a less dazzling, but certainly more constructive, existence. It is difficult to predict how soon this will be. It is safe to predict that many fingers will be burned before it does happen. However, psychology will assume its distinct place among the applied sciences. It will also develop that professional caste and dignity which give to medicine and all other well-established professions their standing in the eyes of the world.

But what is psychology? Having made the broad statement which most people will readily admit, that few of those who talk so glibly about psychology have an adequate conception of what it is—we must now answer the question: What *is* it?

Psychology may perhaps be more clearly defined if it is compared with a similar science, for example, the science of medicine. The general nature of medicine is reasonably well understood, and there are no great illusions as to its powers. Nevertheless, medicine has passed through the same stage of nebulosity through which psychology is passing to-day. A thousand years ago, medicine was an art with almost unlimited powers. There was no ill of flesh or spirit for which the ancient healer did not

possess some infallible formula, some unfailing ritual. Among the American Indians, the medicine man was a powerful physician who, by dancing wildly and beating loudly on a drum, was able to frighten off the evil spirit which had taken a temporary abode in the patient's vitals. At a later day, and not altogether beyond our own memory, medicine consisted largely of *home remedies*. Sage tea, bitters, avoidance of the night air, a rabbit's foot—these and many other cures and preventives are within the memory of the present generation.

Although some of these primitive home remedies occasionally proved useful they were, in general, a decided failure. Their failure was due to the fact that their use did not rest upon a scientific knowledge of the human anatomy and of the exact effects upon the body of certain drugs and expedients. The physician of that day knew little about the mechanism of circulation, respiration, and digestion. His cures were due more or less to shrewd guesses. To-day the guessing method has been largely if not entirely displaced, and a scientific method has taken its place. A physician to-day would not think of examining a man without registering his exact temperature, using a stethoscope on his heart and lungs, taking his blood-pressure, counting his pulse, making a urinalysis, etc. All of these measures are tests, and it is by means of these accurate tests that the physician is enabled to pronounce a reliable verdict on a man's bodily condition. Medicine is still far from being a perfect science, but it is at least so far perfect that its general superiority over the older methods is universally conceded.

Psychology, like medicine, has had its evolution. The early Greeks thought the mind a fine essence or a very subtle gas, which animated the body with its presence.

At death, this spirit left the body at its last breath, and departed into some other region. This belief, in a more or less refined form, constituted the heart of psychology as far down as the present decade. Within the memory of most people are the famous experiments conducted by many prominent physicians, in which bodies were weighed on the most delicate scales just before and just after death in order to discover if the departure of the soul was accompanied by any falling off in weight. At the present time, psychology is in what we have called the stage of *home remedies*. People are believing all manner of queer things and following all kinds of strange advice because they are labelled psychology. Hypnotism and the ability of the psychologist to make people do impossible stunts are still considered a psychological *sine qua non*. Indeed, it is most common for people to ask whether it is possible for a psychologist to read minds, and they are usually disappointed at a negative answer. The writer once made a deep impression on a group of hard-headed business men to whom he was being introduced as a psychologist. During the introduction he remarked to one of the men: "You are a Cornell man, are you not?" This happened to be the case and all the men marvelled at the uncanny insight of this psychologist, when, as a matter of fact, his question was nothing more than a lucky guess. Instances of this kind, and the frequent misuses of the word *psychology* which have been pointed out before, are evidence of the nebulous idea which psychology suggests to the majority of those who use the word.

However, within the last fifty years, in secluded and little known laboratories, psychology has been developing very rapidly into a genuine science. The workings of the mind have been subject to a scrutiny as minute and thorough

as that which the body receives at the hands of physicians. To be sure, it is impossible to dissect the mind as the body can be dissected, and yet, in a way, it is quite possible; for to the psychologist, the mind is first of all the nervous system and the activities which it controls. In order to understand the mind, the psychologist must thoroughly understand that most intricate of all mechanisms, the nervous system. And in order to understand the workings of this mechanism, it is necessary to study not only its structure but its activities as well. The actions of people are the best clue to the nature of their nervous system, or their mental make-up. However, the study of these actions must be of a special nature. Not every study of the mind can be called psychology. The novelist, writing a so-called "psychological novel", may make a very extensive and subtle study of the actions and thoughts of the characters which he is portraying; but such a study would not be considered psychology by a psychologist, any more than the autobiography of an invalid would be considered a treatise on medicine by a physician. The psychological study of the mind applies to human actions the same scientific methods which physics applies to the study of matter, medicine to the study of the body, or chemistry to the analysis of compounds. The true psychology, and the core of facts around which the many nebulous ideas of psychology current to-day are clustered, is this exact psychology, this psychology of scientific methods.

What are the applications of this science to the problems of employment? Before answering this question it will be wise to consider briefly what we mean by the scientific method; for, if any word is more constantly used and misused than *psychology*, that word is *science*.

Every propagandist for a new scheme to solve the problems of mankind labels it "The Science" of something or other. Since the value of the scientific method is undisputed, the addition of the word *scientific* to any scheme whatsoever immediately raises a presumption in its favor in the eyes of the credulous consumer. Science, like psychology, is a word in whose name many sins are committed.

The word *science* comes from the Latin word *scire*, to know; but this fact tells us nothing about the meaning of science; a man may know the entire "Encyclopædia Britannica" and yet not be a scientist. Science means more than knowledge, however extensive. It means more, even, than accurate knowledge; for an accountant may know every figure and item in his accounts and yet not be a scientist. A scientist is one who can formulate and apply *standardized* knowledge in a given field. And the scientific method is a method by which knowledge is standardized and refined far beyond the ordinary powers of the human mind. But what do we mean by *standardized* knowledge? Is this not carrying even science a bit too far, some one will probably ask? Not at all. An inch is an example of standardized knowledge. How many people could agree on the size of an inch without the use of a rule? In the Bureau of Standards at Washington lies the original rule, a metal bar which is used as the standard for every other inch. But this is only a first step in science. What should we say to the tool and gauge maker who measured his work with a foot rule? For his purposes science has devised the micrometer which can measure distances as small as .0001 of an inch and less. The gauge maker is a master of standardized or scientific knowledge in his field. If he were to send the drawings and spec-

ifications of his work to another gauge maker on the other side of the continent, that gauge maker could turn out an exactly similar piece of work. Moreover, he could prove, by means of his instruments, that the work was identical. The chemist does not make up his compounds after a cook-book formula, so many cups of this and so many spoonfuls of that. He weighs his materials on the finest of scales which tell him to a thousandth of a gram what amount he has. The cook-book method is the empirical or *home remedies* method and many excellent results this method has produced; but no two cooks can obtain the same result from the same recipe. The scientist can, because his method is standardized and minute, and enables him to speak in terms that always mean the same thing. This statement holds true in any field of facts to which the scientific method has been applied. Another excellent example is the weather report. The weather man is still the subject of frequent jibes. It is a common practice to look at the weather report and then believe the contrary. But how many people are willing to have the weather man replaced by the good old-fashioned goose-bone prophet? And how many would stake their own empirical judgment against the scientific inductions of the weather man? Meteorology is the result of applying the scientific method to the study of atmospheric conditions, that is, substituting for the crude and unaided human faculties such scientific tests as thermometers, barometers, rain-fall gauges, and other quantitative tests. Consequently, weather men all over the country, in making up their weather reports, can describe atmospheric conditions to each other in standard and unambiguous terms. There is no Yankee or southern dialect in the science of meteorology.

The same can be said of any field of facts to which the scientific method has been applied, whether it be astronomy, physics, biology, meteorology, chemistry, mathematics, acoustics, or hydrostatics. In every case, science consists of the application of an exact and refined method to the study of the facts, with the result that we have knowledge which has two chief characteristics: first, it is relatively free from the inaccuracies and prejudices of the unaided human faculties; secondly, it is standard knowledge; that is, knowledge which can be transmitted in unambiguous and indisputable form from one person to another, or from one time to another.

It is worth while clearing up some of the ambiguities and misunderstandings which cling to the words science and psychology, because by doing so the definition of our own subject, employment psychology, is made more easy. Psychology has been defined as the application of the scientific method to the actions of the mind in general. Employment psychology, therefore, may be defined as the application of the scientific method to the mental actions concerned in employment.

The application of science to the problem of employment is just beginning to receive serious attention. The old-fashioned method, and the method which is still commonly in use, is the method of "hire and fire". That is to say, there *is* no particular method. Every employer uses his own method, and each one obtains various results. In general, the practice is to receive a number of applicants, look them over, ask them a series of general questions, and then hire those that "look good". Many amusing strictures on this crude method have been written. A quotation from one of these will suffice to typify the rest: "One large manufacturing establishment has

appointed as monarch of the 'hiring-on window' a man who had the misfortune to lose a leg in the company's employ. As a consequence of this loss, he was given his present life job which he performs to the queen's taste. He was induced to describe his methods and they were something as follows: 'On Mondays I turns down all the men with white collars, on Tuesdays all with blue eyes, Wednesday all with dark eyes. Red-headed men I never hires, and there do be days when I has a grouch and hires every tenth man.'" This exaggeration serves at least to bring out into sharp relief the weakness of the old and present method of employing. This weakness, in brief, is due to the absolute reliance upon the particular ability and experience of the individual or individuals who happen to be doing the hiring. This method, like the method of *home remedies* in other fields, is not without its virtues. There are undoubtedly people who have an almost uncanny ability to select the right applicant for the right place. However, the most experienced employment manager will admit that its shortcomings more than outweigh its virtues. These shortcomings are the shortcomings of every unscientific or *home remedy* method, namely, the lack of accurate standards or measurements and the failure to provide a safeguard against the thousand and one prejudices to which the human flesh is liable and by which personal judgments are so frequently vitiated.

A few general instances will serve to bring out these weaknesses more distinctly. In a large employment office there are usually three or four or more men and women taking applications and interviewing applicants. Each of these interviewers has probably had a different kind of experience and training, and each may have different

ideas on the best way in which to hire applicants. Therefore, even though there is some understanding between them regarding the general character of the applicants they wish to hire, their methods of selection are not standard, and their results are bound to be different. For instance, it is quite within the realm of probability that each of two interviewers should interview in turn and unknown to each other the same applicants, and that one interviewer should hire one-half of those interviewed while the other hired the other half. Even if a corps of interviewers should happen to work together harmoniously, the fact that the personnel of the corps is subject to constant change will result in a corresponding change in its standards of employment. In one year, an entirely new staff of interviewers may come into office, with the consequence that the entire method of hiring is radically changed.

But even in smaller places, where one person does all the hiring, there is no guarantee of uniformity. To begin with, there is the same likelihood that the person who does the hiring will be succeeded by another. But in addition to this source of variability, each man in himself possesses a variety of moods and methods which make it impossible for him to produce standard results. On some days the interviewer will be in a jovial and sympathetic mood, so that he will find it almost impossible to turn away even the most unsuitable applicant. On other days he may be cross enough to turn away most desirable applicants. Moreover, every individual is subject to certain prejudices of religion, race, caste, etc., which affect his judgment. Unconsciously, these prejudices operate in the mental processes by which the interviewer selects from among the available candidates. If two applicants are

applying for the same position, and one seems considerably more desirable than the other, the interviewer may be just on the point of hiring this candidate when his eye is suddenly caught by the pin of a fraternity which he heartily dislikes. The sight of this pin may immediately cause him to shift his favorable opinion to the other and less desirable applicant. Anyone familiar with employment conditions knows that the instances given above could be multiplied indefinitely.

The casual methods prevalent not only in employment work but in the handling of workers throughout industry in general is one of the anomalies of the age. For fifty years and more, the utmost attention has been paid to the development and refinement of the mechanical processes of manufacture. The division of labor has been carried to a point which would have been incredible a generation ago. *But the division of laborers is almost as haphazard now as it was then.* Now every large industry has its chemical and physical laboratory, in which it examines most minutely the quality of the materials which it receives and fabricates. But the effort during all this time devoted to the improvement of methods for handling *human* material has been ridiculously cheap and inadequate. As a single and a very practical instance of this easy-going policy, as applied to employment problems, the following quotation from an address to a convention of California railroad men is given: "Would you, gentlemen, enter into a contract to buy material from a concern, the excellence of whose product you had grave reason to doubt? Would you place orders to the extent of three and one-half million dollars a year, waive inspection of material, accept whatever was offered you, and make no effort to get your money's worth?

You would not—not if you expected to hold your job. And yet, that is what you are doing with respect to the public education system of California. In 1916 the railroads of this state paid in operative taxes $7,151,583. Of this sum 51 per cent, or $3,647,300, was used for purposes of public education. *The boys and girls sent you from the public schools you take into your service, sometimes after a perfunctory mental examination, generally with none;* in other words, *you waive inspection,* and then complain of the character of the material after it has reached you and been paid for."

What has psychology done to solve these problems and to introduce into the employment methods of today a more scientific procedure? The greatest single contribution of scientific psychology to the solution of this problem has been the application of mental tests. A mental test is a device, similar to a measuring instrument in any of the sciences, by which certain mental activities can be accurately measured. The use of mental tests is not absolutely new or unfamiliar. All formal examinations may be regarded as coming under the general category of mental tests. A written examination which is absolutely alike for all those taking it, and for which every person is allowed exactly the same amount of time, is a good example of tests in general. Such tests have been used quite commonly in schools, as requirements for entrance into college, and for similar purposes. The civil-service system is a good example, outside of the field of psychology, of the development of standard mental tests. The civil-service tests are standardized for all parts of the country and are given under conditions that approach uniformity. This is what gives them their value. It is evident, therefore, that the use of psycholog-

ical tests is quite in accord with the dictates of common sense and good practice. However, while similar in principle, psychological tests differ from the general tests just mentioned in being far more refined and accurate. They are developed by a method based on very careful experiments and the use of accurate statistical formulæ. The details of this method as applied to employment are explained in subsequent chapters.

This method is gradually making it possible to obtain standard measures of the mental qualities, measures which are infinitely more accurate than those used in the past. By means of these measures or tests, it is becoming possible to set up standard specifications for the kinds of applicants who are desired for a given position, and to fill these specifications exactly as the tool maker would fill the specifications for a tool which he is to make. Not only will it be possible to apply these standards in the particular office or location where they have been originated, but it will be possible to apply them in all places. The psychological tests devised for use in the army, for instance, were distributed throughout every camp in the country, and as a result, the classification of all privates, commissioned and non-commissioned officers, was based largely upon standard measures.

The distinguishing feature of employment psychology, that which differentiates it from applied psychology in general, is its field of activity. Heretofore mental tests have been devised largely in the university laboratory and have been tried out for the most part on students and pupils in educational institutions. Employment psychology, however, works directly in the field of employment, not employment as represented merely by the activities of the employment office, but employment in the sense

of the work as it is actually being done. Its laboratory is the shop and the office. The conditions under which it conducts its experiments are the actual conditions and not the highly artificial and theoretical conditions entailed by the stereotyped psychological laboratory. The employment psychologist must find and apply mental tests to employees on the basis of a study of the work which they are doing. In fact, he must become an employee himself, in order that he may understand the kind of mental action for which he is trying to find tests or measures. Only the most temerarious psychologist would attempt to devise or apply tests to employees whose work he understood in only a superficial fashion.

There is a very decided tendency to-day to make a widespread and wholesale use of tests for employment purposes. Newspapers and periodicals have given much space to the description of tests and have made many sensational and extravagant claims for their usefulness. There is great danger in a sudden and extensive application of tests. Indeed, ridicule has already been provoked by their indiscriminate use; for anyone with a little ingenuity, whether he be a psychologist or not, can take a ready-made psychological test and apply it, after a fashion. But, having applied it, the chief difficulty remains, namely, how shall it be interpreted? What does it mean? No test has any significance for employment purposes until it has been tried out (by the scientific process to be described later) on employees doing exactly the same kind of work as that for which new applicants are to be tested later on. If, for instance, an employment manager receives a set of trade tests or clerical tests for use in connection with the selection of workers, he can not use those tests effectually until a trained psychologist has tried them out on

the particular work in question. Even though tests have been devised and carefully applied elsewhere by a first-rate psychologist, it does not follow that they will apply equally well in the new situation. For instance, trade tests and intelligence tests were of great value in classifying the army. However, before these tests can be applied to a particular industry, they must be carefully and scientifically tried out on the work of that industry and modified to meet its specific demands. This is a task which requires not only a psychologist who is technically equipped, but one who is ready to make a thorough study of the work of the particular industry in question.

There are thousands of valuable tests in existence to-day. The chief problem of employment psychology is to determine the value of particular tests when applied to particular tasks. The first step of every employment psychologist in each new field is to *test tests* rather than applicants. The progressive employment manager is facilitating the work of the employment psychologist by enabling the latter to enter directly into the shop and the office, there to study and work and to try out tests for future use. To give a concrete example, a large footwear industry of national importance has recently engaged a staff of six trained psychologists who are now engaged in a first-hand study of the various operations of the industry. As they become familiar with the various kinds of work they will devise tests or select tests from those available and try them out. If these tests prove significant, they will then be used for employing new applicants. This method of approach, from within out, is the road by which employment psychology and the employment psychologist must proceed, to be genuinely practical.

It should not be thought, however, that employment

psychology or the field of employment is limited to the mere act of hiring or rejecting applicants. This notion of employment work is rapidly becoming obsolete. To-day, the training of new employees, keeping accurate records of their activities, transferring them when advisable, devising methods of promotion, are all phases of the employment problem. The first half of this book deals particularly with the application of psychology to the selection of employees; the latter half deals with its application to these other important phases.

II

A FIRST EXPERIMENT

The general purpose of this experiment was to discover a set of mental tests which could be used by the employment office in selecting applicants for certain kinds of work. Just where and how, specifically, this was to be done was a somewhat hazy problem at the outset. Hitherto, the work of the experimenter had been confined to the orthodox experiments of the psychological laboratory. Factory conditions and factory problems were therefore novel to him, no more, however, than his purposes and methods were to the factory. In the midst of this somewhat hazy and intricate problem, four distinct conditions were discernible. First, in finding the proposed set of tests, it was primarily necessary to go out among the shops and make a general survey of the types of work for which applicants were being chosen. Secondly, it was necessary to make an intensive study of one or two operations at the start, rather than an extensive study of a large variety of operations. Thirdly, a large number of workers all engaged in the same work had to be studied in order to make as wide a series of observations as possible (obviously, the tests tried on a hundred workers would give more conclusive results than those tried on only ten or twenty). Fourthly, it was advisable to try out these tests where the work was simplest and most automatic, on the assumption that the more standardized the work the more easy it would be to discover a standard set of tests.

Following these conditions, therefore, the experimenter was first of all conducted on extensive tours through the various shops, and the various types of work were explained to him. After six or seven trips of this kind, two types of work, conducted side by side in the same room, were settled on as the most fruitful field for the experiment. The work chosen was that of inspecting shells before they had been loaded, and gauging them for head-thickness. This work was being done in two long, well-lighted rooms, by about 330 girls, two-thirds of whom were engaged in inspection and one-third in gauging. This large number of girls offered the opportunity of conducting a sufficiently extensive series of observations, thus meeting the third condition stated above. Most of the girls, at the time, were inspecting the same kind of shells, and this fulfilled the fourth condition; namely, a highly standardized type of work. A further advantage offered by this type of work, and one that was absolutely essential to the success of the experiment, was the fact that it offered a basis for comparing the activity of the various workers. For instance, it was possible, at the end of each day, to find out exactly how many pounds of shells each girl had inspected or gauged during the day as well as to find out how many good shells she had thrown out as "scrap".

The above might be called the preliminary steps of the experiment. We now come to the details of the experiment itself.

The general purpose of the experiment was, as has been stated, to discover a set of tests which would guide the employment office in selecting new candidates. The more specific purpose, at this stage in the experiment, was to discover a set of tests in which the performance of the

girls would correspond with their daily *production* or *output* of shells. If it could be demonstrated that the best workers did best in certain tests, and that the poorest workers did the poorest work in these tests, then it would be reasonable to assume, subject to further proof or disproof, that these tests gave a reliable indication of the workers' ability at inspection. And it would further be reasonable to assume that these tests, given to applicants whose ability as inspectors was an unknown quantity, would enable the employment office to select those who had certain qualities necessary for success at this work. Only those applicants who showed a certain degree of skill in these tests would be selected for the type of work on which these tests had been found significant. This, in brief, is the method of trying out tests, the details of which will become clear in the course of the experiment.

After the type of work for this experiment had been decided upon, the next step was to make a careful and intensive study of the qualifications involved in doing that work. The work of inspecting shells was done at a table like an upturned shallow box. Upon this hollow table was dumped a large box of brass shells, not yet loaded, and all of exactly the same kind. The work of each girl was to inspect these shells and throw out those that were defective. In doing this, a girl would first gather up a large handful of shells, as many as could be piled in one hand, being careful to have all of them pointing in the same direction. Then she would put both hands around the shells and turn them all up so as to expose their insides. She would then look down into every shell for dents, scratches, stains, and other very minute defects. When any such defect was discovered, the shell was skillfully extracted from the pile and thrown into one of three

or four appropriate scrap boxes. The entire handful was then turned over, and the head of every shell examined for various defects. The shells were then held in a horizontal position on the left hand, and allowed to roll from the pile into the right hand. Each shell, in the process of rolling from one hand into the other, exposed its lateral surface and was closely scrutinized for scratches, oil dents, stains, and other defects. The good ones were taken in the right hand and dropped into a pocket at the right side of the table, through which they fell into a box below.

An analysis of this operation showed that it required the following qualifications:

1. Good eyesight. The defects to be detected were often so minute as to be indistinguishable to any but the best of eyes. It took the experimenter almost a minute to see one of the most common defects which these girls were required to notice in an instant. Any weakness of the eyes or marked difference between the two would be likely to show bad results in the inspection.

2. Keen visual discrimination. Good eyesight is not sufficient. The inspector, looking at a whole handful of shells, must, with a few glances, be able to recognize those which are defective and remain oblivious to those which are not.

3. Quick reaction; that is, the ability to extract, as quickly as seen, the defective shell and toss it into the appropriate box.

4. Accuracy of movement, required in picking out the right shell from the closely held handful. This requires a very peculiar kind of deftness, and, in order to facilitate it, many of the girls allow their finger nails to grow to an unusually long and sharp point.

5. Steadiness of attention. The least wavering of the

eyes or letting up of the attention is likely to allow some bad shells to slip by or to lengthen the operation.

This analysis having been made, the next step was to find tests which would be likely to detect the presence of these qualities. Sixteen different tests were chosen and prepared for preliminary trials. It is not possible or necessary to go into detail on all these tests at this point. However, each test was tried out on a large enough number of girls to give a good indication as to whether it was likely to prove significant. A good deal of time was required for this part of the experiment, but eventually a set of eight tests was selected for the body of the experiment. These eight tests will be described later; but before describing them, one or two preliminary problems will be of interest.

An important question to be settled was the question as to just how these tests should be given. The rooms in which the girls were at work were very noisy, due to constantly running machines and the handling of thousands of brass shells. Should the girls be tested in this noisy atmosphere or should they be taken off to some quiet place, free from any possible disturbance? In the end it was decided to give the tests in the workroom, on the supposition that if the subjects were left in their regular environment, they would be more likely to show characteristic results in their performance in the tests. A girl suddenly taken out of a noisy shop to which she had become accustomed and into a soundless room might feel just as strange as a girl taken from a quiet place into a very noisy one. A small room was screened off on one side, and this served as a place in which the tests could be given with comparative freedom from intrusion.

Some difficulty had been anticipated in putting the

tests into operation, both on the part of the girls to be tested and because of the confusion that might be introduced into the running of the shop. It was feared that the girls might resent the experiment as an infringement upon their personal liberties. However, through perfect frankness in explaining to the girls the exact purpose of the tests, and through the help of the foreman and instructors in removing the air of mystery and suspicion which naturally would surround such an experiment, and through the use of a "matter-of-fact" procedure which took each girl's acquiescence for granted, but still refrained from the slightest indication of compulsion, it was possible to carry out the entire series of tests without a single unpleasant occurrence. At the outset, an instructor took the girl to be tested from her work and brought her into the room and remained there while the tests were being given; but after a short time, even this precaution was unnecessary. The experimenter became a fixture in the shop and could, without the least embarrassment to the girl, bring her into the experimental room for the tests. Thus, a great deal of time and trouble was spared to the foreman and his assistants.

The eight tests chosen for the body of the experiment were as follows:

1. A simple eyesight test with the use of the Lowell chart.

2. A card sorting test. The subject was given a pack of 49 cards, upon the face of each one of which from 7 to 12 letters were distributed promiscuously. Twenty of the cards contained the letter "O" and the rest did not. The subject was asked to sort these cards into two piles, those which had "O" on them and those which did not. The time required for this performance was taken and the

number of errors recorded. The object of this test was to bring out the subject's ability to pick out the essential element from a more or less heterogeneous collection of elements, and also, in some measure, to bring out the deftness of the subject in handling the cards. These cards were so marked and numbered on their reverse side that, after every test, it was possible for the experimenter to sort them back into their original order and to observe the number of mistakes that had been made. In this way it was made possible for every subject to perform this test in exactly the same manner.

3. The Woodworth-Wells cancellation test (see Appendix, test number 6). The subject was requested to cross out, with a pencil, every "7".

4. The Woodworth-Wells "Easy Directions" test.

5. The Woodworth-Wells number checking test, in which the subject was asked to place a check opposite every group which contained both a "7" and a "1" (see Appendix, test number 8).

6. A modification of the tapping test, in which the subject was requested to push down, as rapidly as possible, a telegraph key to which was attached a Veeder counter. The number of recorded thrusts over a period of one minute constituted the record for that performance.

7. A modification of the Whipple accuracy test. This consisted of a brass plate with nine round holes graduated in size from $^1/_2$ inch to $^1/_8$ inch in diameter. The subject was asked to take a brass-pointed pencil and insert it into each hole, beginning with the largest and continuing through the smaller ones, until the pointer touched the brass side of one of them. The brass-pointed pencil was wired in circuit with the brass plate containing the holes so that, whenever the brass point touched the side of the

hole or any part of the brass plate, an electric contact was made which produced a click in a telephone receiver which the subject held to her ear. At the start of the test, the subject was instructed to put the brass pencil into each hole in succession until she heard a click in her ear, when she was to start all over again. The speed of the subject's movements was controlled by a metronome set so as to allow thirty trials per minute. The experimenter also had a telephone receiver to enable him to follow the subject's performance. The holes were numbered 1, 2, 3, etc., to 9. As soon as the subject failed to put the pointer squarely into a hole but touched the brass plate and produced a click, the experimenter recorded the number of the hole at which she had failed. This constituted one trial. Each girl was allowed fifteen such trials, and the numbers of the last ten were taken and averaged, the first five serving as preliminary practice. For instance, if a girl, in her first trial, reached the fourth hole and missed on the fifth, the number five was recorded; if she missed on the sixth, six was recorded, etc., until fifteen numbers had been taken. Then, the sum of the last ten trials divided by ten gave the average performance for the subject. The larger the average, the better the performance. This test occupied from two to three minutes.

8. A modification of the Whipple steadiness test. This consisted of two brass bars, about 12 inches long, set so as to form a long, horizontal V. The subject was asked to take the brass pointer and pass it along between these two bars. The farther she went, the narrower became the space between the brass bars. As soon as the brass pointer touched one of the bars it produced a click in the telephone receiver. The point at which this brass pointer

touched was then read on a scale under the lower bar. Each subject was given fifteen trials and the last ten were averaged and constituted the subject's record for this test.

These eight tests were given to seventy-three girls. Fifty-two were inspectors, and twenty-one were gaugers. The work of gauging will be described later. It was impossible to test a larger number of girls because the experiment came at a time when the work of shell inspection was rapidly slowing up and a majority of the girls were being laid off or transferred to other jobs. After the tests had been given came the process of computing the results. In figuring up these results, the very first step was to obtain the ranking of the girls as shown by their daily work. Without such a ranking of the comparative abilities of the inspectors, it would be impossible to discover whether those who had done well in the tests were good workers and the reverse. The experimenter had, while conducting the tests, also kept a record of the number of pounds of shells inspected by each girl on the day that she was tested. However, this record was not deemed extensive enough to afford a reliable criterion of a girl's ability. To be sure, if a girl's work on the day that she was taking the tests was unusually high, that fact might show up in an unusually good performance in the tests, and thus serve to maintain the correspondence between the two. However, the object of the tests was such as to make an immediate correspondence a distinctly minor feature. It was rather to discover whether any correspondence existed between the performance in certain tests given for the first time and occupying only a few minutes and the work of a girl over an extended period of weeks and even months. Unless such a correspondence

could be shown, the tests would be of little worth to the employment office. Therefore, it was decided to take as the basis of each girl's standing, an average of her work for four weeks. These averages were obtained by making a detailed statement, drawn from the separate daily production slips of each girl, showing the number of pounds done for every day in the week, together with the exact number of hours taken to do them. The total number of pounds inspected by a girl, divided by the total number of hours worked, gave the average number of pounds per hour for the particular girl and became the basis for her ranking. In making out these statements, all work other than that on a single kind of shell was discarded. This was done for the sake of uniformity, it being manifestly unfair to judge the relative speed of different girls on a basis of pounds when one girl was inspecting large shells which went very quickly while another was inspecting small shells which went very slowly.

After the average hourly production of each girl for a period of four weeks had been determined, the results were compared with the performance of each girl in each of the tests. This was done to obtain the degree of correspondence or the *correlation*, as it is technically called, between the tests and the actual production. Now the method by which the correlation between the performance of the girls in the tests and their rate of production was determined was not by guesswork or by rough observation, but by an exact statistical process. This process is very simple and can easily be described. Let us suppose that girls A, B, C, D, E, F, G, H, I, and J are ten girls who have been tested (see table on page 32). After the tests have been given, it is necessary to rank them in the order of their ability; that is, the girl who turns out the most work

TABLE OF RANKS AND RESULTING CORRELATIONS

Name of Girl	*Rank in Production*	*Rank in First Test*	*Rank in Second Test*
A	1	1	8
B	2	2	5
C	3	3	3
D	4	4	2
E	5	5	4
F	6	6	7
G	7	7	9
H	8	8	1
I	9	9	10
J	10	10	6
Correlations.		1.00	.19

per hour is ranked as number one, the one who turns out next most as number two, and so on down the line to number ten. Every girl having been ranked on the basis of output from 1–10, the next step is to take one of the tests in question and rank each of the ten girls in the same fashion according to her work in that test. We are now ready to compare the output of the girls with their rank in the test. For the sake of explanation, let us suppose that the first girl in production was first in the test; the second in production, second in the test; the third in production, third in the test, etc., right through the group, the tenth or lowest in output being tenth or lowest in the test. It is evident from this that we should have a perfect agreement or *correlation* between the performance of the girls in the test and their performance in their regular work.

Now, let us suppose that, in another test, there was not such an agreement. Suppose that the girl who was high-

est in the second test was eighth in production, and the girl who was second was fifth in production, etc. There may be a difference all along the line, showing that there was a *lack of agreement* or a *low correlation* between the performance of the girls in this test and their performance at their regular work.

In every case, the degree of agreement or correlation between tests and production is determined, not by guesswork, but with mathematical exactness, by means of the method already described and certain simple formulæ discussed in the Appendix under the heading "Correlations". It would be too cumbersome to go into further details on this subject here. Suffice it that the degree of correspondence between two sets of rankings, the ranks of a group of subjects in production and their ranks in a given test, can vary between plus 1.00 and minus 1.00. Plus 1.00 is a perfect correlation. Minus 1.00 is an absolutely negative correlation. Plus .70 or .60 is considered good for shop and factory conditions. A test which, under factory conditions, shows a correlation with production of .40 or more is considered a valuable or a *significant* test.

The method of computing the value of tests just described was applied carefully to each of the tests given in this experiment with the following results:

TABLE OF CORRELATIONS

Card sorting	.56
Tapping	.14
Cancellation	.63
Easy directions	.14
Number group checking	.72
Accuracy	.38
Steadiness	.24

Because of the nature of the eye test, only individual correspondences could be shown. Some of these will be mentioned later. It was plainly evident, however, that an inspector needed two very good eyes in order to succeed at this work.

From the above figures, it can be seen that three tests show a correlation which is really significant. Two of these show a correlation of over .60 which is very good, and one shows a correlation of .56 which is also quite good.

The significance of these correlations will be more apparent if we compare them with those brought out by another section of this experiment. Besides giving the tests to girls engaged in visual inspection, the same tests were given to twenty-one girls engaged in gauging the head-thickness of shells. This work does not require the use of the eyes. The operator simply picks up a handful of shells and, with or without looking, tries the head of each shell on a gauge. The gauge is a piece of steel with two notches or openings. The shells which are too small pass through the first opening and fall into a box of rejects below. Those that do not pass through are tried on the second opening and, if they pass through, they are of the right size. If they fail to pass through, they are too large and are thrown aside. The operator sits in front of her gauge which is rigidly fixed, and tries each shell at one opening and then at another, just as rapidly as she can move her hands up and down. It will readily be seen that this work requires qualities quite different from those required by the girls engaged in the work of inspecting. This difference was admirably brought out by the tests. The tests showed, in this instance, an entirely different set of correlations. The correlations found in both instances are given below.

	Correlations	
Tests	*Inspectors*	*Gaugers*
Card sorting	.55	.05
Tapping	.14	.52
Cancellation	.63	.17
General intelligence	.14	.18
Number group checking	.72	−.19

It so happens that the very test which shows the highest correlation among inspectors shows the lowest correlation, a minus correlation, in fact, among the gaugers. This is quite in accord with the apparent fact that for the work of inspection visual discrimination is probably the quality least necessary. An interesting fact was the absence of correlation between the test for intelligence involving the ability to read and follow easy directions, and the work of both inspecting and gauging. This indicated that intelligence of this kind was not necessary for success at such work and this, so far as ordinary observation could tell, was quite true. The only test which shows a significant correlation among gaugers is the tapping test. This seems reasonable since, in both the test and the operation of gauging, speed of movement and endurance are the chief factors. The significance of this part of the experiment is therefore chiefly negative since it serves to bring out the fact that girls who, to the ordinary observer and even to the trained employment manager, look very much alike may still possess very different sets of qualifications. If all the gaugers and inspectors had been lined up before the employment window, it is highly improbable that the employment manager would have been able by mere observation to make the radical division between the applicants which the tests would have enabled him to make.

No doubt it would have been possible to devise or select tests which would have been more applicable to the work of gauging. However, this particular type of gauging was only a temporary process and was almost completed at the time. It was therefore considered inadvisable to go further in this direction.

Besides the work of inspecting shells which has just been described and for which significant tests were found, there was a large amount of inspection differing from the work described only in respect to the size and shape of the object inspected. With regard to the fundamental qualifications required to do the work, there was almost complete identity. It would have been very valuable if the tests found applicable to the work of shell inspection should also be applicable to these other kinds of inspection. However, it was not permissible at this early stage of the experiment to assume that tests found significant for one kind of work would be as significant for another kind, much as the two kinds resembled each other to the ordinary observation. Therefore, in order to avoid all uncertainty and guesswork, it was decided to give the three tests (exclusive of the eye test) which had been found most significant, to representative groups of inspectors for other kinds of work. This was done in the same way in which the first tests were given. Twenty-eight cartridge inspectors, thirty paper shot shell inspectors, and ten bullet inspectors were examined. The results are given in the table of correlations on page 37.

From these figures it can be seen that the correlations for the cartridge and bullet inspectors are almost but not quite as high as those found for shell inspectors. The difference was due in part to the fact that when the later tests were given, about four-fifths of the girls had been

Kind of Work	*No. of Girls*	Correlations: *Card Sort. Test*	*Canc. Test*	*No. Group Checking*
Shell inspecting.....	51	.55	.63	.72
Bullet inspecting.....	10	.52	.48	.62
Cartridge inspecting.....	28	.49	.26	.58
P. S. S. inspecting.....	30	.13	.11	.02

laid off. By this process both extremes had been eliminated; that is, the slow girls had been laid off and the fast girls had modified their pace to suit the retarded pace of production. Thus, all the girls who were left tended to accomplish about the same amount of work per day. These conditions made the production of these girls an unfair indication of their relative ability under normal conditions, and consequently made it impossible to obtain a fair estimate of the tests on the basis of production. This was especially true in the case of the paper shot shell inspectors where the lowest correlations were found. In fact, the average difference in the rate of production between these girls was only two and two-tenths per cent of the average day's work, as contrasted with an average of twenty-seven per cent in the case of shell inspectors. The average difference for the four groups was as follows:

	Per Cent.
1. Shell inspectors.....	27.7
2. Bullet inspectors.....	18.7
3. Cartridge inspectors.....	6.9
4. P. S. S. inspectors.....	2.2

It can readily be seen from this that the smaller the average difference between the quantity of work done by the workers of each group, the lower the correlations in the

tests. And in the case where there was almost no difference between the individuals, it was impracticable and impossible to obtain any significant correlation.

However, the results in their entirety were such as to justify the use of the three most significant tests together with the eye test in the employment office. The manner in which the tests were applied and the results of their application are described in the following chapter and in the Appendix.

III

APPLYING THE RESULTS

At the time of this writing the tests found significant in the course of the experiment just described had been given to over 2,900 applicants for the work of inspection. Of this number over 800 had been assigned to work other than that of inspection. These facts are in themselves some testimony as to the practical application of the results of the experiment. However, this chapter is concerned not so much with the extent to which the tests were applied, as with the question of just how and with what success they were applied. This question will be discussed in two ways: first, by showing what *would have* been the practical advantages had the inspectors who were tested in the course of the first experiment been tested before being hired; and secondly, how and with what success the tests were later given to a large number of new applicants who came into the employment office for work.

In describing what would have been the advantages if the tests had been given to those inspectors who were examined on the job, we shall first consider in detail some individual cases. One of the conspicuous instances of the practical significance of the tests was the case of an inspector who was examined at the particular request of her foreman. The foreman remarked, at the time, that she was one of his best girls. With this unsolicited bias in mind, the experimenter was not surprised to find that the

girl did very well in the tests. While she was going through them, the experimenter noted down the usual remarks which he was in the habit of passing on each subject in his capacity of an observer rather than an experimenter. In this case they were as follows:

General intelligence.....A
Rhythm.....A
Attention.....A
Physique.....Slender, healthy
Personal appearance.....Neat, attractive
Remarks.....Capable looking, ambitious, clean movements.

However, when this girl came to the number group checking test (8 in the Appendix), she began it so poorly that it seemed as if she had mistaken the instructions; and so, taking the paper away from her, the experimenter repeated them. "I understood you the first time," she answered pleasantly, and then proceeded to do the test in 204.4 seconds, which was 19.4 seconds slower (including mistakes) than the maximum time set for this test. This puzzled the experimenter and so he inquired further from the foreman as to the success of this girl. It thereupon developed that, although she was a very steady and conscientious worker, and of more than average intelligence and willingness, she had been working for over six weeks and had not yet reached the stage usually reached by successful girls in one or two weeks. She was still on day-work, and her inability to make piece-work puzzled not only herself but the foreman as well. In this instance, therefore, when all other signs pointed conclusively toward a successful inspector, this test—the test which had shown the highest correlation, it will be remembered—showed conclusively that she lacked the very qualification

most needed. And yet it would have been even more difficult for the employment manager than for the foreman to detect this lack. As an operator on some other job, this girl would undoubtedly have been an exceptional success; but as an inspector she was an evident misfit.

One girl was so nervous when she appeared for examination that it did not seem possible that she could have the qualities required by the exacting work of inspection. Her nervousness, according to the shop instructor who brought her, was not due to fright but was chronic. This subject was absolutely helpless in the tests for steadiness and accuracy. However, her time in the number group checking test and in the cancellation test (numbers 8 and 6) was considerably faster, that is to say better, than the maximum. This girl, it was later found, was the eighteenth best inspector among the 58 examined. (It will be remembered that the accuracy and steadiness tests were not found significant for this work, while tests numbers 8 and 6 showed the highest correlations.) The instructor who supervised the work of these girls expressed her inability to understand the success of this particular girl. "She's a reliable girl", was her only explanation. But so were many less successful girls, and besides, her rank as a worker was not based on mere steadiness but on speed as well. This also goes to show how misleading a more superficial observation of a person's qualifications may be, even though the observer be one whose business it is to pass judgment on those qualifications, as in the case of the instructor just mentioned.

Another case was that of a girl who was exceptionally good in the steadiness and accuracy tests but who was considerably beyond the maximum time in tests numbers 8 and 6. This subject was a good, quiet worker,

of more than average intelligence. General observations about her were:

Intelligence	B
Rhythm	B
Attention	B
Physique	Strong
Personal appearance	Neat
Remarks	Steady, conscientious.

But here again, the tests showed that she was too slow to make a successful piece-worker, and she was therefore compelled to remain at day-work at which her average wage was considerably below her needs. This worker, who was twenty-nine years old, was very much worried over her inability to make good; and yet, it is altogether likely that she would have been very successful at some other kind of work.

Another conspicuous instance was that of a girl, seventeen years old, who had been at work only a few weeks when she was examined. The instructor assured the experimenter that this girl was learning very rapidly and would soon be at piece-work. The experimenter put down as his observations:

Intelligence	B
Attention	B
Physique	Slender, healthy
Personal appearance	Neat, attractive
Remarks	Clean movements.

However, in each of the three significant tests, this girl was decidedly poor. She has since demonstrated that she will not make a successful piece-worker. Like many others, this girl, would not have been hired for inspection if the employment office had had the use of these tests at that time.

In the case of one girl, no test but an eye test would have been necessary. This girl was so short-sighted that she had to hold the shells almost to her eyes, and even then her work was of the very poorest quality. Her presence at inspection was an eloquent testimony to the need of eyesight tests.

In another case it was discovered that a girl had one good eye and one poor eye, due to the fact that she had had an ulcer on one eye which had left it permanently weak, with a tendency to water. In the tests she was fair, and without any further handicap should have been a successful worker. The experimenter, suspecting that the presence of one poor eye would be likely to interfere with her ability to pick out shells which had flaws, asked her whether she had any trouble with her work. The girl replied that boxes of shells which she had inspected were very often returned to her for re-inspection and that she "simply couldn't understand why, because she was so very careful with them". In a case of this kind it would have been much better to put the girl on the inspection of some other work where the defects to be looked for are larger and do not require such fine eyesight.

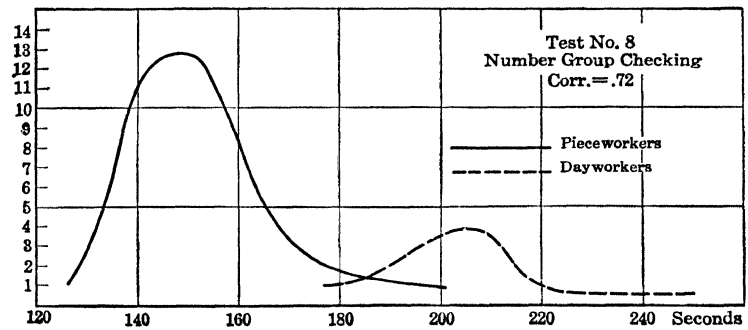
The individual instances which have been related are suggestive and typical instances in which the tests could have been profitably applied. However, since it is not safe to base conclusions on a few examples, a graphic representation of all the inspectors involved in the preliminary experiment will be given. In this way it will also be made clear how the standard for selecting and rejecting applicants is determined. In discussing the instances given, the reader has been required to assume that such a standard or *maximum time*, as it has been called, had already been set. The method by which

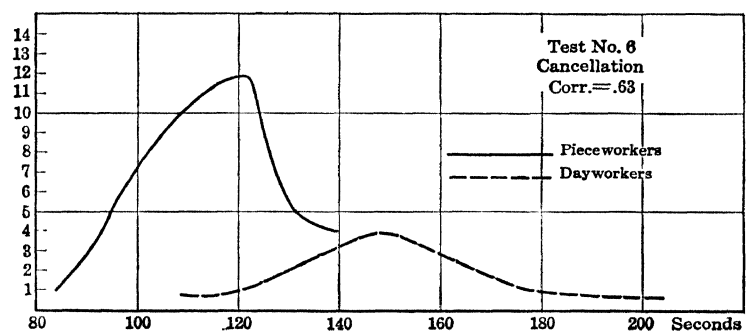
this standard is determined is one of the most interesting and important steps in applying the results of an experiment.

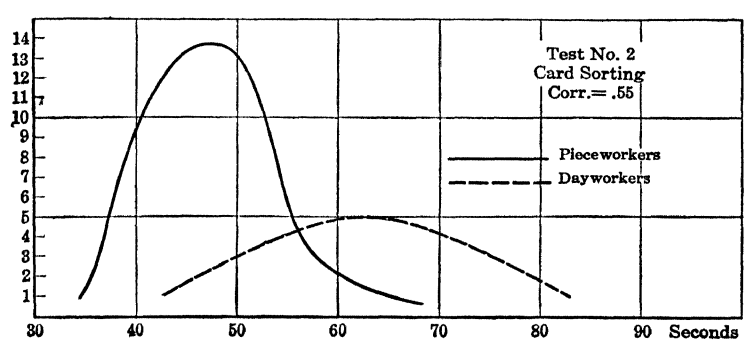
The curves on the following page are drawn for each of the three significant tests. Before these curves were drawn, the inspectors tested were divided into two classes, the piece-workers and the day-workers. The piece-workers are represented by the solid line, and consist of those who have made good as inspectors. The day-workers are represented by the dotted line, and consist of those who were too dull or slow to make piece-work.

When the results of the tests are represented in this way, their practical significance for the employment office becomes immediately apparent. On the basis of their performance in the tests, the day-workers and piece-workers separate themselves into two distinct groups, the day-workers on the right and the piece-workers on the left. The nearer the curves approach the left, the quicker and better the work in the tests. This is shown by the numbers on the horizontal line. These numbers, as has been stated, express the number of seconds taken to do the test including corrections. The day-workers, for the most part, took so many more seconds that their curve is very far to the right.

Now, if the employment manager had taken as the basis for selecting applicants the time represented by the points at which the two curves cross, what would have been the result? The applicants represented by the larger curve would have been accepted while those represented by the smaller curve would have been rejected. In brief, those applicants who subsequently proved their ability by becoming piece-workers would have been selected, while those who subsequently proved their


Test No. 8
Number Group Checking
Corr.= .72
Pieceworkers
Dayworkers
14
13
12
11
10
9
8
7
6
5
4
3
2
1
120
140
160
180
200
220
240
Seconds


Test No. 6
Cancellation
Corr.= .63
Pieceworkers
Dayworkers
14
13
12
11
10
9
8
7
6
5
4
3
2
1
80
100
120
140
160
180
200
Seconds


Test No. 2
Card Sorting
Corr.= .55
Pieceworkers
Dayworkers
14
13
12
11
10
9
8
7
6
5
4
3
2
1
30
40
50
60
70
80
90
Seconds

inability *would not have been hired.* To be sure, taking this point as the standard would have resulted in selecting a few who were destined to fail and rejecting a few who were destined to succeed. On the other hand, the large majority would have been selected correctly, and probably many more who had failed and left before this experiment began would have been rejected at the outset, and would never have been given the expensive trial which they received.

If we look below the points of intersection of the curves, we shall see that the time represented is 56 seconds for test number two, 140 seconds for test number six, and 185 seconds for test number eight. These figures were taken as the maximum below which an applicant must come in order to be selected for the work of inspection. It is apparent that these figures are considerably higher than the average in the various tests, for the average is indicated by a point near the center of the larger curve. However, if the average times had been taken as the standard for selecting and rejecting, a large number of successful inspectors who fell below the average in the tests would probably have been rejected. The standard finally selected was such that the maximum number of applicants who were likely to succeed would be chosen and the maximum number of applicants who were likely to fail would be rejected.

It must not be thought that this standard is absolutely rigid. In fact, one of the particular merits of such a standard and of psychological standards in general is flexibility. If two or more applicants fall within the standard or the maximum time set, the employer does not necessarily accept all of them but selects those whose time in the tests was *farthest* below the maximum. Thus,

this standard adapts itself to the varying conditions of supply and demand. On the one hand, it sets a maximum, or limit beyond which applicants should not be hired for the work in question; that is, as long as the work and working conditions remain the same. At the same time it sets an ideal which guides the employment office in making its choices, enabling it to select from a group of available candidates those most likely to succeed.

We are now prepared to take up the second of the two questions proposed at the outset: How and with what success were the tests given to a large number of applicants in the employment office?

For an experimenter to find certain experimental results is one thing, and to turn them over to an employment office for use under practical conditions is quite another. The first step was to find some one who could give the tests with the proper degree of intelligence and understanding, a step particularly important at the outset when the work had not yet been placed upon a firm footing. This need was met in the person of a young woman, a college graduate, who had had some courses in psychology. This young woman was first taken out into the shops and instructed in the technique of giving tests and allowed to get as much practice as possible. At the same time the directions for giving the tests were carefully standardized and written down so as to insure practical uniformity in giving them at all times. The detailed results of this work are given in the Appendix and in Chapter XIV. Then a room near the employment office was set aside for the purpose of giving tests, and there examinations were conducted as prescribed, first in small numbers, then in ever-increasing numbers.

The results of these selections were of the utmost

interest. It would have been practically impossible, without a much larger clerical force than was available at the time, to follow up closely the results of each individual selection. Instead, therefore, of attempting a superficial survey of all those selected, it was decided to make an intensive study of all selections made for one shop. One of the largest and most carefully managed shops was chosen for this purpose. A careful record of the production of each girl examined and hired for this shop was started, in order that her record in the tests might later be compared with her actual work as an inspector. However, when these tests were first given, there was a sudden and imperative demand for workers, and consequently, applicants were accepted whether they passed the tests or not. This provided an exceptional opportunity for discovering the value of the tests and of comparing the results of the old method with that of the new. For it now became possible to discover to what extent the girls who passed the examination were better than those who did not. Subsequently the recommendations made on the basis of the tests were observed, and only those who met the standard requirements were hired.

Before a sufficiently extensive record of production was at hand, a question arose as to whether the results of the tests justified their use. This question arose because the exigencies of the war made a vast number of new workers necessary, and because this need was being aggravated by the fact that an appreciable number of applicants were being rejected because of too low a rating in the psychological examination. A large proportion of those rejected in this way were assigned to other work; but there was still a considerable number who refused to accept any other kind of work, and who were therefore regarded as a dead

loss. The question which had to be answered, therefore, was this: Is the success of psychological examinations such as to justify the rejection of an appreciable number of applicants when applicants are very scarce?

Since it was necessary to answer this question without delay, it was inadvisable to wait until complete production records were available. Another method of checking up the results had therefore to be resorted to. The following method was finally adopted. Of the number of inspectors who had been examined, ninety-four had, for a variety of reasons, stopped work or been transferred to other work. Now, whenever a girl leaves or is transferred to some other shop, the foreman is required to make out a leaving slip and to enter upon it the reason for the girl's leaving. In addition to this he is required to state whether the girl has been a good worker or a poor worker, and also whether or not he is willing to have her return. These slips were secured, and a comparison was made between the records of the girls in the tests and the opinion expressed by the foreman at the time of their leaving. In order to bring out the results of this comparison the girls were first divided into two classes, those who met the standard set by the tests and those who fell below this standard. Then each of these two classes was subdivided into three groups, those described by the foreman as satisfactory, those described as unsatisfactory, and those about whom no opinion was expressed. The results were as follows:

	Satisfactory	*Unsatisfactory*	*No Opinion*	*Total*
Above the standard	34	1	32	67
Below the standard	1	17	9	27

Therefore, of twenty-seven girls below the standard who would not have been hired if the results of the examination

had been applied, seventeen were definitely unsatisfactory, while nine were not described. And of those above the standard who would have been hired, thirty-four were definitely described as satisfactory, only one as unsatisfactory, and thirty-two could not be designated. These results were such as to vindicate the application of the tests, even at a time when workers were urgently demanded.

Later on, however, it was possible to make a much more satisfactory comparison, based upon the actual production or output record of the girls. Forty-three inspectors who had succeeded or almost succeeded in becoming piece-workers, and who had been at work for two months or more, were considered in this comparison. The hourly production of each girl was averaged for a period extending from one to four months. In this way a consistent production record was obtained for each girl, one which expressed the dominant characteristics of the girl rather than her particular ability on a particular day. The ranking of the girls in production was then compared with their rankings in the cancellation and number group checking tests, tests number 8 and 6. (Test number 2, the card sorting test, had not been given because of the length of time it required and because of the large number of girls who were applying for work.) The correlation for these tests was found to be very good, being forty-four for number 8, forty-seven for number 6, and fifty-eight for both tests when taken together. These correspondences are not as high as some of those found in the first experiment, but it will be remembered that at the time of this comparison a good many extremes had already been eliminated by their own failure.

The striking thing about this comparison, however, is

this: Of all the girls who had been hired as inspectors, those who survived as successful inspectors were the girls who had been above the standard set in the tests. To be specific, thirty-seven out of the forty-three were producing from fifty to seventy pounds an hour, and of this number all but two had been chosen on the basis of the tests. Six were producing less than fifty pounds an hour, and were therefore failures judged by the standards of the shop, and every one of these six was decidedly below the standard set by the tests and would not have been hired if the results of the examination had been observed. In other words, out of a group of thirty-nine successful inspectors, all engaged on the very same kind of work for a fair period of time, ninety-four per cent were above the standard set by the psychological examination.

This does not mean, necessarily, that the inspectors chosen on the basis of the tests were successful in ninety-four per cent of the cases. There is always a goodly number of workers who pass the examination but who do not succeed at the work for which they are passed, and there is an endless number of reasons why this should be so. For example, the new employee may not like the work, or may not be satisfied with the pay, or may be displeased with her surroundings, or may become ill or move out of town. Any one of these reasons may cause her failure as an inspector, even though her performance in the tests shows that she could succeed if the proper incentive were present. What the comparison shows is that among all those who tried inspection, only those, on the whole, who passed the psychological examination were a final success.

Finally, what were the results of these tests in so far as they affected the labor turnover? Taking as a basis again the ninety-four inspectors who had left and whose term of

service could therefore be estimated, the results were as follows:

	Length of Service
Inspectors recommended by the tests	9.56 weeks
" not recommended but hired	1.05 weeks

In other words, the average term of those who were recommended and hired on the basis of the tests was almost ten times as long as the average term of those who were hired contrary to the evidence of the tests. This is really a striking commentary on the results of these tests in so far as they affected the turnover.

To summarize, individual cases showed that the personal judgments of the experimenter, foreman, and instructors were not nearly so reliable as the evidence of the tests. A large number of cases, represented by curves, showed that the tests made possible at once a separation between piece-workers and day-workers which was quite beyond the scope of the ordinary employment methods. This graphic representation showed also how the standards which made possible the desired distinction between applicants was found. The careful steps by which these tests and standards were introduced into the employment routine were traced. Finally the concrete results of applying these tests in the employment office were presented. It was found (1) that the verdict of the foreman tended to bear out that of the tests; (2) that of a certain group studied intensively, ninety-four per cent of the successful workers were above the standard in the tests, and all failures were failures also in the tests; (3) that those who passed the tests worked almost ten times as long as those who did not.

IV

SELECTING GIRLS AS ASSEMBLERS

Quantity production, as it is being carried on to-day, may be roughly divided into three parts: first, manufacture, which consists of the actual work, machine or hand work, required to bring certain materials to the desired dimensions; secondly, inspection, which consists of the watch which is kept upon each part in the process of manufacture in order to detect any flaws which might occur; thirdly, assembling, which consists of putting together the manufactured parts into the finished product, the final goal of the productive process. In times past, these three phases were combined, for the craftsman was manufacturer, inspector, and assembler all in one. However, the division of labor has separated the productive process into these general functions. And it is probably safe to say that no matter how far this division is carried and how refined the methods of manufacturing become, these three general functions will remain. There will always be necessary a large class of machine operators and bench hands, shaping the actual materials. There must always be inspectors to inspect the work done both by machines and by hand at every step of the manufacturing process. And there will always be assemblers who put together the completed parts and who make those slight adjustments which are necessary at the end of every fabricating process no matter how perfect it may be.

In conducting these experiments, it was inevitable

that the existence of these three functions should soon become apparent. The first experiment was concerned with inspectors, and, although it was originally confined to one shop only, its scope rapidly extended over a group of other shops which were devoted entirely to inspection of a very similar nature. The present experiment was made in the field of assembling and consists of an attempt to discover tests bringing out the essential qualities which go to make a successful assembler.

The assembling with which this experiment was concerned was that of small gun parts. The particular influence which led up to the experiment was the belief that a large amount of the assembling hitherto done by men could be done just as well by women. This was at the time when the substitution of women for men had become a critical matter in the war industries. The experimenter found that this opinion had already been conceived and worked out by the general foreman of the assembling shops. This foreman had made a careful analysis of the work and had made up a program according to which women were to be introduced. However, the question which still remained to be answered was: What kind of girls will be able to do this work and how are they to be obtained? This was the question which the psychologist was particularly anxious to answer.

Since there were no girls doing this work at the time it was impossible to do what had been done in the previous experiment; that is, try out a set of tests on a group of workers in order to discover certain significant tests. If a sufficiently large group of men had been doing this work, it might have been possible to try tests out on them. Then, if any tests were discovered to have a high correlation, they could be given to girl applicants on the assumption

that if they indicated the necessary qualities in men they would indicate them in women as well. However, this was impossible because the process of assembling had itself been entirely rearranged to meet the conditions of greatly increased quantity production. Hitherto, guns had been assembled in their entirety by one man. Now it was proposed to break up this operation into a large number of steps, so that one assembler assembled one small part, another some other part, and so on, up to the last step which consisted of putting together into the finished product all the parts that had been assembled. The old operation required a mechanic of considerable skill and long training. It will readily be seen that the new method did not require nearly the same degree of mechanical skill, although it did require more speed and nimbleness in assembling a large number of relatively small and simple parts. Because of this change in the method of assembling, a standard on which to base the significance of the tests was lacking. And consequently, the finding of significant tests had to be something of a leap in the dark.

The first step was to go into the shop and examine the exact nature of the proposed operations. It was not considered sufficient to do this by asking questions and observing the work from a little distance. A first hand knowledge was obviously the best, and therefore the experimenter actually performed the various operations at a bench and in the customary way, until he was able to do them with some degree of celerity. Instead of describing this work in technical minuteness, it will be best for the purposes of this exposition to describe it in terms of the tests which were finally devised.

The work of assembling gun parts as it is now done

consists of taking small parts, placing them in the proper position, and then either hammering, screwing, pushing, or springing them together. The successful assembler is therefore one who is possessed, to begin with, of unusual manual dexterity. A clumsy fingered person loses a disastrous amount of time at this work, for any natural awkwardness has hundreds of opportunities to repeat itself in the course of a day. In order to detect the presence or absence of the necessary ability, the so-called *manual dexterity tests* were devised. They consist of a form board with a row of pieces of graduated size cut out and the pieces left fitting loosely. In giving the test, the pieces are turned into the cover of the board and left in their exact order, after which the subject is asked to put them back into their proper spaces as expeditiously as possible. This is tried first with the right, then with the left, then with both hands. The pieces are in some cases quite large, in others quite small, just as in assembling, certain operations consist of putting together very minute and delicate parts, while others have to do with larger parts. In every case, the pieces were graduated in size and the subject was always required to work from the largest to the smallest. This served the useful purpose of increasing the difficulty of the test by degrees, thereby making it unnecessary to upset the subject by starting him suddenly at a difficult and novel task.

Another quality required by the successful assembler is the ability to pick up a part, size it up, and then decide just where it belongs and how it shall be placed there. In some cases it is the ability to size up a space and then pick up the proper piece for that space. In many cases, a very fine discrimination of shapes and spaces is required

in order to get the right part to the right space in exactly the right position. In one case, a difference of one thirty-second of an inch had to be detected. The girl who can detect this difference at a glance is far more successful than the girl who has to try the piece out first in one position and then another until the proper fit is found. In order to detect these qualities, a test for the *perception of odd shapes and sizes* was devised. It consists, like the dexterity tests just described, of a board with pieces cut out, except that in this case the pieces are of odd shapes. Some pieces are quite different in shape, but some, almost alike in shape, differ very slightly as to size. When the test is given the pieces are dropped into the cover of the form board and arranged there according to a predetermined scheme. Then the subject is asked to size each piece up carefully and put it into its proper space, making as few mistakes as possible.

It is very interesting to watch the various subjects take this test. Some girls see at a glance where each piece belongs. Others have not the least conception of the relation between certain shapes and certain spaces, but aimlessly try out each piece at one opening after another until, by chance, the right space is hit upon.

Besides the mental qualities just described, the work of assembling requires strong hands. In order to determine roughly the strength of the hands, a grip-testing instrument or hand dynamometer is used. Each girl is given six trials, three with her left hand and three with her right. The number of pounds registered in each trial is recorded and the average for each hand constitutes the record.

The conditions under which this experiment was conducted represent a departure from the usual procedure.

Heretofore tests had first been tried in the shops where a comparison with the actual production of those to whom they were given made it possible to get an immediate index of their value. In this case it was impossible to do this, because, as has already been stated, the force intended to do this work had not yet been built up. Therefore, tests having been chosen as well as possible under the circumstances, they were given immediately to new girls as they came into the employment office in search of work.

The girls chosen on the basis of these tests were carefully watched, and after a period of from one to two months from the time at which they had been chosen, an attempt was made to compare their performance in the tests with their ability as assemblers. However, because each girl was assembling slightly different parts it was impossible to rank their ability on the basis of production records. Consequently, the opinions of the foreman and section head were sought. It may be said here that personal opinions of this kind are a very poor substitute under any circumstances for the impersonal testimony expressed by cold production figures. However, the girls concerned had been watched with particular care, since this was also an experiment on the part of the shop in introducing women for this kind of work. The rankings of the foreman and section boss were obtained independently of each other and agreed in every case but one. The records of the girls in the tests were then compared with these rankings, and a remarkable agreement was found.

Eighteen girls had been tested. Of this number twelve had been hired for assembling work. Ten of the twelve were still there. The two who had left were girls who had done poor work in the tests. Those girls who had done

well in the tests were doing excellent work as assemblers and were making over three dollars a day. "They are far better than some boys we tried on that work before," remarked the foreman, "and all but one of them stands up to her work."

The standing of the girls in the test for the perception of odd shapes and sizes and their standing in the opinions of their superiors agreed in every case but two. Expressed in terms of correlation, the agreement was plus .72. In the other tests the agreement was not so marked, but nevertheless there was a positive and significant correspondence. The correlation for the combined manual dexterity tests was .52, while that for the hand dynamometer was .34.

The impersonal but nevertheless easily interpreted results of these tests may be illustrated by the following instances: One girl's record in the test for the perception of odd shapes and sizes showed that she had been very slow and made frequent mistakes. On her record card this showed simply as #51;87–4 (meaning test number fifty-one, done in eighty-seven seconds with four mistakes). The writer, although he had not given these tests and knew nothing about the girls in question, remarked to the foreman:

"This girl's record shows that she had a very poor idea of where the parts belonged."

"That's exactly how her work was," quickly responded the foreman.

"But on the basis of these tests,"—indicating the girl's record in the tests for manual dexterity— "she seems to have had pretty nimble fingers."

"Yes," countered the foreman, "but her mind wasn't as fast as her hands."

This girl had been laid off some time before.

Two girls who did poor work in the tests were hired with the particular purpose of finding a negative proof of the value of the tests. The section head, who knew that the tests were being given, one day met the young woman who had given them and said:

"I thought that you gave the tests to Miss ——?"

"I did," was the reply.

"Well, she's no good. She'll never make an assembler."

"I didn't expect her to," was the answer. This girl was one of the two who had done poor work in the tests. The other one has already been referred to.

The number of instances mentioned above is hardly sufficient to establish with scientific certainty the value of these tests. However, the practical success with which they were used insured the desirability of their further use. The foreman in charge of the assembling shops had been extremely interested in the development and application of the tests, and was moved to write the following letter expressing his opinion of the psychological examination:

"The tests which you have been giving applicants for assembling have proven beneficial and I would like to see you not only continue them, but extend them to the men applicants.

"We have had only two failures so far out of twelve new girls, and the tests given these girls showed that they were slow to begin with.

"One of the difficulties in training piece-workers is the fact that they must first be given from two to four weeks' training. During this time, the aim is to train a man in thoroughness, and he is therefore compelled to work slowly and carefully. Consequently, it is impossible during this time to tell whether the man will be fast or not.

"After this training, the man is put on piece-work, and then, if he has the natural ability to speed up, he will make good. However, if he lacks this ability, he will either fail to make his piece-work rate and quit, or he will speed up and ruin the work and have to be laid off.

"If we could find out beforehand whether a man would have the necessary speed after he has been trained how to do the work, it would save us a good many very expensive trials."

An experiment among men assemblers will be described in a subsequent chapter. The significant tests are being continued in use for the selection of women assemblers, and as soon as a sufficient number have been working at one kind of assembling for a certain length of time, another attempt to find the correlations will be made.

In the meanwhile, there are many kinds of assembling, similar and yet unlike that described here, to which tests could be applied. Almost every manufacturing process ends with assembling operations, some of which are complex, some very simple. Innumerable packing operations are really a sort of assembling, and require workers of more than average dexterity. The assembling of locks, clocks, and watches also requires peculiar nimbleness. All of these assembling tasks warrant experimenting to find tests which will consistently select the best assemblers.

V

THE PORTABLE LABORATORY

One of the first essentials in scientific work of any kind is a laboratory. A laboratory is a place where work can be done under uniform and controlled conditions, and where the apparatus necessary for an experiment can be properly set up or stored. Most universities are equipped with a psychological laboratory differing little in general appearance from a physics laboratory. Whenever an experiment is to be conducted in one of these laboratories, the apparatus is set up and, when preparations are complete, the subjects who are to be tested are required to come to the laboratory according to a prearranged schedule. For a time it was considered desirable to establish and equip a similar laboratory to be devoted exclusively to the psychological work of the factory. At first glance, such a laboratory would seem to be in line with the physical and chemical laboratories which now form an essential part of every large industry. However, it soon became obvious that such a laboratory was impracticable for factory purposes. It was highly inadvisable to ask a large number of employees to leave their work and come to the comparatively remote point occupied by the laboratory. Not only would such a procedure have caused a great loss of time, but it would also have made inevitable a disconcerting uncertainty in the arrival of the expected subjects. And yet it was highly desirable to conduct experiments and tests under conditions of a cer-

tain uniformity, and in a place free from upsetting intrusions. It was also desirable to have a secure place in which the necessary apparatus could be set up and stored. Consequently, since it was found impractical to ask employees to come to a central laboratory, which would fulfill these conditions, it was decided to bring the laboratory to them. For this purpose the *portable laboratory* was devised.

This laboratory is a room six feet square. It is built of light beaver board, set in a light wood frame. Each wall of the room is a unit in itself. When the room is set up, the walls are held together by means of hooks and by a transverse brace over the top of two of the walls. One wall is used as the door. By means of a double hinging device it is possible to fold this door back upon the wall to which it is fastened. When the laboratory is collapsed, it consists simply of four walls stacked against each other. In this compact form it is a very slight task to carry the entire outfit from one shop to another. It can be set up or collapsed in just about three minutes. Its light and simple construction make it very easy to shift and to manipulate.

The exterior of the room is painted a dark, unobtrusive brown. Thus it escapes being conspicuous in the shop where it is set up. The interior is painted white, in order to make the most of the daylight when it is available. An electric drop light which can be adjusted to various positions in the room is part of the equipment. The table which is used is an integral part of the construction of the room. It consists of a white enameled board, eighteen inches wide, hinged to one wall and supported by three swinging brackets. At present it is being planned to replace this table with a more substantial one. The light

construction of the room makes it impossible to give a rigid surface to a hinged table, and a table on four legs is therefore being secured. The portable room is further fitted out with devices providing for the necessary combination of electric currents. Its equipment includes an electric fan, a necessary adjunct to a room otherwise devoid of ventilating mechanisms.

In this laboratory only such apparatus is carried as is necessary for the experiment in hand. This apparatus is stowed in a large but lightly constructed chest. In this way it can easily be carried around or stored. The bulk of the apparatus is kept in a permanent laboratory where new apparatus is constructed and tried out before it is sent out for use in the portable laboratory.

As was expected, the use of this room provoked some scoffing and ridicule among the shop men and their overseers at the outset. All kinds of queer names were given to it by the men such as "pill box", "monkey cage", "star chamber", etc. However, it was never abused and the experience which those who were examined had with this room tended to transform their contempt into curiosity and often into admiration.

"Do you know," said one man who had been given tests, "I have much more respect for that place in there (pointing to the portable room) than I did before. At first I thought it was a lot of monkey business, but it got me. It made a monkey of me all right. It showed me that I wasn't quite as smart as I thought I was."

After the expiration of a few days, the laboratory is taken as a matter of course in the shop where it has been set up. No one pays any more attention to it than to the permanent shop fixtures. This has been the case wherever the room has been used. The first few days provoke a

mild interest and some jocular remarks. After that, nothing more is said.

When a man is to be examined, he is simply informed that it is his turn, his work ticket is stamped to show at what time he stops work—all subjects are paid out of a special cost account for the time occupied by psychological examinations, and special care is taken to make this pay generous—and he is then conducted into the laboratory. Here he is properly seated and the necessary tests are given to him. In all cases, tests to men are given by a male examiner, and as far as possible, all tests given to women are given by a woman examiner. Since this work has become established, this is done without exception. Where women or girls are given tests by a male examiner, some woman in the shop, well known to all the girls, is chosen to accompany each subject. The door of the laboratory is left part way open, and this woman sits just outside where she can observe the process of the examination. This precaution, while not absolutely essential, nevertheless serves to forestall any possible embarrassment on the part of the girl being examined, and consequently contributes to the reliability of the results of the tests. When the examination is conducted by a woman, this precaution is naturally unnecessary.

The use of this laboratory has, on the whole, been quite satisfactory. It serves the purposes for which it is intended admirably. It is convenient; it can be set up or taken down very quickly—in three minutes to be exact; it fits well into any available space in the shop; it is inexpensive; it saves an enormous amount of time which would otherwise be consumed by having the necessary subjects come some distance to a more remote stationary laboratory for examination.

Nevertheless, it is subject to considerable improvement. To begin with, it is not sound proof. In fact, it does nothing to keep out sound, because it is open above and below. It remains for some one to construct a portable room which shall be sound proof. Such a room would increase the scope of the tests to a very great extent, especially in the field of audition. A sound proof room would also make possible a greater uniformity of conditions, because each subject could then be tested under the same sound conditions instead of being tested in the midst of the various noises which go on in the shops.

This, however, is a doubtful advantage to say the least. To bring a subject from a shop ringing with the noise of hundreds of machines into the sudden quiet of a sound-proof room might easily upset him much more than allowing him to perform the tests amidst the noises to which he has become accustomed. In fact, one of the greatest difficulties to overcome is the danger of putting a subject into a state of initial nervousness so that it becomes impossible for him to give a characteristic performance in the tests. In order to avoid this difficulty which is ever present, the utmost skill and sympathy must be exercised. It is also a serious question whether a sound-proof laboratory will make it possible to give tests under more uniform conditions than would otherwise be the case It is altogether too easy to confuse the technique of the chemical and physical laboratory with that of the psychological laboratory. To give an example: the laboratory conditions for producing nitric acid are always the same. Given the standard apparatus, and substances of the proper kind, the results are always the same as long as the standard method of procedure is carried out.

But individuals are infinitely more complex and more

uncertain in their reactions than material substances; therefore, mere external uniformity in procedure, or standardization of laboratory technique and conditions, is by no means a guarantee that characteristic or typical reactions will follow. For this reason it may be undesirable to construct a factory laboratory which will place the subject under conditions too different from the conditions of the place in which he is accustomed to work or undergo his normal reactions. No one should understand the complexity of this problem better than the psychologist himself. As a student of sensation and habit, he can readily understand that what he may consider a nice, quiet place may be, to the man accustomed to the continuous clanking and grinding of machines, a place howling with strange and fearful sounds. There are times when nothing makes so much noise as silence.

This question, together with a great many others, must be considered by those conducting psychological experiments under factory conditions. The portable laboratory which has been described is by no means a final or comprehensive one. However, as compared with a permanent laboratory such as is used in universities, it is a vast improvement. The stationary laboratory, except as a place in which to develop and store apparatus, possesses and magnifies all the difficulties mentioned. To recapitulate, it makes it necessary to bring subjects long distances from the shop in which they are working, thus involving a very considerable loss of time. The portable laboratory obviates this difficulty by going to the shop in which its proposed subjects are at work. Secondly, the stationary laboratory makes it difficult to secure the right subjects at the right time. Psychologists who have tried at universities to get students to report at the laboratory at

certain stated times for examination, know to their regret what a genuine difficulty this is. A laboratory stationed in the immediate vicinity of those to be examined makes it very easy to get the right subject at the right time, and saves thereby an endless amount of confusion and effort. Thirdly, a stationary laboratory, with its pretentious equipment and its striking contrast with the shops, would tend to upset a subject who knew nothing about such matters, and thereby lessen the value of the results of the experiment. A laboratory set up in the shop does not entirely avoid this difficulty, but certainly reduces it to a minimum. Finally, a laboratory of this kind keeps the experimenter in the shop most directly affected, and no condition is more important to the successful conduct of an experiment than a very intimate contact with the ways and work of the shop in which it is being conducted.

VI

TESTING MEN ASSEMBLERS

THE FIRST EXPERIMENT WITH MEN

Up to the time of this experiment nearly all tests had been given to girls and on jobs which were handled almost wholly by girls. The present experiment was conducted entirely among men. It was therefore an experiment in a double sense: first, an experiment to determine the value of certain tests; secondly, an experiment calculated to show what could be done among men in a situation of this kind.

The two largest gun-assembling shops served as the field for this experiment. It must be admitted that considerable apprehension was felt as to the attitude which a large body of shop men would adopt toward being taken from their work into a mysterious-looking brown box—the portable laboratory which was set up for this purpose was only a brown box to them—for a series of mysterious tests. However, as with the girls, a policy of entire frankness was pursued from the very outset. As soon as the portable laboratory had been set up—a process which immediately aroused the interest of the men—a notice was posted on it to this effect:

"The tests which will be given here are in the interests of the employment office. Their purpose is to provide the employment office with standards by which to select successful assemblers in the future. Your coöperation is requested."

The coöperation of the foremen was first secured. Due to these precautions, not a single hitch or unpleasant incident occurred during the entire experiment. On the contrary, the men took a very lively interest in the matter and discussed it freely not only among themselves but with the experimenter as well. The intelligent grasp of the problem which some of the men displayed was so surprising that it was thought worth while to jot down snatches of their conversation.

"What's the good of them 'physicological' tests anyway?" asked one man. It was explained to him that the experiment was being conducted to discover whether there was any agreement between certain of the tests and the efficiency of the men as assemblers.

"What if they don't show up that way?" asked the man.

"Then we throw them aside," was the reply.

"And if they do show up?"

"Then we'll turn them over to the employment office to give to new men whose ability we know nothing about."

"That's not physicology, that's common sense," said this man. And another of the group looked wise and remarked:

"Sounds good to me."

At another time one of a group of men who were discussing the tests with the experimenter asked:

"What do you think of this for a test? You know that the men on this job have to know something about filing. Well, suppose you have a man applying for this work who claims experience as a filer. Suppose you lay four files in front of him and ask him to do a piece of fine filing and he picks up a bastard file to do it with. Or you ask him to do a piece of rough filing and he picks up a fine file.

Well, you would know right away what to expect of him as a filer."

"Yes, but listen here," broke in another. "All the filing required for this work can be learned by a likely man in a few days, and it wouldn't be fair to throw out a man because he happened to pick up the wrong file once. Inside of a week or two weeks at the most a man who has never had a file in his hands might be able to do filing well enough to do this work."

This is an example of the kind of discussion which was freely indulged in by the men in these shops. It not only showed how well they understood and sympathized with what was being done but also gave many valuable suggestions and viewpoints to the experimenter. Indeed, one of the most valuable features of an experiment conducted in this way lies in the intimate touch with the men and their work which it promotes. And as an additional suggestion it may be stated that nothing pleases the men more than the recognition that their work is important enough to merit a careful study.

The work in which these men were engaged was the assembling of gun actions and the final assembling of the various component parts of the gun into the finished product. A thorough study of this work was made by the experimenters, not only by observation but by actually doing the work as well. In some respects, this work was like the work of assembling done by girls. However, it required in addition some filing ability and a considerably higher grade of judgment. Instead of describing the work in minute technical details it is better for our purpose to describe it in terms of the tests which were finally selected for the experiment.

The first test given was the spatial perception test (51).

This has been described in the chapter on girl assemblers. The object of the test was to determine the ability of the subject to glance at a group of objects of various sizes and then assemble the right object to the right space. Some men could see at a glance where each piece belonged; others were compelled to try out a piece on one hole after another until, more or less by chance, they hit upon the right space. The second test was given to determine the subject's ability to discern slight differences in the size of objects shaped alike. For this test the triangles of the smaller form board were put in irregular order. The subject was asked to put each one in its right space. It will be seen that this test requires ability to discriminate between dimensions that are almost alike, a faculty which is quite necessary in fitting parts of an action or gun together.

In addition to the ability just described, an assembler, to be successful, must be able to do his work quickly. In other words, he requires manual dexterity. In order to discover the presence of this quality form board tests numbers 22, 23, 33, 34 were used. These tests have also been described in the chapter on girl assemblers. Strength of hands, although not an absolute essential, is a decided asset. The hand dynamometer was used to test for this quality. It may be said that testing the strength of hands is one of the most interesting and amusing of all tests, so far as the subjects tested are concerned. In this case, as in other cases, considerable rivalry and interest were aroused among the men through its use.

Finally the Stenquist mechanical test was given. This test consists of a box with eleven compartments each of which contains some implement in its unassembled form. The first compartment contains a simple monkey wrench; the second contains a chain; the third a three-piece clothes

clip; the fourth a bicycle bell, etc. The task of the subject is to take the object in each compartment and assemble it. Twenty minutes were given for this test and the results recorded according to the scale of values worked out by Professor Stenquist. The object of this test was to discover mechanical ability.

This experiment was conducted in two sections. In the first section all but the last of the tests named were given to thirty-one men engaged in action assembling. In the second section of the experiment all the tests were given to fifty-one finishing assemblers and twenty-six action assemblers. During the course of the first part of the experiment, all the assemblers were on a day-work rather than a piece-work basis, and for this reason it was impossible to obtain an objective rating of the men based on their actual production. Therefore, in lieu of something better, each foreman was asked to rank the men. It was carefully explained to him that his ranking should be based upon his opinion as to the possible production of the men if they were allowed to work on a piece-work basis. The fact that during a previous drive on production most of these men had been on piece-work made it possible for the foreman to make such a ranking on something more than merely hypothetical grounds. The foremen's rankings were then mathematically compared with the ranking of the men in the various tests, with the following results:

CORRELATIONS

	No. 51—Spatial Perception	*No. 34—3 Trials*	*No. 31—Hand Dynamometer*
31 Action Assemblers..	.56	.18	.29

It will be seen that test number 51 is the only test which shows a significant correlation.

In order to verify the results obtained and also because it was considered that not enough men had been examined to make the results very reliable, another set of examinations was given about six months later. In this section of the experiment fifty-one finished gun assemblers and twenty-six action assemblers were given the spatial perception test number 51 and in addition the Stenquist mechanical test already described. It had been hoped that by this time it would be possible to obtain piece-work records showing the comparative productiveness of the various men. However, although the men were on piece-work, each man was limited to a certain number of pieces a day; therefore, it was again impossible to obtain production records showing the comparative ability of the men. Again it was necessary to resort to the opinion of the foreman. On this occasion both the immediate overseer of the men and the foreman were asked to rank the men independently in five groups according to their opinion of the productive ability of their workers. The ranking of the men in the tests was then mathematically correlated with the ranking of the overseer and the foreman taken separately and with the combined ranking of both men. The results are given in the table on page 75.

It will be seen at once that the correlations for test 51 are not as high as was the correlation found in the first part of the experiment, though high enough to encourage further experiments in the same direction. The Stenquist test shows a slightly higher correlation, although it, too, is not high enough to justify its use as a criterion in the selection of new assemblers. The correlation between the opinions of the foreman and the overseer is very high,

CORRELATIONS

	*A & B** *with Sten-quist*	*A & B with No. 51*	*A with Sten-quist*	*B with Sten-quist*	*A with B*	*No. 51 with Sten-quist*
31 Finishing Assem..	.35	.32	.20	.37	.92	.42
26 Action Assem....	.34	.26	.32	.32	.82	.58

* A represents the overseer. B represents the foreman.

and shows that they were in close agreement in their estimates of the various men. This is by no means always the case. The correspondence between the Stenquist and the spatial perception test was also good, showing that both tests involve the same ability or abilities to some extent.

On the whole, the results of this experiment were not such as to justify using any of the tests tried as a basis for choosing new assemblers. Nevertheless, the correlations found justify continued research in this field. An interesting sidelight was cast upon the experiment by the foreman when the results were shown to him. Upon being told that the results of the second part of the experiment were not conclusive, he remarked that this was to be expected under the circumstances. When asked to explain himself, he stated that the examiner had not had the entire coöperation of some of the men and that these subjects performed the tests in a very careless manner. As a matter of fact, the second section of the experiment was conducted in part by a novice who was for the first time trying his hand without close supervision. In view of this fact, and the positive correlations which were found never-

theless, the success of future experiments in the same direction seems assured.

The outstanding feature of this experiment, however, is the manner in which it was received by the shop men. This reception clearly indicated that a psychological experiment, with all its novelty and necessary details, can be conducted among shop men in such a way as to secure their hearty interest and approval. Indeed, the psychologist who can adapt himself to a situation of this kind and who can genuinely amalgamate himself with the work and spirit of the shop, will find himself in a very fortunate and strategic position. Men will be only too glad to explain to him the nature of their work and to point out the little intricacies and subtleties which can so easily escape even the trained observer. Subsequent experiments have demonstrated the value of such an attitude and have also shown that the best way in which the psychologist can promote it is by beginning, not as a psychologist, but as a workman, actually donning the apron or the overalls, and learning the nature of the job by doing it. Nothing else is so convincing a proof of the experimenter's sincerity and thoroughness; and nothing will do so much to win the sanction and coöperation of the men to be examined.

VII

CLERKS

Clerical work of one kind or another is a necessary adjunct to almost any kind of enterprise. The choice of clerks is, therefore, a problem of universal interest. The fact that much clerical work requires a quite different type of worker than is required by most factory work, makes the problem still more interesting. As a rule, office workers must have a grammar-school or high-school education in order to meet the demands of their work. The time required to "break in" new clerks is commensurately long. Even for the more routine work it usually takes from two weeks to two months to develop a new clerk. As a consequence, mistakes in selection mean a correspondingly big loss to the organization. It is most desirable to select at the outset those applicants whose work will justify this training. For the purpose of discovering and standardizing tests which should accomplish this object, a series of experiments was conducted at various times and under various circumstances. During the course of the first experiment tests were given to fifty-two men and women doing clerical and near-clerical work. An aggregate number of four hundred and forty tests was given. The office serving as the field for this experiment was a departmental office in which large groups of clerks were engaged on very similar work. This office was chosen largely because of the fact that its manager had been making a careful study of his clerks and their

work, and had attempted to rate them as to their actual ability. This promised to give a fairly reliable basis upon which to estimate the results of the experiment. At the conclusion of the experiment, the manager of the office made a statement regarding his opinion of the results. This statement describes the problem of selecting clerical workers so clearly that it has been considered advisable to quote it before rather than after the experiment has been described.

"The problem of hiring clerks consists of sifting from the candidates available those who can, by constant application, adapt themselves successfully to certain very definite routine tasks. In dealing with large numbers of such people, all possessing more or less similar personalities, an interview, no matter how searching it may be in analyzing a person's aptitudes, is not sufficient to determine a clerk's degree of *technique*. Up to the present time we have as a rule guessed at a person's skill and hired him on trial. We have gone to the expense of 'breaking in' clerks on one task and then another until they have reached their level, or until they have left, or have finally been discharged.

"The tests which have been employed in this office seem to supply the mechanical means of quickly and cheaply determining to a practical degree the manual, ocular, and mental technique demanded for certain classes of routine office work. By thus supplementing the personal interview, I believe we can not only eliminate some of the expensive 'trials' now being made but give good personal advice and prevent many personal disappointments and embarrassing situations.

"As a case in point, a new girl was hired in one of our sections because of her alertness of speech, pleasing appearance, interest and conscientious attitude, and because she had been taking special lessons on a computing machine. We felt that she would be particularly well adapted to our work. In starting

at this work, she was first given the sorting of factory time tickets. So far she has done so poorly on the simpler work of the section that her section head is ready to discharge her. In the tests, I noticed at once that she was the poorest one in the entire group, and if these tests had been applied at the time of her employment, I presume that she would not have been hired, in spite of the other things in her favor. She may still be valuable for simple work, but she has started with a false estimate of herself and a wrong kind of encouragement from us. We have other cases in mind where clerks have done exceptionally well, although first impressions have been poor owing to an estimate made from their general appearance and deportment rather than from a knowledge of their technique."

It was at the suggestion of the office manager making this statement that the tests given in this experiment were classified under the head of tests for *technique* and tests for *intelligence*. The distinction is by no means clear cut, but it has a certain practical value which every office manager will recognize. By technique is meant the speed and accuracy shown by clerks in sorting tickets and papers, posting and adding columns of figures, indexing and filing, and in other routine clerical operations. In short, technique is the degree of mechanical perfection which is desirable in all kinds of routine office work. The tests calculated to give an index of a clerk's technique were tests numbers 4, 10, 12, and 15, all of which are given with appropriate directions in the Appendix. The term *intelligence* was interpreted to designate the facility and success with which a clerk could master new tasks and follow directions about new work assigned from time to time. One of the tests used for this purpose was test number 13, the well-known Woodworth-Wells *hard directions* test. (See Appendix. This test has since

been abandoned for more specific tests of intelligence.) Another test used for this purpose was the "abstract relations" test devised by Prof. Robert M. Yerkes, Major in charge of the psychological section of the army. This test can not be given here because, at the time of this writing, Prof. Yerkes had not yet put it into final form. These tests were given to fifty-two clerks. The clerks were divided into four groups of about equal numbers, each group being engaged in a different type of office work. When all the tests had been given the results were computed and tabulated so as to bring out the following points: (1) the rank of each individual with reference to all the rest; (2) the relation of each of the four groups to each other; (3) the relation between technique and intelligence. The results were then submitted to the office head who compared them with his records and with his own opinion of the relative merits of the various individuals and groups. This comparison showed a very marked agreement between the testimony of the tests and the rankings of the office manager. In the first place, a comparison showed a distinct difference between the four groups, both in technique and intelligence. The comparison was made by averaging the ranks of each individual in the tests and then averaging the ranks for each group as a whole. The result of this comparison may be expressed as follows:

	Average in	
	Technique	*Intelligence*
Time-study group	92	96
Ledger group	82	80
Statistical group	77	71
Computing machines and sorting group	79	69

The most striking fact about these group averages is the decided superiority of the time-study group. As a matter of fact, the members of this group were not strictly clerks, although they required clerical ability to a very high degree. The group was composed of young men, college graduates, whose duty it was to go into the shops and study operations of various kinds, observing and recording with the aid of a stop watch the most minute elements which entered into those operations. This requires not only a very high degree of technique, but an unusual degree of intelligence as well. On the basis of the tests, this group is very markedly superior to every other group, both in technique and intelligence. This corresponded exactly with the relative importance of the group, both from the point of view of the wages they received, the work with which they were intrusted, and the office manager's opinion. The differences between the remaining groups were not so marked. The ledger group, however, was higher than the other two in both technique and intelligence. This, again, corresponded with the relative value and importance of the group. The two remaining groups, doing less important work and receiving, on the whole, lower pay, were very much alike. The computing-machines group excelled the statistical group in technique but was in turn excelled by them in intelligence. This was in accord with the fact that the statistical group was engaged in work not quite so routine as that of the other group.

As regards the ranking of individuals, the results of the tests were more striking. Every member of the first group with one exception was ranked among the fifteen highest out of the entire number of fifty-two clerks tested. The exception was a man whose work was unsatisfactory

and who left shortly after this experiment was tried. The leader of this group outranked its other members. The leaders in each of the other three groups also ranked within the first fifteen. The young man who had the highest rank in intelligence and who was in charge of the ledger group has since been promoted to a much more important position. The girl who was first in technique and third in intelligence was considered the fastest girl in the office. The clerk who was lowest in both technique and intelligence had been at work for four weeks and in that time the man in charge of her work had tried in vain to make her a success. She was unable, after four weeks of practice, to sort time tickets without making bad mistakes. It was in the test most nearly resembling this operation, the card-sorting test, that this girl did most poorly. Although externals were all in this clerk's favor, the man in charge of her had finally lost patience and recommended her discharge. Another clerk with a responsible position, a college education, unusual business experience, and a prepossessing appearance, showed up quite well in the intelligence test but very poorly in the tests for technique. The conclusion suggested by these tests has been remarkably borne out. The promising appearance and poor performance of this clerk had caused a considerable difference of opinion in the office; but her immediate superior and supervisor maintained that he did not feel comfortable while she was at her present work. On the strength of the tests, the files which this clerk was keeping were inspected and the suspicions as to her accuracy were confirmed. The files were found to be in very bad shape.

Unlike some previous experiments, this case showed a decided correspondence between technique and intel-

ligence. The actual correlation was plus fifty-five (probable error four hundredths). This indicates that general intelligence or mental flexibility, while not absolutely necessary for all clerical work, tends on the whole to be an advantage. It will be remembered that inspectors to whom similar tests were given did very poor work, thus indicating that intelligence of this kind was not at all necessary in their work. However, in clerical work, where tasks are frequently changed and where new directions are often given, a little intelligence will often make it possible for a clerk to fall into a given routine with much greater readiness than can a less intelligent clerk. Clerks lacking in technique may often compensate for their lack by superior intelligence.

As a result of this experiment, it was decided to give these tests, together with others which might be added from time to time, to all incoming clerks. One of the first candidates to be examined was a young woman who had recently been interviewed by one of the office heads. This candidate was so unprepossessing in appearance that in spite of signs testifying to her intelligence, the office head was in doubt as to the advisability of hiring her. He therefore asked that the psychological tests be applied. This was done, and the young woman did remarkably well in every test. She was then hired, and proved herself so ready and capable, that it was decided to train her for the work of an office assistant. In six weeks she had mastered the routine of four different kinds of work. This is a striking instance in which the testimony of the tests belied the testimony of observation. As was stated in the letter quoted in the beginning of the chapter, it is almost impossible to tell, by merely observing and interviewing a candidate, whether that candidate has the

proper ability and technique required by clerical work; and it needs some more searching and impersonal method to get at these very desirable facts. In the case just discussed, superficial appearance and a personal impression might easily have meant the loss of a very desirable worker.

At the time of this writing, nine hundred and thirty-five clerks had been selected on the basis of these tests or similar tests developed in the course of subsequent experiments. The results of these selections were carefully followed up and recorded on the form containing the record of the applicant in the tests (see Appendix). It will be seen, by reference to this form, that provision is made for a periodic follow up, at the end of the clerk's first, second, third, and sixth months of employment and finally, at the expiration of a year's work. The results of this follow up showed very clearly that the tests were an aid in the selection of clerks. The great difficulty, however, in finding the true value of the results was the fact that the estimate had to be based upon the personal opinions of a large number of different office and section heads. This brought into the situation the very defects which the psychological method seeks to avoid, the prejudices and variations of the human equation. For instance, the person following up the results of certain selections might come to an office head and ask: "How is Miss —— getting along?" "Oh, she's no good at all," might be the answer; "What did she do in the tests?" It may happen, and it frequently does, that the particular clerk in question has done well in the tests, and the examiner is then called upon either to justify his selection or admit his mistake. Now in many cases of this kind, the mistake has been found to lie with the personal opinion of the office head, and later events have

vindicated the impersonal testimony of the tests. For instance, one girl, very unattractive in appearance and ungainly in her movements, was held up by a certain office head as a particularly flagrant error on the part of the examiners. This girl was finally transferred to another office. After the expiration of the usual time, the follow-up clerk asked her new superior "How is Miss —— getting along?" "Oh, she's doing good work," was the immediate reply. Actually, this girl, considered a failure by her first superior, was considered a success by her next, although she was doing work in which her previous experience was of no decided value. Another instance of a similar kind is the case of two clerks who had been recommended on the basis of the tests. After the expiration of a few days, their superior complained about their ability. "Why Miss —— even thought that the United States Government was a company!" exclaimed the office head in despair. When he was informed that both of these girls had passed the tests, he agreed to withhold judgment for a few days more. At the end of the month, he was again asked to express his opinion of these clerks. "They will do," was the rather reluctant answer. Situations of this kind arise constantly in an office made up of several units, due to the fact that the head of every unit has his own peculiar ideas as to what a clerk should be and how she should perform her work. This lack of a uniform and impersonal standard makes the task of following up the results of selection an extremely intricate one. However, by force of instances like those described above, the office heads concerned are realizing more and more how unreliable their personal impressions are likely to be, and at the same time, how worthy of their consideration is the selection made by the

tests. Whereas mistakes in hiring were once attributed immediately to the tests, office heads are now inclined to question their own judgment as well. The result of this change of emphasis from the personal to the impersonal has been a much more consistent treatment of clerks in general, and a much more decided conservation of human material. Snap judgments are less common than was once the case.

On the other hand, there have been frequent instances in which the tests themselves were at fault. For example, the examiner would find that certain clerks who had failed in the tests but who had nevertheless been engaged for a trial, were succeeding beyond a doubt. A more minute scrutiny of such cases usually showed that the clerk in question was engaged at work for which the tests were not in the least intended. For instance, it was once customary to give every clerk a test in the fundamentals of arithmetic. However, it frequently happened that clerks were put at work which did not involve any knowledge of arithmetic, and therefore they often proved successful even though they had done extremely poor work in this test and only fair work in the remaining tests. Such cases, frequently met with, showed not so much the inadequacy of tests in general as the inadequacy of certain tests for certain kinds of work. In fact, one of the most valuable features of the systematic follow up outlined was to reveal discrepancies between particular tests and particular kinds of work, and thereby point out the need for a more careful study of the varieties of clerical work and, at the same time, a more careful adaptation of specific tests to meet these varieties. The manner in which these requirements were filled is described in following chapters.

Although, as has been pointed out, there were certain inadequacies in the tests applied as well as in the judgments obtained from the office heads, the value of the results became more and more clear with each passing month. The inspection or follow up conducted at the end of each month showed a consistent increase in the percentage of agreement between the estimates based upon the tests and those given by the office chiefs. For example, one hundred and eighty-eight clerks recommended on the basis of the tests and followed up at intervals of one month for a period of three months were estimated as follows:

Percentage of those called good by their superiors

At the end of one month	75%
" " " " two months	89%
" " " " three months	92%

In brief, the verdict of the tests was corroborated with increasing certainty as the various office heads learned to know their workers better. Looking at the matter from another angle, the verdicts rendered on the basis of tests occupying only a few minutes' time were more reliable than those rendered by the office heads after they had known the workers thus selected for one, two, and even three months. If tests have any value it is in this ability to effect in a few minutes a selection which time will justify; and the measure of that value is the degree in which succeeding months confirm this selection.

VIII

STENOGRAPHERS, TYPISTS, AND COMPTOMETRISTS

The work of typists, dictaphone clerks, stenographers, and computing-machine operators, is clerical work which is specialized by the use of a standard machine. In applying tests to this kind of work, therefore, it is necessary to take into consideration two additional factors: first, the skill already acquired by the worker at a certain machine; and secondly, the aptitude which the worker possesses for learning and improvement in the use of the machine. A typist, for instance, must usually possess, at the outset, a certain degree of clerical ability. However, this is only the foundation of her work. She must also be trained in the use of the typewriter, and she should have, in addition, that aptitude or innate ability which will make her, in time, a fast and accurate typist. The same holds true of other office-machine operators, except that the stenographer must also have ability in taking dictation and in reading her notes.

In order to find tests which could meet these conditions, an extensive series of experiments was conducted in which relevant tests were given to two senior classes of over three hundred girls and boys in a commercial high school, to seventy-six pupils of two business schools, to a group of twenty-two office typists, to another group of nineteen stenographers, to over four hundred candidates for positions as typists and stenographers, to three groups of over

one hundred and forty comptometrists, and finally, to more than one hundred and twenty candidates for comptometry. That is, more than one thousand people were tested and more than five thousand tests were given. The tests selected on the basis of these experiments are those which showed the highest and most consistent agreement with the abilities of those examined. By no means comprehensive or final, they have nevertheless proved themselves practical guides in the selection and grading of applicants for the kinds of office-machine work mentioned. Most of these tests are given in the Appendix, with directions for use, under the names of the work to which they apply.

TYPISTS AND DICTATING-MACHINE OPERATORS

Obviously, the most important test which can be given to a typist is a test in the actual work of typing a given copy or form. Several tests were selected or devised for this purpose and tried out on a number of typists with a view of discovering which tests were most significant. Some very important points were revealed by these preliminary trials. In the first place, it soon became apparent that the tests must be given on a machine of the type to which the applicant had become accustomed or on which she had been trained. A slight difference in machines was frequently enough to throw a typist out of her stride and cause her to make an unusual number of typographical errors, errors which were obviously due to unfamiliarity with the machine. The solution of this difficulty was to allow each applicant to take the typing test on the machine of her choice. However, where this was impracticable, a standard machine was chosen, and the applicant given sufficient time to adjust it to her use.

In order to minimize the results of unfamiliarity with the machine, the tests finally chosen were confined to the universal keyboard and all catches were avoided. Moreover, those errors in the copy of the typist which were apparently due to novelty, such as the striking of an "i" for an "o", were not counted against the applicant as heavily as other mistakes, such as omitting a word or a punctuation mark.

Another test chosen to give to typists was a spelling test. The first step in devising this test was to select representative letters and forms from the correspondence of the company. These samples were then gone over and those words which were most frequently misspelled were selected and made up into a series for test purposes. A number of the words, purposely misspelled in characteristic fashion, were mingled with words correctly spelled, and the applicant was asked to check off those which were incorrectly spelled. The written method was chosen because it is much quicker and more comprehensive than the oral method. However, it frequently happens that an individual is unable to spell a word correctly or recognize its correct spelling until he writes it down. In order to meet this condition, those words incorrectly spelled on the test sheet which were not checked by the subject, and those correctly spelled which were checked, were read aloud to the subject and she was requested to write them down correctly. In this way, the possibilities of error were greatly reduced. It may be said that a typist does not necessarily have to be a good speller because she has the words before her. This assertion does not take into consideration the mental mechanism which copying involves. Copying is more than a merely photographic process. It involves learning and memory. An individual

who had never studied French would have great difficulty in copying correctly a paragraph in French and it would undoubtedly take him a long time to do it. It takes us much longer to copy a word which is new to us or which we have seen only a few times than to copy one with which we are familiar. To be sure, the ability to spell is not as essential to the copyist as it is to the stenographer, because the stenographer must rely almost entirely on her memory for the spelling of the words she takes down. Nevertheless, the lack of this ability will greatly increase the typist's liability to error and very markedly decrease her speed as a copyist. Moreover, in the case of dictaphone typists, spelling is even more important than it is in the case of stenographers. For whereas the latter has an opportunity to look up doubtful words in the dictionary without holding up her machine, the dictaphone typist must bring her dictaphone to a stop before she can look up the necessary word, and when she resumes, must frequently set the dictaphone back so as to recover the sense of what she is writing. It frequently happens that the applicant has only recently learned how to type and is therefore not yet proficient. It is very essential to distinguish between a typist who is not proficient because of inexperience but who promises to become proficient, and one who is naturally inept and is not likely ever to become very proficient. The spelling test is one means of discovering this fact; for a candidate who is a poor speller has an initial handicap which will greatly retard her progress.

Another test, chosen largely for this purpose, is the substitution test. Other experimenters have already established the connection between ability in this test and actual or potential ability in typing. If an applicant

without much previous experience in typing does very well in the substitution test, the indication is that she has the necessary aptitude or potential ability to become a good typist with practice. It is very desirable to engage a candidate of this kind with the view of giving her the opportunity to develop this potentiality for the sake of her future usefulness. It is just as desirable to know when this potentiality is lacking in a typist in order to avoid engaging an applicant upon whom practice and experience will, to a large extent, be wasted.

Another test which contributes to this end, particularly in the case of typists using a dictating machine, is the Trabue completion test or the language tests built on this model. Tests of this kind require the subject to fill in the blank spaces left by the omission of certain words and phrases in a sentence, with those words and phrases which will complete the meaning of that sentence. For instance, in the sentence: When the alarm clock....I immediately....out of bed, *rings* and *jump* obviously make the necessary sense and complete the sentence. It very frequently happens that a typist is confronted by a copy or by a record in which a word or phrase is illegible or unintelligible. In the face of such a situation some typists are quite helpless and can solve the difficulty only after much thought or after making inquiries from their neighbors or superiors. Others are able, by their own sense of the meaning of what has been said or written, both before and after the blank, to supply the necessary words. That is, their *sense of context* enables them to complete sentences the parts of which are missing. The ability to do this is a very great advantage to the typist, and one which will greatly increase her capacity for good work.

STENOGRAPHERS

The tests described as being applicable to typists are equally applicable to stenographers, and in some instances more so. The Trabue completion test, or the *context test* as it might also be called, is particularly significant, for the stenographer must not only be able to supply the words and phrases which the person dictating fails to enunciate clearly, but she must also be able to read the sentences which she has taken down and to supply those parts which she has herself failed to record clearly. The sense of context is therefore of twofold importance in the case of the stenographer. In addition, she should have a knowledge of grammatical expression, and for this purpose, a grammatical test like that given in the Appendix under paragraph 21 was chosen. It will be seen that this test calls for the detection and correction of certain fairly common errors in expression, some of them obvious and others more subtle. The individual who can not immediately see and correct most of these errors is obviously handicapped as a stenographer; for a good stenographer should not only be able to avoid grammatical mistakes on her own part, but she should also be quick to detect them on the part of her employer. The variations and modifications to which grammar tests lend themselves are infinite. Besides the context and grammar tests the spelling test is also of great importance in the case of stenographers. A stenographer whose spelling is slipshod is a trial to her superior.

The most important test, probably, which can be given to a stenographer is of her ability to take and to transcribe dictation. This is a difficult test not only to take but to give. Two methods may be adopted. One is to dictate a certain amount of material to the candidate within a

given length of time, regardless of whether the speed of dictation is too slow or too fast. The other is to adapt the speed of dictation as nearly as possible to the capacity of the applicant. In either case the result is graded according to the amount done correctly. The former method has proved unsuccessful partly because it is impossible for any examiner to give dictation at an absolutely uniform rate of speed to every individual, and partly because it is obviously unfair to require a novice or an unpractical stenographer to take dictation at a rate which her subsequent employer may never expect her to equal. The tests given in the Appendix are examples of tests used for this purpose. These tests were given as nearly as possible at the speed which was best adapted to the applicant's ability. The results were then graded on both the basis of the total time consumed and the amount done correctly.

Stenographers are frequently required to do work of more importance than merely taking and transcribing dictation. They frequently hold secretarial positions which require considerable executive ability. In that case, care must be taken not to place an interpretation on these tests which exceeds the purpose for which they are intended. Further tasks and abilities require additional and more difficult tests.

COMPUTING-MACHINE OPERATORS

The use of computing machines in connection with cost and payroll work, the taking of inventories, and statistical work of all kinds, has become very extensive. Indeed, so important has this work become that there is now a very large class of workers who specialize in the use of one of these machines just as the typist and stenographer specialize in the use of a typing machine. The

name most generally applied to these operators is *comptometrist*, and the number of comptometrists is already beginning to rival the number of typists and stenographers. It is therefore extremely and increasingly important to establish means for the selection of operators who are already proficient and others who promise to become so.

In order to develop tests for this purpose, various studies were made and experiments conducted. At one time a series of four tests were given group-wise to a group of forty-one comptometrists. At another time, comptometer tests were given to separate groups comprising ninety-three operators. As soon as tentative tests and standards were established, they were given in the employment office where, at the time of this writing, over one hundred and twenty applicants have been tested and the results followed up. In addition, tests were given to over eighty pupils who entered evening classes conducted to instruct girls in comptometry, and comparisons made between the performances of the pupils in the tests and their subsequent progress on the computing machine. As a result of these experiments the tests given in the Appendix under the head of Tests for Computing-Machine Operators were finally established. It must be stated that these tests were developed in connection with the use of comptometers (really a trade name) and the Burroughs adding machine, probably the two most widely used machines.

The tests found most significant for this purpose were, first, a mental-arithmetical test. This test was the same as that chosen for clerks who use arithmetic in their work. The method of performing arithmetical operations mechanically does not necessarily presuppose a very thorough knowledge of arithmetic. Adding, multiplying,

dividing, and pointing off decimals on a machine is an entirely different process from the process involved in the mental solution of identical arithmetical problems. In fact, a girl who knows nothing whatsoever of division can be taught how to divide on a machine in a comparatively short time. However, in spite of this fact, it is highly necessary that a comptometrist have a fundamental knowledge of arithmetic. A comptometrist who does not have this is far more likely to make errors and to overlook errors than one who does. The experiments conducted proved this conclusively. An operator who knows arithmetic can frequently tell when her answer is wrong or absurd by a mere inspection. To be specific, the decimal point in a calculation done on a machine can be taken care of automatically by setting an index or pointer and then following certain definite rules as to which rows of keys to use. As long as these rules are followed, no mistakes will occur. However, when, by chance, the operator fails to follow these rules she may obtain a result as follows: 1468 x .00034 equals 4.9912. Now, the numerical answer here is correct, but the decimal point is in the wrong place, and unless the operator knows the arithmetical rules regarding the use of decimals in addition to the rules governing the mechanical operation, she may see nothing wrong in the above answer. Frequent mistakes of this kind were found in the course of the experiments on comptometrists. Such mistakes made in actual work are likely to be very costly. Even though mistakes in the long run tend to equalize themselves, the fact that most of them are not allowed to run long, but must sooner or later be corrected, usually with an amount of labor far more costly than the errors themselves, makes it very important to reduce such errors to a minimum. The modern

industry, with its enormous payrolls and extensive cost systems, is well aware of the importance of this particular item. For this reason it is very important that comptometrists have, in addition to their mechanical knowledge, a knowledge of fundamental arithmetic, as determined by the arithmetical test described.

The test in comptometry itself must necessarily be based largely on the kind of comptometry to be done or the kind of practice which the individual has had. The work in connection with which these experiments were conducted involved very little division, and consequently, most emphasis was placed upon addition and multiplication. Care must be taken in all cases to establish tests which will not lay too much value upon the specific ability of an individual at a specific moment. For instance, some schools, knowing the little use to which division is put, spend very little time teaching division to their pupils. It does not follow that these pupils would not quickly learn division if properly instructed, but unless tests discriminate carefully, it is quite possible to reject an operator, fair in other respects, but poor for the time being, in division. This is a matter which must be determined from a practical rather than an experimental standpoint. If the industry wants thoroughgoing experts *at once*, a complete test should be given. If the industry is satisfied to take operators who are not entirely expert but who promise well, less emphasis should be placed on a complete and perfect comptometry test and more on the tests which indicate an individual's aptitude or potentiality. The arithmetical test discussed is one test which serves this purpose. Another is the numerical substitution test. This test bears virtually the same relation to the work of comptometrists which the mixed

letter and number-substitution test bears to typists and stenographers. It has been found that this test correlates very well with the subsequent ability of operators who are not expert at the time when the tests are given. The so-called general-intelligence tests which have been applied to comptometer operators thus far have not shown any marked correlation with their ability as operators. Since the work on which these operators are engaged requires intelligence of a peculiar kind this is not surprising.

After tests had been given to applicants for comptometry for several months, the value of the tests had won the recognition of most of those concerned. A certain official, however, head of the largest group of operators, remained skeptical and would not admit that the tests had been successful in selecting operators for his group. In order to convince him and also for the sake of making further improvements in the tests themselves, this official was asked to allow an experiment to be conducted with some of the members of his group. He consented to the proposition upon two conditions: First, he was to be permitted to select the girls to be tested; and secondly, he was to keep the standing of these girls unknown to the experimenters until the latter had completed their ranking of the girls according to the tests and were prepared to submit these rankings to him in written form. These conditions were naturally acceptable, since it is situations of exactly this kind that employment tests are calculated to meet. This official then selected twelve girls for the experiment, and the comptometry tests discussed here and given in the Appendix were given to them group-wise. When the results were complete, the twelve girls were arranged in one, two, three order. This was done both for each test individually and on the basis of the tests taken collectively.

These rankings were then submitted to the official who had previously ranked his workers in the same way, but according to his own opinion of their comparative abilities as comptometrists. The agreement between the two was very close. The rankings based on the tests in comptometry alone coincided with those given by the official in every respect. On the basis of the tests other than the comptometer tests, there were two disagreements, both very slight. It appeared that one of these operators was new and comparatively inexperienced and, although not yet quite as good as some of the others on the machine, gave indications, by her good work in the other tests, that she would soon surpass some of the other girls who had been ranked above her. The department head agreed that this was his opinion also, but said that he had ranked the girl low because he was using as a criterion only ability in comptometry, without regard to mental ability or potentiality. The other operator who had been ranked higher by him than on the basis of the tests was a very old and experienced hand who had won her rank through continued practice in the same kind of work, but who was admitted to be not as versatile or as capable as some newer girls ranked beneath her. The important fact about this group of tests, from the employment point of view, is that the instantaneous verdict made possible by them was substantially the same as that rendered by the official in charge of the group after he had known the individuals tested for weeks, months, and even years. As a result of this experiment, the official who had been skeptical before made a written statement in which he expressed himself as entirely convinced that these tests were reliable.

of the difficulties in convincing individuals of the scientific significance of the psychological method. Most individuals have no conception whatsoever of the statistical method and of the importance of basing judgments on a large number of cases rather than a small number of isolated instances. In the experience of the writer it has seemed as if not one business man in a hundred were able to free himself from the compelling magic of the isolated dramatic instance. Mention has already been made of the impression made upon a group of hard-headed business men by a wild guess that one of the group was a Cornell man. To be right with respect to a single applicant has sometimes done as much to convince a certain official of the value of tests as an entire experiment, covering forty or fifty individuals, and involving the most accurate and painstaking statistical work. On the other hand, one or two failures have often done more damage than a similar experiment could repair.

The power of the dramatic instance—called dramatic because it happens at the time being to monopolize the entire stage in the mind of the individual—is one of the chief obstacles to the pioneering psychologist. "That may all be true;" one hears an individual say after an experiment or a follow up covering fifty or a hundred applicants has just been explained to him, with the correlations which were found and the high percentage of agreement between the verdicts of the tests and those of the foremen or those obtained from actual production figures; "but there is Miss ——. Now I know her and her work very well. She has been with the company for five years and during that time has given perfect satisfaction in the place where she works; and yet, according to your tests, she would not be considered good for the work she is at. Then,

there is Miss ——. I know her personally, and I know her work, and I am sure that she is a very inferior worker, and yet, according to your tests, she is above Miss ——."

This more or less imaginary criticism is typical of the power which isolated and personally known cases have over the minds of certain individuals, and which is one of the greatest obstacles which the psychologist has to overcome. The difficulty will remain, not only in the psychological field but in all fields until people are educated sufficiently so that they can weigh the value of an investigation or a problem, not by one or two isolated points which happen to stick out most vividly in their minds but by weighing and comparing all the points present in the situation. It is not the intention here to minimize the importance of the dramatic instance, or the particular case. Individual instances are, in the last analysis, the fundamental facts upon which scientific laws and generalizations rest. However, people will not be able properly to place the value of individual instances until they become statistically minded; that is, until they are able to see facts in the light of percentages, proportions, curves of frequency and distribution, and until they are sufficiently at home in this kind of thinking so that their entire train of thought will not be thrown out of gear when an isolated instance comes along, or an exception with which they are *personally* familiar.

The little experiment related above was a more fair attempt than usual on the part of a layman to obtain a reliable basis upon which to estimate the value of the tests for his work. The official in question chose twelve cases upon which to base his opinion. However, from the psychologist's point of view, even twelve cases are not

sufficient ground upon which to make very extensive deductions. In fact, the psychologist who bases conclusions with regard to the significance of tests upon a study of less than twenty subjects at the least feels that he is resting on very precarious ground indeed.

XI

TESTING TO SPECIFICATION

The tests discussed in the preceding two chapters were designed to apply to certain general kinds of office work, such as typing, stenography, comptometry, and routine clerical work. However, it soon became evident that these tests were neither comprehensive nor specific enough to meet every situation. This fact was revealed through the follow-up work which has already been spoken of. The follow-up work consisted of inspecting the results of every selection, whether for factory or office work, at intervals of a month for three months, then at the end of the sixth month, and finally, after the lapse of a year. In the course of this work it was found that tests were frequently given for abilities which the worker did not need to possess, and also, that the tests given did not adequately cover the work in question. As instances of this kind multiplied, it became increasingly necessary to provide more tests and more highly specialized tests for the varieties of work which were being encountered. It finally became evident that, in order to provide for this situation systematically, it would be necessary to make a complete survey of the different kinds of clerical work, and then apply tests accordingly.

Before entering upon the more complete and minute survey, a hasty preliminary canvass was made in which it was discovered that there were seven hundred and fifty seven clerks engaged in tasks going under two hundred and

three different names. Manifestly, it was not feasible to provide specific tests for each of this large number of positions. For not only were these positions subject to great variations from time to time in the kind of work they involved, but they were often differentiated from each other by mere technical or superficial characteristics for which applicants did not need to possess corresponding differences in their natural equipment and ability. The differences between tasks were often differences only in routine and in method, differences which could easily be overcome by a few hours' acquaintance with the work. On the other hand, the preliminary survey also revealed that among this great variety of work a comparatively small number of characteristics dominated. That is, it seemed as if a large number of tasks could be reduced to a comparatively small number of elementary abilities, such as ability in spelling, copying by hand, typing, counting, adding, multiplying, dividing, working in fractions and decimals, filing, sorting, taking dictation, transcribing, operating computing machines, and so forth. It was therefore decided to make the more comprehensive survey with this fact in mind, and to describe all clerical tasks, so far as possible, in terms of their elementary requirements. If this could be done, it was to be expected that the process of finding and applying tests to these varieties of work would be greatly simplified. Instead of a heterogeneous mass of tests, corresponding closely to the heterogeneous varieties of clerical tasks differentiated from each other only in superficial respects, it would become possible to establish a much smaller number of tests designed to detect only the more fundamental abilities and therefore susceptible of application to the wide variety of tasks encountered.

Another advantage of this procedure was the practical

one to be derived from the simplification of the method of making requisitions for clerks. Because of the many kinds of work, the requests from various offices and departments for new clerks came into the employment office in terms that were extremely vague. The term *clerk*, for example, might mean a clerk of almost any kind. The term *stenographer*, specific in some respects, might still be vague in essential details, for some stenographers might be required to have filing or statistical ability and others not. The term *payroll clerk* was found to apply equally well to six or seven kinds of clerks, each engaged in work of a different kind. This vagueness made it very difficult to examine clerks with reference to the specific abilities which were required of them by the specific tasks for which they were intended. In order to overcome this difficulty, it was proposed to base the requisitions for clerks upon the fundamental factors which were involved in each kind of work. That is, instead of asking simply for a payroll clerk, let us say, without specifying what *kind of payroll clerk*, the request would have to state the exact specifications according to which this clerk was to be furnished. If the payroll clerk required was to possess ability in division, that fact would have to be stated. If ability in sorting, that fact would be noted, and so forth. With the specifications given in this way, it would become possible to give the appropriate tests and to select the candidates who most closely approached the specifications outlined.

The survey upon which this change of procedure was to be based was conducted by going directly to each office or section head and asking him to explain in detail the tasks of those in his group. At this point a serious obstacle was immediately encountered. When the head of a group

of office workers was asked to describe the work of those in his group he usually gave the description in stereotyped and technical terms which had very little relation to the fundamental requirements of the work in question, and which meant almost nothing to any one not closely acquainted with the particular routine of the work being described. For instance, the work of a master plan clerk was described as preparing, scheduling, and closing out of all sub-orders; that of a check clerk as cutting amounts on checks and analyzing cash disbursements; auditor, checking the work of the blotter and inker. These descriptions are somewhat ambiguous for one not familiar with the work.

In order, therefore, to guide the analysis and description of tasks into specific channels and also in order to facilitate the use of this information after it had been obtained, the following outline was prepared and printed on a form card:

Name of job.....Classification.....
Department.....Division.....Section.....
Characteristics of Work:

- Manual
  - Writing—Figures—Drawing—Posting—Sorting.
- Machine
  - Typing: Copy—Statistics—Dictation—Forms.
  - Stenography: General Dictation—Technical—Secretarial.
  - Comptometry: Add—Multiply—Divide—Decimal.
  - Miscellaneous: .....
- Mental
  - Filing: Alphabetical—Topical—Symbolical.
  - Mathematics: Add—Multiply—Divide—Subtract—Percentage—Decimals.
- English
  - Conversation—Correspondence—Grammar—Spelling—Handling Inquiries.

Posture
Standing—Sitting—Walking.
Education (in years): Grammar—High School—Business School—College.
Prerequisite Experience.....
General Description of Duties.....
.....
.....

This outline, while neither comprehensive nor final, made it necessary to describe each particular kind of work in fairly specific terms and in terms of activities which were fundamental rather than incidental. When the work of the five hundred and fifty-seven clerks involved had been described by making out these forms, it was found that two hundred and three different tasks were listed. However, closer study showed that many of these tasks differed only in name, and that the fundamental activities involved were much the same for large numbers of them. Therefore, a further simplification was brought about by classifying the various tasks still more strictly on the basis of the abilities involved, regardless of the name given to these tasks by the various offices in which they were being performed. Finally, the two hundred and three jobs were reduced to about sixteen, which were named as follows:

File Clerk	Posting Clerk
Checking Clerk	Correspondence Clerk
Order Clerk	Follow-up Clerk
Ledger Clerk	Sorting Clerk
Record Clerk	Statistical Clerk
Messenger Clerk	Comptometrist Clerk
Typist	Dictaphone Typist
Stenographer	

The names given to these jobs are unimportant. The important feature is the fact that each name stood for a

specific group of fundamental requirements such as those outlined above. Each one represented a set of specifications drawn up for the purpose of guiding the employment office and especially the psychological examiner, in selecting the proper candidate for the proper place.

From this point on, tests were developed and applied to meet these specifications. Some of these tests are given in the Appendix under titles which, in the light of this analysis, will immediately suggest their use. The filing tests, for instance, correspond to the kinds of filing designated in the descriptive form. Topical filing is one of the common kinds of office work. Letters have to be filed according to the subjects with which they are concerned, and to determine what these subjects are is a task which requires a certain kind of intelligence or analytical ability. The topical filing tests, one simple and the other more difficult, are calculated to test this ability. Alphabetical filing is a still more common task and requires ability of a very different nature. It requires a certain kind of mechanical precision rather than analytical powers. The alphabetical filing test is calculated to give an index to this ability. A still better test for this purpose is to give the subject a file box, with a certain number of cards containing names. The subject is requested to file these cards under the proper letters. Other tests are designed to detect other fundamental abilities. Such tests are being found or developed from time to time.

The specifications just mentioned are standard specifications for standard kinds of work. However, it frequently happens that clerical positions are to be filled for which the standard specifications at hand are not adequate. For instance, a stenographer may be desired who shall possess, in addition to stenographic ability, ability

in topical filing. Or the employment office may receive a requisition for a clerk whose work is very simple and requires no ability whatsoever in arithmetic. In the former case, a stenographer who did not possess ability in topical filing would probably prove unsatisfactory. In the latter case, a clerk who did have ability in arithmetic would be a waste of human material, especially if such a clerk were urgently required for another position which did require that faculty. Obviously, therefore, it is desirable to make arrangements by which specifications could be made more flexible, so as to cover any situation which might arise. This can be done by means of the requisition blank. To begin with, a copy of the standard specifications must be kept in every office covering the tasks being done in that office. A complete set of specifications is kept in the employment office. The ordinary requisition for help may therefore be made by merely marking on the requisition blank the name or symbol of the particular specifications to be filled. However, when an exception arises for which the standard specifications are not adequate, the form already described can be sent to the employment office, where it can be used as a basis for selecting the proper applicant. In this manner, a considerable degree of flexibility may be had.

There is nothing theoretical or abstract about the procedure described. All of these measures and more have been worked out in detail and put to practical use with increasingly good results. Nevertheless, a word of warning must be given. In the first place, the activities enumerated here as elementary or fundamental are neither comprehensive nor final. It may be possible to analyze them into other still more fundamental activities. Certainly, there are many kinds of work besides those named

which call for fundamental abilities not included in this analysis. The same criticism applies to the tests given here to detect fundamental faculties. They are not final or perfect, and they must therefore be applied to work of other kinds with discretion. In each case, the work must be carefully studied, and tests tried out in a preliminary fashion to discover their adequacy. Particularly is this true of the standards which are to be used as a basis of employment. The work of one employer may make it necessary for him to have a much higher type of stenographer, let us say, than the work of another. These standards can be determined only by means of actual experiments conducted on the field. To be sure, the development and standardization of tests elsewhere will make each new application increasingly simple, and the trained psychologist will have to expend less and less effort in preliminary experiments as the technique and material of his science grow.

In the second place, it is necessary to determine, in every case, the relative importance of the abilities involved. For instance, ability in spelling may be very important for a stenographer and somewhat less important for a typist. Arithmetical ability may be very important for a statistical clerk and also important, though less so, for a record clerk. When a group of tests is given to an individual, there must be some means by which the results are combined in such a way as to give every test its proportionate value. How are these proportions to be determined for different kinds of work? This is a problem which can be settled only by an immediate study of the work itself. The investigator must determine in each case what is the relative importance of various faculties in the accomplishment of a particular task, whether, for in-

stance, spelling should count twenty or thirty per cent of the total result, whether arithmetic should be valued at forty or at twenty-five per cent. The scientific method of determining these proportions is by actually giving all the tests involved to a group engaged in the same kind of work. The relative importance of the various tests can then be computed on the basis of the correlations which are obtained. The mathematics of this process is outlined in the Appendix.

Hiring by specification, as here described, is not entirely free from arbitrary and unscientific elements, and yet it can be seen that it is a long step in the direction of a genuinely scientific procedure. When a quantity of steel is required for manufacturing purposes, the first question is the exact function which that steel is to fulfill. When this is known, the proper specifications for steel which will serve that purpose are made and the order placed accordingly. The laboratory then makes the appropriate tests to discover whether or not the steel which is to be used has the characteristics specified. Much the same process must be applied to human beings if they are to be fitted for their work with the same consideration and care with which we usually select steel.

X

MACHINE OPERATORS

The third large division in the manufacturing process in addition to inspection and assembling is the operation of production machines. Finding operators for these machines offers one of the most difficult of all employment problems. The turnover among such operators is unusually large for a variety of reasons, most prominent among which is the monotony and strain of the work. To sit day after day watching or feeding a machine which does the same operation over and over again in an endless chain is indeed work which requires ability and temperament of a peculiar kind.

However, the problem is not merely one of finding individuals who can stand the strain; it is also one of selecting workers who can obtain the maximum output from the machines at which they are stationed. It is the general practice of production engineers to make a very generous allowance for the inefficiency of a machine; but as a matter of fact, this allowance should frequently be charged against the operator. For the inefficiency of a machine is in a large part determined by the ability of the operator. A slow or a poor operator means an inefficient machine, at least in the case of machines which are semi-automatic or entirely fed by hand. The writer has observed hundreds of hand-fed machines which were only fifty or seventy per cent efficient because the operators could not feed them fast enough. On the other hand, many

slow machines have been and are being tended by operators capable of feeding the fastest machines efficiently. This discrepancy is evidently due in large part to the fact that there has been no way of distinguishing beforehand between operators who are naturally quick and those who are naturally slow. To be sure, shops which are well managed will in time eliminate the workers who are too slow; but this is a long and expensive process. Besides, the process does not work so well the other way, and fast operators who are placed at slow machines are often content to remain there.

In attacking this problem, the first task was obviously to find some means which would make it possible to distinguish at the very outset between applicants who were able to operate fast machines and those who could not. A general survey of the work which had previously been done in this field by psychologists brought to light the Bogardus fatigue apparatus. This apparatus had been designed and put into use by Bogardus as a test for machine operators. ("American Journal of Sociology," XVII, 1912; "The Relation of Fatigue to Industrial Accidents.") Its purpose was not to distinguish between fast and slow operators but to detect the relation between fatigue among machine operators and industrial accidents. The apparatus consists of a small round table over which two arms are revolved at given speeds. At the edge of the table is painted a little square, and the person being tested is asked to take a small wooden cube of the same size and place it exactly upon this square. As often as the cube is put in place, one of the revolving arms comes around and knocks it off to one side of the table. The operator's task is to pick it up and replace it on the square before the next arm can come around and knock it off

again. The experimenter believed that an operator could do this more rapidly and successfully at the beginning of a day when fresh, than at the end of a day when fatigue had set in. He further believed that if this could be demonstrated, it would also follow that machine operators were more liable to accidents toward the end of the day than in the morning, for the same reason.

The manner in which this experiment was conducted and the merits of its results are not of particular interest here. However, the apparatus seemed very promising for the purpose of separating the slower from the faster operators. A similar apparatus was therefore constructed and tried out. To begin with, tests were given to twenty operators in order to familiarize the experimenter with the use of the apparatus, the giving of directions for it, and scoring the results. As a result of these preliminary tests, certain difficulties were discovered. First, the construction of the apparatus was such as to make accuracy of performance impossible. For instance, each time the arm struck the cube on the square it would knock it off onto a different part of the table. This condition became worse as the speed of the rotating arms was increased, and frequently the cube would be knocked entirely off the table and would have to be picked up from the floor. This factor might have been a desirable one, and a measure of the operator's resourcefulness, had it not been for a second difficulty. It was practically impossible to score the results. The operator hardly ever placed the cube exactly on the painted square, but each time the angle or degree of displacement was different, making it extremely difficult for the experimenter to make any score on the mistakes of the operator. Even if the observer had been able to estimate the misplacement in every

case, the speed at which the apparatus worked made it almost impossible even to see the cube's position after it had been placed; for the arm would cover the cube before the hand could be taken away. Sometimes, the hand was not taken away quickly enough and the revolving arm collided with it, slowing down its revolution. This would still further increase the difficulty of scoring. Add to this the fact that it required the experimenter's entire attention to keep the apparatus moving properly, and it will be seen that the difficulties of obtaining a proper score on an individual's performance were almost insurmountable. This difficulty naturally deprived the apparatus of much of its value as a test. A third important drawback was the difficulty of revolving the arms at speeds which were both constant and readily adaptable to the purposes of the test. The electrical control which was tried out was found much too troublesome and expensive for the purpose.

In spite of these difficulties, it seemed as if the principle of the test were correct and, therefore, it was decided to design a similar apparatus which would obviate the difficulties found in the original. In designing this test, the first step was to find out exactly what kind of work machine operators were doing. It seemed unreasonable from the outset to assume that one test could apply equally well to all kinds of machine operators, for the work of operators is as variegated as the work of clerks, stenographers, packers, assemblers, and others. If special tests were needed for these varieties of work, it seemed logical to suppose that machine operators of different kinds would also require different kinds of tests. Therefore, only one type of machine was chosen. The operation finally chosen was that of hand-feed dial machines. A dial

feed machine has a revolving table ringed with holes or pins which the operator has to keep filled with the parts upon which the machine is operating. In some shops these dials revolved very slowly and therefore did not require fast operators. In other shops they revolved very quickly and required very fast operators. The foreman of the largest of these shops stated that seven girls out of ten failed to make good as operators on his machines.

The test which was finally developed to meet these conditions was similar to, and still quite different from, the Bogardus piece. Its motive power consisted of an old graphophone motor. The advantages of this motor were its comparative compactness and simplicity. On the top of the graphophone dial was placed a round, sheet-metal disk, large enough so that it projected considerably over the edge of the motor box. Near the edge of the disk were cut two slots eight inches long and an inch and a half wide. These slots were fitted with slides which made it possible to regulate the size of the opening. Under this disk, and attached to the motor box in such a position as to be directly under the slots in the revolving disk, was placed a funnel. At the neck of this funnel a Veeder counter was attached in such a way that a one-inch steel ball dropped through the funnel would cause it to register. The object of the test was to revolve the sheet-metal disk so that the slots in its border passed over the mouth of the funnel at a certain number of revolutions per minute. As the slot passed over the funnel, the operator, or person being tested, was to drop the steel ball so that it would fall through the slot and into the funnel below it, where it would be registered. If the ball were dropped on the disk or at one side of the opening, it would naturally fail to register.

This apparatus overcame, to a large extent, the difficulties inherent in the Bogardus piece. In the first place, it was so constructed as to make possible a fairly accurate performance. If the steel ball missed the slot and fell on the disk, it was prevented from falling off by a raised rim. If the ball fell through the slot but missed the funnel, it was caught by a sort of apron which extended around the motor box. This apron was constructed at a pitch which quickly brought every steel ball to the front of the machine into a little depression from which the operator had to pick it up. The apron was made of tin, and was very noisy at the outset. However, it was later lined with heavy felt which subdued the noise very effectively. In the second place, this apparatus made it possible to obtain an accurate score. Every successful attempt of the operator to drop the ball through the funnel was recorded automatically, which meant, of course, that the failures were also registered. The latter was facilitated by a Veeder star counter attached to one corner of the motor box in such a manner as to engage a pin projecting from the bottom of the revolving metal disk. This counter registered the revolutions of the disk and, at the same time, the number of opportunities for dropping the balls given to the operator. The experimenter could therefore devote his entire attention to the operator or person being tested. A third advantage was the ease with which the revolutions per minute of the disk could be governed in contrast with the intricate and expensive control of the Bogardus apparatus. Fortunately, the range of the motor was exactly suitable for this purpose. Moreover, extensive trials showed that the disk would revolve at a constant speed for eighteen minutes without the loss of a single revolution. After the eighteenth minute, the speed gradu-

ally dropped off; but eighteen minutes was more than enough time for testing one subject. In addition to this, the difficulty of the test could be varied not only by increasing the revolutions per minute but by decreasing the size of the slot. By means of the slides, these slots could be so shortened as to obtain practically the same effect as that obtained by increasing the speed of the machine, though with far less effort.

The preliminary study of typical dial machines had revealed that the fundamental requirement was the ability to acquire a certain bodily rhythm in feeding material into the dial and in timing the movements of the hand and arm with those of the machine. Some operators acquired this rhythm very readily, others only after a long time, and still others never. The problem, therefore, was to detect these differences so that the most likely candidates could be placed at the most difficult machines, the less likely at the slower machines, and those who failed entirely at work of another kind. When the apparatus described was put into use, it soon became evident that it required a knack similar to that required by dial-machine operators, and also that it divided the people who tried it into radically different classes. The point which remained to be proved, however, was that those who were slow in this test were also slow as dial-machine operators and vice versa. In order to determine this, ninety-six dial-machine operators in three different shops were tested. One of these shops contained slow dial machines, the other two contained fast machines. Each operator was given three trials of two minutes each, the first two being given with the slot wide open, the third with the slot half closed. The revolutions per minute were kept constant throughout. The results were then compared with the piece-work

earnings of these operators, averaged over periods of from one to four months, depending on the shop and the number of months of production available. In one of the three shops a night shift had recently started work and tests were given to twenty-one women on this shift. Many of these women were immigrants who could not understand English, and quite a number were elderly women. However, comparatively little difficulty was experienced in showing them how to perform the test. The results in all cases showed that there was a marked correspondence between ability in this test and ability to feed dial machines. The results in all groups may be summarized as follows:

CORRELATIONS

	Number of operators tested	*1st trial*	*2nd trial*	*3rd trial*
First Shop.....	25	.36	.40	.54
Second Shop....	22	.43	.14	no trial
Third Shop.....	28	.41	.28	.43
Third Shop.... (night shift)	21	.22	.22	.50

The correlations found are not high in every case, but all the correlations obtained on the third trial are uniformly good. This may be due to the fact that the first two trials were too easy, whereas the third trial, with the slot only half open, more nearly approached the actual operation in difficulty. It also seems likely that some operators were so set in their regular habits of machine operating that they could not readily adapt themselves to the changed conditions of this test. The interference of previous habits is a well-established psychological prin-

ciple. Moreover, it appeared that some of the operators had been working at dial machines for periods of from two to ten years, while others had been working only a few months. Naturally, the old workers would be the better operators, even though some of them may not have been as promising as some of the newer girls who had not yet had much experience. All these factors entered into the situation, and still there was a consistent correlation. These correlations were high enough to permit the separation of all operators into two classes, the fast and the slow operators, and this classification suggested the basis on which applicants could in the future be assigned to fast or slow machines.

That this test distinguished between slow and fast operators was still further borne out by the fact that two of the four shops mentioned contained slow operators, who did correspondingly slow work in the tests. One shop had slow machines while the night shift of the other shop had very slow operators. Correspondingly, the average performance of the night shift in the test was between twenty-five and thirty per cent poorer than that of the day shift which was made up of fast workers.

To check the results still further, the test was given to sixteen applicants chosen at random from the employment office. Only three of the sixteen attained the average made by the operators in one of the shops, thus tending to confirm the statement made by the foreman of this shop that seven out of every ten girls sent in for this work failed to make good.

Besides the test already described, the Scott three-hole test was given. This test consists of a board set at an angle of 45° with three holes six inches apart forming an equilateral triangle. The task of the subject is to push

a short plunger into each hole in succession as rapidly and accurately as possible. A Veeder counter at the bottom of each hole registers the successful thrusts. The results from this test showed very little agreement with the piece-work production of the dial-machine operators. Neither was there any agreement between the performances in the three-hole test and in the machine test. This seems to indicate that the three-hole test does not apply to work of this particular kind.

Much has been said and written about the sense of rhythm and its effect upon continuous repetitions of the same operation. The real nature of rhythm and its connection with, or contribution to, work is, however, only faintly understood. Nevertheless, it was perfectly obvious to the observer, in watching various kinds of work, that the sense of rhythm frequently does play an important part, especially in work which is based upon some artificial rhythmic stimulus, like the rhythmic action of a machine. The body and limbs seem to lend themselves entirely to the rhythmic completion of a continuous cycle of movements. Now, this tendency was very conspicuous in the use of the machine operator's test. Those who did well in this test seemed almost at once to fall into a bodily swing which enabled them to govern their motions with much greater ease and certainty than those who did not. Their manner of dropping the ball through the slot at the appropriate instant seemed to be mechanical rather than studied, and they maintained a poise and control which those who lacked this rhythmic swing did not have.

The conclusions to be drawn from this experiment have already been indicated. In the first place, by means of this test, it was very clearly demonstrated that there was a distinct difference between the average of those who

came into the employment office and those who finally made good as operators. Secondly, an even finer distinction was made between the groups of operators who had survived at fast machines and those who were working at slow machines. Thirdly, in every group tested, whether slow or fast, there was a significant correlation between piece-work earnings and the performance in the test. On the basis of these conclusions, therefore, it was decided to use this test in the employment office in order, first, to eliminate the slowest and most clumsy operators, and secondly, to classify the better applicants for machine work of this kind into two groups, those for work on fast machines, and those for work on slower machines. This is now being done.

XI

APPRENTICE TOOLMAKERS AND MACHINISTS

The choice of apprentices is one of the most important of all problems of selection. In most other cases, a mistake is discovered soon after the worker begins to apply himself to the work for which he has been hired. The apprentice, however, is not expected to show much ability or skill at the outset. He is engaged as a pupil rather than as a worker, and it may be months before he begins to give definite promise of success in his chosen trade. The usual duration of an apprentice course is four years and apprentices are bound for the period of the course. The training and instruction spent upon them and the equipment placed at their disposal make mistakes of selection in this field very costly indeed. The problem of selection, therefore, resolves itself into an attempt to choose, at the very beginning, the boy who is likely to succeed in the long run.

Moreover, it is becoming increasingly necessary to exercise the same degree of care in the choosing of men for a similar purpose. The immediate necessity for toolmakers and machine-tool operators has so far exceeded the supply naturally resulting from apprentice schools that it has been found advisable to begin intensive-training shops. The purpose of these shops is to take green men and, in the course of a few weeks or months, train them to do the more simple work of toolmaking or handling a machine tool. Where intensive training of this kind

is practiced and where the need for trained men is imperative, it is all the more urgent that those to whom this training is given should be men who are able to assimilate it.

The experiment upon which this chapter is based was performed in a shop designed to give a short course of intensive training to prospective machinists and machine-tool specialists. Three groups of men comprising thirty-five in all were tested. Five tests were given and three of these showed a consistent correlation with the rank of those tested. These three tests were the Stenquist mechanical assembling test (see Chapter VII), the cube test, and a form-board test based on test number 51 but much longer and more involved. The cube test consists of a three-inch cube, painted green on the outside. The cube is cut into twenty-seven one-inch cubes. The large cube is placed before the subject and he is told that it will be demolished into twenty-seven small cubes and that he must restore them so that the large cube looks exactly as it did before, viz., green on all sides with no wood color exposed. Each subject is allowed to do this twice. The more complex form-board test really consists of two form boards. On one board, the cut-outs are promiscuously arranged, on the other they are arranged in a definite order; but the same cut-outs are used for both boards, the task being to place them from one board into the other. Incidentally, this solves the problem of always presenting the cut-outs to each subject in exactly the same position.

These tests were given first to the twelve men composing the day shift. The members of this shift with one exception had been working from three to five weeks. All of them had begun as green hands. After the tests had been given, the chief instructor and foreman of the shop

was asked to rank the men in the order of their *ability to learn the prescribed work.* At the same time, he was asked also to rank his men according to the opinion he had formed of them when they first came into the shop. The method by which these ranks were obtained is probably worth describing for the aid which it may be to other experimenters.

It had been found that, usually, when a foreman is asked to rank the men or women under him, he is unable to rank them in any but the crudest form. He may call one group good, another fair, and a very few, poor. This crudity is often due to the fact that it is extremely difficult to make an accurate classification mentally. In order to overcome this difficulty, the name of every person tested was written on a small card. The pack of cards was then handed to the foreman and he was asked to divide all the men into three equal groups, according to their ability. This was comparatively easy. Having done this, he was next asked to take each group and arrange the cards in it in the same way. Thus, by dividing the work and by making the mechanics of the classification simple and helpful, an unambiguous and probably more reliable result was obtained. The tests were then also ranked and compared with the ranking of the men being trained. The correlations found were: plus .81 for the form-board test, plus .75 for the cube test, plus .84 for the Stenquist test, and plus .90 for the three tests combined. These correlations are unusually high, but they were based not on the foreman's first impression of the men but his mature opinion after having been in close contact with them during several weeks of intensive training. (The foreman knew nothing whatsoever of the performance of the men in the tests when he made his rankings.) The ranking of

the foreman based on his *original* impression of the men correlated with the three tests only to the extent of plus .28, thus showing that in the course of training the men, his opinion of them underwent a considerable modification, a modification which resulted in bringing his *final conclusive ranking of the men into very close harmony with the ranking immediately given by the tests.*

Several particular examples were very conspicuous. A young soda-fountain clerk who had been admitted into this course was originally considered very promising by the foreman, so much so that he was retained after the completion of the intensive training as a handy man around the machines. The foreman's original ranking of this man was four. In the course of time the foreman found that the ability and intelligence which he had attributed to him were considerably in excess of what he really possessed. Indeed, the foreman expressed himself as quite disappointed in him and finally ranked him as nine. This happens to be exactly the rank which was immediately given to the man by the tests. It seems that the superior education and polish which he possessed, and a pleasant, willing disposition, had enabled him to make a very good impression on the foreman at the outset and during the first few weeks; but these virtues did not have the same influence on the tests as they had on the foreman. Another conspicuous case was that of a sixteen-year-old boy who began in the shop as a helper and apprentice. This boy was overgrown, rather slipshod in appearance, and gave one the impression of not being very wide-awake. The foreman's original impression placed him tenth among all the men in the shop. In the tests, however, this boy was extremely bright and successful, ranking first in one, second in another, and fifth in the third. The foreman's

opinion of this boy, after seeing his work for a month, was such as to raise his rank from tenth to fifth. If the indications given by the tests are reliable, this boy will rise still higher in the opinion of the foreman. There were several similar cases. In one, the foreman's original rank was eight, his subsequent rank four, and the rank in all the tests four. Another man was ranked by the foreman first as five, then as twelve, and by the tests as eleven. Still another was twelve, then eight, and six in the tests. The decided trend was to confirm the value of the ranks which had been obtained on the basis of the tests. The eleventh man according to the foreman was twelfth according to the tests; the first, first; the tenth, ninth; the second, third, etc. In brief, the testimony of the tests, given immediately by a half hour's examination, was a remarkable forecast of what the opinion of the foreman-instructor was to be after having known the men and trained them intensively for a period of several weeks.

No conclusive decision as to the value of these tests can be based upon only twelve cases. However, it is almost impossible to obtain a large number of apprentices who have been trained under uniform conditions, for an equal length of time, by the same instructors. Preliminary to the experiment under discussion we had given seven tests to over two hundred apprentices in two of the largest manufacturing companies in the country. However, the difficulties encountered in obtaining a uniform ranking of each apprentice were so great that it was practically impossible to compute the significance of the tests. The intensive-training shop presented greater uniformity of conditions than had so far been met with.

In addition to the day shift there were two evening classes. The pupils in these classes were tested and the

results computed in the manner previously described. Below is a table showing the correlation between the final rankings of each foreman and the ranking based on three tests taken together:

CORRELATIONS

1st Group (12)	.90
2nd Group (11)	.65
3rd Group (12)	.50

The correlations in groups two and three are not as high as those in the first. However, group two had met only sixteen times which, at two and one-half hours a session, meant only four days of actual work. The third group had met only twelve times, which meant only three days of actual work. Consequently, although the correlations between the opinion of the instructors and the rank of the pupils in the tests are already significant, their true significance cannot be stated until more time has elapsed. It may or may not be significant that the trend of the correlations varies directly with the length of time which has expired.

In order to obtain a true estimate of the ability of a group of apprentices and trained workers, it is necessary to give to the entire group a thoroughgoing practical examination in the work which they are supposed to have learned. Very few apprentice schools make a practice of this precaution. They assume that when a boy has passed through their various grades and classes of work, he is qualified to serve as a full-fledged journeyman. This assumption is patently unjustified. Moreover, it increases the difficulty of obtaining reliable information about the relative abilities of a class of apprentices and

consequently the difficulty of discovering the value of a certain group of tests.

Some apprentice shops take it upon themselves to give a test to those who wish to enter. The test usually is one in the essentials of arithmetic. Naturally, a prospective toolmaker should be able to perform certain mathematical operations before he is allowed to enter the course, and the best way in which to determine this is by an actual mathematical test. (See Appendix, test number 47.)

The results of this experiment indicate a very decided significance in the tests applied. One of the most important facts about these tests is that they have nothing whatsoever to do with the acquired ability or education of an individual in the work of toolmaking. The foreman-instructor of the first shop, for instance, an expert toolmaker, was excelled in the tests by more than a third of his men including the sixteen-year-old boy. The purpose of these particular tests, as distinguished from the trade tests which will be described later, is to detect a person's innate ability, the faculty for thinking in ways which will be of value when applied to the work of a machinist or toolmaker. As has been stated at the outset, they are intended to serve as a forecast of what an apprentice will be able to do after he has been trained for a considerable length of time.

XII

GENERAL INTELLIGENCE

A Dialogue

CHARACTERS

MR. WILLIAMS: *Manager of Workers' Service Department.*
MR. LAMBERT: *Head of Employment Division.*
MISS NELSON: *Head of Psychological Section.*
MISS HURLBUT: *Psychological Examiner.*

MR. WILLIAMS: If you were asked, Mr. Lambert, to name the one most important fact about an applicant, what would it be? I mean, if you were compelled to base your selection of applicants upon a single quality, which quality would you choose?

MR. LAMBERT: I should choose intelligence, by all means.

MR. W: Yes, I believe that I should too. And I believe that most employment interviewers would also look for intelligence first. What do you think, Miss Nelson and Miss Hurlbut?

MISS NELSON: Perhaps I could answer that question better if Mr. Lambert would tell me just what he means by intelligence.

MR. L: Why, Miss Nelson, if you don't know what intelligence is I don't see how I or anybody else can tell you. Intelligence is just plain intelligence.

MR. W: That is a perplexing proposition, Miss Nelson;

but maybe we can help out by giving you a few synonyms or brief definitions of the word. I am sure that Mr. Lambert could do that. For my part, I should like to suggest mental alertness, the ability to analyze a situation and also to follow instructions.

MR. L: I suppose that does cover the ground pretty well, only I should say that intelligence was simply ability to learn—to *catch on* or *take hold* as the foremen would say.

MISS N: And would you apply these definitions to all intelligence whatsoever?

MR. L: Yes, I should. Except, of course, that there are degrees of intelligence just as there are of everything else. Still I believe that all intelligence can be boiled down to ability to learn.

MISS N: Then what would you say to a case like this? When I taught school, I had some children who were very good in arithmetic. They could learn to do a problem in half the time usually required by the slower pupils of the class. They seemed to have a special faculty for *catching on*, as you termed it, or for *taking hold* of arithmetic. And yet, these very same pupils, when it came to geography, showed the utmost denseness. On the other hand, I had pupils who were very good in geography and very poor in arithmetic. Now which of these pupils would you call the more intelligent, Mr. Lambert, those who could learn arithmetic best or those who could learn geography best?

MR. L: I don't think that I should call either more intelligent. I should simply say that each group was intelligent, but in a different way.

MISS N: That is exactly what I thought, and that is the problem which always confronted me in my school work. Every pupil seemed to have his own peculiar aptitudes.

Some were most intelligent in arithmetic, others in spelling, still others in geography, some in English, some in manual training, and so on. To be sure, there were pupils who did uniformly well in all their subjects, and some who did uniformly poor work in everything; but they seemed to be the exception rather than the rule. Even the most stupid or most intelligent seemed to have especial preference or excellence in *some* line of work. Now, take your own boy, Mr. Lambert. When I had him in the eighth grade I remember distinctly that he was very fond of arithmetic and manual training and had very good marks in these subjects, but he did not do very well in spelling and in grammar.

MR. L: You are right. And since he has gone to high school his marks in English literature and rhetoric have been very poor, but he has led his classes in mathematics and physics. He seems to have a peculiar bent toward the sciences.

MISS N: That is what I expected of him. My former pupils, those whom I can follow, are all developing in different directions. But how would you define the intelligence of such pupils? Would you average up their abilities to learn in the different subjects and call the result their general intelligence?

MR. L: Why, I suppose we should have to.

MISS N: Then your son, in spite of his brilliance and promise in the sciences, would be brought down to a much lower level of intelligence by his inability to learn the languages.

MR. L: I suppose so. But that won't worry me if he turns out to be a first-class chemist or engineer.

MR. W: I think I see what Miss Nelson is driving at, and maybe I can help her out. When you are interviewing

a candidate for work, Mr. Lambert, you usually have in mind some particular kind of work, I believe?

MR. L: Yes. Nearly every applicant has a certain choice and we try to follow that as much as possible.

MR. W: Suppose a man applies for work as an engineer. We have just admitted that intelligence is the most important thing to look for. Would you, in interviewing this man, look for his general intelligence—that is, for his average knowledge of English, geography, history, arithmetic, engineering, and so forth—or would you be interested in his engineering ability alone?

MR. L: Primarily the latter. As long as he has ability as an engineer, it wouldn't matter much if he were below the average in other respects.

MR. W: And if a candidate applies for a job as toolmaker, would you be interested in his general intelligence, or in his ability as a toolmaker?

MR. L: Why, in every case when I interview a man I look for some special kind of intelligence, because almost every job requires intelligence of a different kind.

MISS N: Then you don't hold it against a man if his intelligence in other respects is likely to bring his general average down?

MR. L: Certainly not. We can't all be good in everything, Miss Nelson, as you yourself have just shown us.

MR. W: Miss Hurlbut, you are the latest among us to come from college; you ought to be able to give us the last word of science on this subject. What does psychology have to say about intelligence?

MISS HURLBUT: As I remember, most psychologists define intelligence as the ability to profit by trial and error.

MISS N: That is as much as to say the *ability to learn.*

And what do you think this definition adds to that of Mr. Lambert and Mr. Williams?

MISS H: I am afraid it is just as vague and ambiguous. It doesn't seem to say anything at all about ability to learn in a special way or in a particular subject, which is what you have just been talking about. Still, not all psychologists give this definition. There is a later school of applied psychologists who define intelligence in a way which I am sure will meet your requirements.

MR. L: And what way is that?

MISS H: Well, I can't seem to remember that they exactly *define* intelligence. They measure, rather than define it. By means of tests such as the Binet-Simon series and other intelligence tests they can tell pretty accurately how much intelligence a person has.

MR. L: Oh, yes. I have heard about the intelligence tests. They used them in the army very extensively. And the Binet-Simon series is used in many schools. But are we not using the same tests here?

MISS H: Not any more—except that we make occasional use of the Binet-Simon scale.

MR. W: Indeed? Please tell us a little more about the Binet-Simon tests, Miss Hurlbut. What are they like?

MISS H: Well, they require a person to repeat sentences that grow longer and longer; and numbers of increasing size. And they ask questions as to what you would do if you were late to an appointment, or what path a cannon ball would take if shot from one level to another; and the difference between words like poverty and misery, evolution and revolution; and the meaning of words in a long vocabulary; and a great many other things. There are different tests for every age. The vocabulary test is the

most important, however. It is supposed to be worth about forty per cent of the total.

MR. L: My son would probably get a pretty low mark in that test.

MISS N: And quite likely in the whole series, because there are very few arithmetical tests in the Binet-Simon intelligence scale.

MR. W: Are these tests supposed to be for general intelligence?

MISS H: Yes. There are a great many little tests and the total average gives the general intelligence or intellectual age level of a person.

MR. W: But isn't that what we have just been talking about? Mr. Lambert says that he is not looking for general intelligence in the employment office but for specific ability like that of a toolmaker, or accountant, or engineer.

MR. L: Oh, I don't mean to say that we don't want general intelligence. I believe that general intelligence is a good thing. But usually we have to be contented with some one who is not so intelligent in a general way but more so in his own line. This is an age of specialization, as you say, and we are only too glad if we can get men who know their own specialty and know it well.

MR. W: It seems to me that this matter of general intelligence is largely a matter of education and depends upon the amount of schooling a man has had.

MR. L: Yes, and we have many a workman who is an expert in his line who hasn't had a grammar-school education and who would make a pretty poor showing in general intelligence.

MISS N: What finally convinced me that we, in our own psychological work, were on the wrong track in this

matter of general intelligence were the results of some of our occupational and trade tests. When we began giving these tests we believed in general intelligence and we used to include so-called intelligence tests. However, we soon found out that our idea of intelligence and the kind of intelligence required by a certain job did not agree at all. And in all of our tests, we found that some people did specially well in one kind of test while others did well in another kind.

MR. L: Well, that agrees with my experience. As I just said, we in the employment work have to hire people on the basis of their ability in one particular line. We can't expect them to be generally intelligent.

MR. W: But how about imbeciles and idiots, Mr. Lambert? Certainly you could weed them out by means of an intelligence scale.

MR. L: Miss Nelson and Miss Hurlbut can tell you more about that than I because they have been giving tests for that very purpose.

MISS N: Yes, we used to think it very important to eliminate people of that kind and we gave tests with that in mind. But out of over six thousand applicants we have tested in the last year, only three were morons, as they are called; and as it takes from an hour to an hour and a half to give only a part of the intelligence-scale tests, we soon gave up using them. It is possible to detect morons roughly by almost any test, and especially by means of the directions which go with the test. If the ordinary tests prove too much for them we can make use of the intelligence scale.

MR. W: What became of the morons you found?

MISS N: We assigned them to some simple machine work and they turned out to be excellent operators. They

were very quiet and steady. One of them, by the way, we discovered by her attempt to do the hard-directions test. She stumbled along until she got to the direction: "Tell where the sun rises, in the east or in the west?" She pondered over this for a while, and then remarked: "That's a hard one." "Why, don't you know where the sun rises?" asked the examiner. "No. I used to know but I forgot," was the answer. Yet we found that this girl had the ability to do something and do it well.

MR. W: But how about the higher grades of intelligence?

MISS N: There again we find that no matter how high a person's general intelligence may be, it does not follow that he will be especially intelligent in a certain kind of work. For instance, another girl who took the test I mentioned came to the same question and put down as her answer: "The sun does not rise, but the earth revolving around its axis makes it seem as if it came up in the east." This girl was a high-school graduate and above the average in intelligence, but she did not make good at the clerical work for which she was hired.

MR. L: But how about the tests which you *have* been giving? Don't you test for intelligence?

MISS H: Yes, Mr. Lambert, but not for general intelligence. We give tests of different kinds for different purposes; of one kind for inspectors, tests of a quite different kind for assemblers, and tests of still another kind for clerks, and so on. Why, even our clerical tests, which we began giving to all clerks, soon proved to be too general. For instance, we used to place a good deal of emphasis on ability in the filing tests, but we soon found that many clerks could do the work expected of them very well without being good in filing. The same thing happened

in a good many other cases, so now we have adapted our tests to test only for the special abilities required. As long as we failed to do this, we hired a good many applicants who were high in general intelligence but not high enough in the particular ability required of them.

MISS N: Yes, and we rejected many who were low in general intelligence who would have done very well at certain kinds of work. You see, people have a very strong tendency to think of general intelligence as they do of education. They think of it as a thermometer, and they believe that the higher the grade or degree, the higher the intelligence. They carry the same idea into industry; for they believe that the positions in an industry are graded according to degrees of intelligence.

MR. W: Well, are they not?

MISS N: Certainly not. Jobs and positions in industry are based not on *degrees* of intelligence, but on *kinds* of intelligence or ability. To be sure, every kind of ability has degrees; but it takes much finer tests than general-intelligence tests to determine what these are.

MR. W: What do you think of that, Mr. Lambert?

MR. L: I believe that Miss Nelson is right. As I said before, the employment office is interested first of all in finding out what kind of ability an applicant has, and what he can do best. As you yourself have often said, Mr. Williams, this is an age of specialization. We certainly find it so when it comes to filling the demands and requisitions for men and women to fill the many kinds of positions which we have here. And it seems that Miss Nelson and Miss Hurlbut have quickly reached the same opinion which I have had for a long time without quite knowing it, although they came by it in a quite different way. What is your opinion, Mr. Williams?

MR. W: Well, I confess that I had something of the same opinion from the beginning; but I wanted to find out especially what you, as a practical employment man, and our more inexperienced and, as we thought, more theoretical, psychologists thought about the subject. I expected to find some disagreement between the two viewpoints but I was very pleasantly surprised. We began this discussion by saying that the one most important fact about an applicant was his intelligence, and we defined intelligence in general as the *ability to learn*. All the other definitions seemed to boil down to that. But now we seem to have agreed that there is no such thing as general intelligence, and that, if there were, it would be of little use to us in employment work because we are interested in specific abilities or *kinds* of intelligence and not in degrees of intelligence *per se*. Is that a fair statement of the argument?

MR. L: Yes, it suits me.

MR. W: In that case I can only repeat the sentiment which you attributed to me a few minutes ago, Mr. Lambert. This is certainly an age of specialization.

MISS N: Yes, Mr. Williams; and that is just the point.

XIII

LANGUAGE AND LITERACY TESTS

Hitherto, a large proportion of the tests used by psychologists to detect intelligence have been language tests, or *verbal* tests, as they are usually designated. These tests are based entirely upon the use of words, and ability in them rests upon the degrees of quickness with which the individual can associate certain given words with other related words. The following samples of well known and very popular verbal tests will serve as illustrations:

1. PART-WHOLE RELATION

Write after each word the name of the object of which it is a part, as in the first two samples.

page	book
blade	knife

etc.

leaf
finger
wheel
city
inch
letter

2. NAMING OPPOSITES

Write after each word in the column below, its opposite, as in the first few samples.

hot	cold
large	small
	etc.
white	
good	
fast	
friend	
catch	
height	

3. VERB-OBJECT

Write after each word in the column below the word which would be a natural object, as in the first few samples.

read	book
bake	bread
	etc.
sing	
wash	
chew	
learn	
mail	
sweep	

4. ADJECTIVE-NOUN

Write after each adjective below the name of an object to which it refers, as in the first few samples.

sharp	knife
hot	fire
	etc.
dusty	
blue	

raw
fine
deep
ripe

5. CONTEXT TEST

Fill in each blank space in the paragraph below with the most appropriate word.

The only thing that.....in our power to.....is to.....the.....advantageous use possible of the personal.....we possess, and accordingly to follow such.....only as will call them into....., to .....after the kind of perfection of which they admit and to ..... every other; consequently, to choose the....., occupation, and manner of.....which are most.....for their development.

6. COMPLETION TEST

Complete the following sentences, by adding a subject and an additional adjective, as in the first samples.

A trunk is convenient and portable.
Her taste is refined and delicate.
is ridiculous and
is interesting and
is important and
is probable and
is tapering and

Besides these there are other similar tests such as the vocabulary test, the mixed or miscellaneous association test, the free association test, the action-agent test, and

so forth. The essential feature in all of these tests is the association of words or phrases with each other under the guidance of some dominant idea.

In relying so largely on tests of this type, psychologists have been very much under the influence of the *literary* or academic tradition. A majority of the earlier tests were devised in institutions of learning, where they were tried out on members of the student body. Moreover, the study of psychology has been more closely linked with academic and liberal arts courses than with the strictly scientific departments. (Until recently psychology has been considered a phase of philosophy.) Now, the education given by academic and liberal arts schools consists largely of the inculcation of certain general ideas on general subjects in such a way that the student shall be able to talk and write about them with some degree of fluency. The accepted way still in which to judge the amount of knowledge acquired by the college man is to test his verbal ability in certain general topics of economics, sociology, English literature, philosophy, psychology, and so forth. Chemistry, physics, and mathematics are shining exceptions to this rule, and, coincidentally, these three subjects are the most difficult for the average student. With the predominance of the verbal or the literary tradition in education, it is not strange that many psychologists, so closely linked up with this tradition, should have so decided a leaning toward the use of verbal or language tests. The tremendous popularity of Muensterberg's association tests still further accounts for the present popularity of verbal tests.

Since psychology has emerged from its strictly academic environment and has begun to apply itself to the more realistic varieties of industrial life, the inadequacy and

limited scope of verbal tests is becoming more and more apparent. The reason for this is that the vast majority of industrial occupations do not depend so much upon verbal agility or the gift of words, as upon ability of hand, eye, foot, trunk, and combinations of these. This does not mean that the activities involved in these occupations do not require mental agility. As a matter of fact, they frequently require intellectual ability of an extremely high type. However, the kind of mental agility involved is not necessarily the kind which expresses itself in a fluent use of words. Scientists, for instance, or inventors may be very poor in verbal tests and yet highly remarkable for their ability to formulate scientific laws or devise intricate and ingenious mechanical devices. Many a toolmaker or draughtsman is very slow in naming the opposites to a list of words such as that given, but very quick in setting up and turning out a difficult piece of work or in making a complete drawing from a rough sketch. To the unbiased mind of the layman, instances like these are probably too obvious to need elaboration. But even the psychologist, setting out with a penchant for verbal tests, is bound to see in time their comparative insignificance when applied to a vast majority of human activities.

Looked at from another point of view the verbal tests described are entirely too general to be of much value in differentiating between the various abilities required by the various kinds of work. Verbal tests as used hitherto have been aimed at the discovery of general intelligence rather than specific abilities. The so-called Trabue Language Scale is a good example of this tendency. However, agility in the use of words is only one kind of ability and is by no means synonymous with general

intelligence or general ability. How trenchantly this fact is indicated by the somewhat derisive epithet *gift of gab.*

The use made of verbal tests in the course of these experiments has demonstrated that their value is confined to kinds of work requiring verbal ability. In the case of typists and stenographers, for example, context tests were found to be particularly apt. This was to be expected, since ability in typing and in stenographic work involves ability in the use of words. The grammar test may also be placed in this category. Verbal tests were also found to be significant in connection with the work of certain kinds of clerks, particularly correspondence, telephone, and inquiry clerks. In general, verbal tests should be very significant in all cases where verbal ability is essential. Salesmen, orators, promoters, writers, ministers, actors, entertainers, and so forth are all greatly dependent on the gift of words, and to the occupations and professions which they represent language or verbal tests are particularly applicable.

If verbal tests are to be applied to occupations where verbal proficiency is not a chief requisite, they must be adapted to the limited vocabulary of the particular class of workers to be tested. Every trade or job has certain words or phrases, the names of specific tools and processes, which are peculiar to it. Almost every worker is at home in the vocabulary of his own trade, more so than in a general or literary vocabulary. Therefore, instead of verbal tests consisting of general words and meanings, we can have tests made up of the words and names characteristic of a given job. The context test, for instance, can be arranged for toolmakers somewhat as follows:

CONTEXT TEST FOR TOOLMAKERS

a. To make a pulley, the work is done on a..... First set the work in a..... Then drill a hole through the center of the work and enlarge it to the correct diameter with a..... In order to turn the face of the pulley, it is forced upon an.....and placed between the.....of the lathe. It can then be.....to the proper size and shape.

b. To make a reamer, cut off a piece of stock to the proper length. Then put a.....in each end. Place .....on one end and place the work between..... of a.....and turn down to the proper diameter.

c. To cut teeth, a.....machine is used. First place an.....and tail stock upon the..... of the.....machine and adjust the proper.....in the spindle. The number of.....cut is determined by the number of turns the handle of the..... is moved. A shank mill or.....cutter may be used. If a.....cutter is used, it is placed upon an.....

KEY TO TEST

a.	*b.*	*c.*
1. lathe	1. center	1. milling
2. chuck	2. dog	2. index head
3. reamer or boring tool	3. centers	3. table
4. arbor	4. lathe	4. milling
5. centers		5. cutter
6. turned		6. teeth
		7. index head
		8. angle or fluting
		9. fluting
		10. arbor

It will be seen that this is not a test for general verbal ability but for the specific ability to name the proper tools

and processes which are concerned in the work of a toolmaker. The same principle can be followed in a wide variety of other occupations. Another adaptation of a language test is the following part-whole relation test:

PART-WHOLE RELATION

The names in the left-hand column represent the parts. Each of these is to be read to the applicant who is to state the whole of which it is a part. The name of the whole is given in the right-hand column.

"T" mill	milling machine
chuck	lathe or milling machine
centers	lathe or grinder
long-tailed dog	lathe
index head	milling machine
face plate	lathe
steady rest	lathe
clapper box	planer, shaper
saucer wheel	grinder
saddle	planer
tail stock	lathe or milling machine
strap	milling machine or planer
chasing dial	lathe
vertical head	milling machine
spiral finishing tool	planer or shaper
parallel	milling machine or shaper
spotting tool	lathe
collet	milling machine
compound nest	lathe
white lead	lathe
magnetic chuck	surface grinder
mandrel	lathe or milling machine
diamond	grinder
forming tool	lathe
cup wheel	grinder
spring bushing	lathe or milling machine

finger	planer or cutter grinder
hob	milling machine
tool post	lathe
gang cutters	milling machine
boring tool	lathe
nut arbor	lathe or milling machine
splining attachment	milling machine
thread dog	lathe or milling machine
rotary attachment	milling machine

Another variation of the verbal test is a slight modification of the vocabulary test. Instead of asking the applicant to define the meaning of a list of words, a list of names of various kinds of tools is presented to him, and he is asked to check those which apply particularly to his trade. The following list is an illustration:

Tools used by a toolmaker are to be checked

file	mallet
drill	nail
reamer	jack plane
chisel	plumb
brace and bit	emery cloth
hammer	wrench
trowel	winch
sandpaper	miter box
square	dividers
white lead	gauge
chalk	wattock
awl	level
gimlet	shaver
knife	pliers
soda	drift pin
strap	spanner wrench
dog	screw driver
putty	protractor
arbor	micrometer

finger	caliper
cutter	rule
saw	hand planer
hatchet	adze

In this manner some idea of a toolmaker's tool vocabulary may be gained.

Vocabulary tests have been among the most popular of language tests, especially among laymen. However, from the practical and scientific standpoint, such tests are very inadequate. In the first place, it is extremely difficult to give a vocabulary test. In order to make it significant there must be a long list of words to define. Now, if these words are to be defined in writing, the test takes too much time. If the words are to be defined orally, the person to whom the definitions are recited has to make rapid and arbitrary decisions as to their correctness. There is no objective certainty in such a procedure. In any case, the test does not lend itself to scientific rendering and marking. Moreover, even if there were not these difficulties, there is a grave question as to the value of such a test for practical purposes. A large vocabulary is not necessarily a sign of mental ability or reasoning power. It may be simply the inevitable concomitant of a broad general education or course of reading. On the other hand, men with a very poor vocabulary may have unusual ability in a great many different directions. If the vocabulary test is to become at all significant, it, too, will have to be specialized to meet special needs. For instance, an electrical engineer requires a very definite vocabulary in certain respects. So do the mechanical engineer, the chemist, the metallurgist, the fuel engineer, etc., etc. Vocabularies which are made up of words relevant to a particular kind of task or ability will be of much greater value for

employment purposes than general vocabulary tests or vocabulary tests *per se*.

Although specific language tests like those given have been of undoubted value in the selection of employees, experience has hitherto tended to prove that their chief value lies in their ability to eliminate the most unfit. Those who know nothing whatsoever about a certain kind of work will fail signally in these tests, and thereby eliminate themselves from the necessity of further interviewing. On the other hand, there are those who have a bowing acquaintance with a certain kind of work, sufficient to enable them to pass the language tests. Actual trials, however, may reveal that their verbal ability was somewhat in excess of their actual ability. In spite of this limitation, language tests, when properly devised and applied, are of great help in the selection of the best workers available.

LITERACY TESTS

One of the great industrial problems of the day is the problem of literacy. When a foreman or gang boss gives a set of orders and finds a little later that his orders have been entirely misunderstood and that as a result great damage has been done, his patience is sorely tried. And yet this is only a single, though typical, instance of the results of illiteracy. Recently, this problem became particularly acute in a large manufacturing concern, the principal difficulty arising over the inability of many machine operators to make out their own work tickets. In order to make out these tickets, only the simplest knowledge of arithmetic and English was required. Nevertheless, so frequent had been the mistakes in addition and subtraction and in failure to understand the

use of the card, that it was decided henceforth to eliminate all applicants who were below a certain standard of literacy. Before deciding upon that standard, it was essential to try out a number of tests of varying difficulty. The test which was finally decided upon was as follows:

1. Name _____
   Address _____

2. Add $\begin{array}{r} 17 \\ +\ 11 \\ \hline \end{array}$ Subtract $\begin{array}{r} 178 \\ -\ 12 \\ \hline \end{array}$

3. (a) Draw a line through the biggest number. 3 86 28
   (b) Write a number larger than 107. _____
   (c) Put the number 63 on the longest line. — _____ _____

4. (a) Copy "When I am hurt I go to the hospital."

   _____

   _____

   (b) Write these numbers on the lines on the right-hand side.

_____ 2 _____
_____ 17 _____
_____ 89 _____
_____ 346 _____
_____ 5894 _____

Basis for marking

1.	Legible figures	15 points
2.	Legible letters	15 "
3.	Correct arithmetic	22 "
4.	Correct copying	22 "
5.	Spelling	11 "
6.	Judgment	15 "
		100 points

This test was given first to thirty machine operators in a large shop. It was found that some of the best operators were poorest in this test and vice versa. In other words, literacy was not essential to operating ability. It was obvious, therefore, that if this test were used as a basis for selection, some extremely good operators would be eliminated. For this reason, it was decided to give the tests in the employment office in an experimental rather than in a final way, pending the further determination of the practical results.

Over one hundred applicants were given this test and hired regardless of their work in it. At the same time, however, the spatial perceptions form-board test described in Chapter IV was also given. The value of this test was immediately apparent, both because of the ease with which it could be given and the qualities which it tested. Any individual, of any tongue, could understand quickly the essential problem; namely, putting the pieces back into their proper place. And in doing this, a certain kind and degree of intelligence were also involved.

From the outset, it was evident that there was no agreement between literacy and ability in the form-board test. Each of the two tests involved a different kind of ability. In the next place, a follow-up, initiated to find out what would have been the results if the literacy test had been used as a basis of selection, showed once more that there was no consistent agreement between literacy and ability as a machine operator. In fact, if this test had been used as a criterion, fully forty per cent of those who later became good operators would have been eliminated. This, at a time when labor was very difficult to obtain, would have been quite disastrous. On the other hand, the form-board test showed a positive correlation with the subse-

quent work of these men, thus indicating that in one way at least the form-board test was more significant than the literacy test.

On the basis of these trials, and in view of the labor situation, it seemed inadvisable to use the literacy test at the time. Indeed, it was more profitable for the time being to let the illiterate workers go on as before, and to have special clerks pay particular attention to their work tickets, in order to insure their being properly made out. In spite of this temporary arrangement, however, the time is undoubtedly at hand when literacy tests must be given, and when at least an elementary knowledge of English will be required on the part of every applicant.

The problem of illiteracy is a vital one and one which is offering serious difficulties in classifying workers. When the United States conscript army was mobilized, one of the great hindrances to its proper training and classification was illiteracy. The same difficulty described here on a small scale was experienced there on a vast scale. The only genuine solution for this difficulty is education. In the meanwhile, however, it is necessary to make temporary classifications. These can be made superficially, by means of form boards and mechanical tests which do not require any language ability.

XIV

THE TECHNIQUE OF GIVING TESTS

Psychology, like every other science, has a distinct technique. This technique consists of certain well-defined and accurate methods of procedure. Giving tests, for instance, seems comparatively simple to one who is not familiar with the methods of psychology. However, there are minute details to consider and directions to follow of which the untrained individual has no conception. The technique of giving tests, like the technique of the physician and chemist, can be acquired in its completeness only by careful study and continued practice. An error in method, so slight as to entirely escape the uninitiate, is likely to render the results meaningless. The care of the chemist in weighing and mixing his compounds is well known. The psychologist must be even more careful and painstaking, because he is working in the most delicate and sensitive medium known; namely, the human mind.

Although the technique of psychology, so far as it has been developed, can be acquired only by years of study and training, there are certain phases of it which the more casual student can learn in a shorter time; just as there are phases of mixing chemicals which one can learn without becoming a fully trained chemist. The purpose of the present chapter is to discuss some of the fundamental and more obvious features of giving tests, such as must be at the command of the employment manager who wishes to give them.

One of the most frequent questions put to the psychologist is this: "Is not the person whom you are testing likely to be nervous, and, if so, is this not likely to destroy the value of your tests?" This question must be unhesitatingly answered in the affirmative. Subjects *are* frequently nervous and their performance in the tests is therefore often non-characteristic. When a doubt arises as to the fitness of an applicant of this kind, justice requires that the applicant be given the benefit of the doubt. However, there are serious objections to this practice. If the examiner is allowed to set aside the results of the tests according to his own ideas as to whether a subject was very nervous or only slightly nervous, the scientific character of the psychological examination disappears and the old-fashioned method of individual judgment is allowed to slip back into its place.

Instead of this arbitrary procedure another method has been devised. This consists of giving the subject a *shock-absorber*. The shock-absorber is a preliminary test, the purpose of which is solely to overcome the initial excitement of the subject. It is not counted in estimating the final results. The shock-absorber must have two characteristics. First, it must be easy. If it is difficult, it will only serve to increase the nervousness of the individual being examined. Secondly, it must be interesting. The object of the test is to engage the attention of the subject as completely as possible, thereby drawing it away from himself and from the harassing situation in which the applicant for a position usually finds himself. Experience has demonstrated that the best way in which to overcome an applicant's nervousness is by giving him a pleasant and easy task to perform. If the task is easy, it

will restore his confidence in himself. If it is pleasant and interesting, it will put him at ease.

This method is better than the conversational method; for the process of setting a person at ease through the medium of words is an exceedingly delicate one. The slightest sharpness or abruptness in the examiner's tones may only serve to increase the nervousness of the subject. Consequently, while it is desirable that the examiner should keep up a current of cheerful and more or less irrelevant talk, the less strenuous his efforts in this respect are, the better. He should rely upon his conversation only to cover up awkward pauses and to make clear his directions.

The tests chosen to serve as shock-absorbers will vary widely with the nature of the other tests which are to follow. No one test or set of tests can be prescribed as ideal shock-absorbers. For every type of examination, the preliminary test must be selected on the basis of long experience and many trials. In the experiments described here, certain tests have been selected for this purpose. For example, the shock-absorber given to inspectors is the manual-dexterity test. This test is also given to machine operators for the same purpose. In fact, a simple form-board test of some kind is one of the best tests for this general purpose. Besides being easily understood, it requires almost no directions and no technical ability. One of the best form-board tests for this purpose is the pictorial completion test, a colored picture with various details cut out. The picture must be completed by restoring the cut-outs to their proper places. This test is both extremely interesting and funny. It usually puts the subject in a very good humor. For clerks, stenographers, assemblers, and higher classes of workers, this test has proved a very successful shock-absorber.

After the preliminary test has been given, the regular tests should follow continuously, and the results be recorded. Here again, unless the utmost care is exercised, difficulties are likely to arise. Take, as an example, the matter of starting tests. Before beginning a test, it is necessary to give some kind of starting signal. The word *go* is a very simple and commonly understood word, and suggests itself readily for this purpose. Nevertheless, this little word is full of danger, as a momentary consideration will make clear. The examiner may finish his directions to the subject for a given test with the following words: "Now, at the word *go*, turn over the sheet and do just what you have been told. Do it as carefully and as quickly as possible, but do not rush. Ready? *Go!*" Whereupon the subject will rush through the test with the speed and nervousness of a sprinter who has been set off by a pistol. The words *ready* and *go*, harmless as they seem, are associated with all the tenseness and excitement of a race, and consequently tend to induce, by suggestion, the same state of tenseness and excitement in the mind of the person being tested. Even if the examiner does not utter them in the sharp tones of one starting a race, the effect is likely to be the same. Instead of preserving the calmness which has just been induced in the subject, they induce another state of nervousness, possibly more acute than the preceding one. There are times when it is desirable to promote such a state of mind and to obtain a result which is based upon frantic effort. However, for the purposes of employment, it is much more desirable to obtain a characteristic result, one which conforms more nearly to the applicant's ordinary state of mind and speed of motion.

Therefore, the examiner should be careful to avoid

exciting the applicant through the inflections which he places upon such critical words. He should say these words monotonously, rather than in a way which will suggest a violent push from behind. And in order still further to avoid the state of emotion suggested by the word *go* it has been our practice to use the word "*start*" instead. This word serves the purpose perfectly and is free from the significance of the word *go*. This may seem like a very trivial detail. However, experience has demonstrated the importance of just such details, and before there can be any thoroughgoing uniformity in the procedure of giving tests, there must be perfect agreement, both theoretical and practical, in details of this nature.

The time which the applicant occupies in taking tests need not be an empty time for the examiner. In fact, the expert examiner is usually busiest while waiting for his subject to finish a test. Besides watching the stop watch, and being on the alert for any signs of faltering on the part of the subject, he can be preparing the next test or correcting the test which has just been completed. The correcting of tests is one of the most irksome parts of the psychologist's work. Therefore, if he can do it while he is actually conducting an examination, he will not only save a great deal of time and labor in the future, but he will also have the results of the examination ready almost as soon as the applicant has completed the tests. Many devices and short cuts are used to facilitate the process of correcting tests, such as making out correction keys, and using cardboard stencils which, when laid on the test, will cover up all but the parts which must be examined. These are only a few of the many details in the complicated technique which the psychological examiner must acquire.

Closely allied with this particular point is the use of the

stop watch. In nearly all psychological tests, the use of a stop watch is essential. To be sure, much finer time-recording instruments are used by psychologists; but for the practical purposes of employment, the split-second stop watch is accurate enough. The question of importance, however, is the manner in which this watch is to be used. If the subject is allowed to see the watch, he will become aware of the fact that he is being timed, and this is likely to make him self-conscious and to increase his "nervousness". Therefore, it is better to keep the watch as far as possible concealed. For this purpose, a table with a shelf in place of a drawer will prove very convenient. The examiner can keep his watch on this shelf, out of sight of the subject but under his own eyes, and easily within his field of action. It is also wise to have two stop watches; for it quite frequently happens that one runs down or gets out of order without the knowledge of the examiner. The occasional use of a second watch, started "in team" with the first, will call attention to this defect.

A necessary part of every examination is the recording of the subject's name, age, and a few other facts which are necessary for the records of the examiner. If possible, these facts should be obtained before the applicant is sent to the psychological examiner. However, where this is not practicable, no questions should be asked until the tests have been given. It has been found that asking questions is very likely to make the subject uneasy. There are, to be sure, examiners who can ask questions in such a way as to set an applicant quite at ease. However, here again the personal equation enters in. In order to safeguard against this uncertainty, the method of giving a shock-absorber was devised. There is less chance of

clumsiness and lack of uniformity when this method is used than when the matter is left to the discretion of the various examiners. The questions which must be asked can then be asked at the conclusion of the tests when the effects will no longer be of consequence.

Another important factor in the successful giving of tests is an attitude of assurance on the part of the examiner. This is particularly true where tests are being given in shops and offices for experimental purposes. There is always a possibility that some worker will resent being tested. An apologetic and conciliatory air on the part of the examiner will encourage the exhibition of this hostility if it is latent. An attitude of complete assurance will cause its repression. The examiner must conduct his examination as if it were the one important thing in the world. The response will in most cases be a reflection of this suggestion. This does not mean, however, that the examiner should be abrupt or over-confident. An air of presumption is extremely likely to provoke the very hostility which the examiner is trying to avoid. In addition to this, a policy of entire frankness is conducive to coöperation on the part of those being tested. In the course of the experiments which have been described, it was the unfailing practice to make a brief and direct statement as to the purpose of the tests, and to place this statement in the hands of all those affected. This was usually done through the foreman or through some other member of the shop whose character would vouch for the motives behind the experiment. When this was not sufficient and the workers being tested were inclined to ask for further information, the information was always given. In fact, some very excellent suggestions from the workmen were obtained in this way.

In giving an examination composed of a series of tests, every preparation should be made so that each test will follow the other with a minimum of delay. Nothing so disturbs an individual in such a situation as periods of uncertainty and suspense. Therefore, all materials should be arranged in order and in completeness, so that the examiner is ready to start explaining the next test at the same instant in which the subject completes the previous one. This sounds like a comparatively simple matter; but any one who has given tests knows that it is an art which can be acquired only by a great deal of practice. An observer, standing over the expert examiner and watching him as he gives one test after another, is struck with the smoothness and dispatch of the process. He does not realize that there are intricacies and devices here which were developed only after months of experiment and practice. The psychologist, familiar with the minutiæ of his technique, can impart this knowledge to a novice in a comparatively short time. The novice, however, if left to himself, may blunder for months without developing the necessary technique or acquiring a knowledge of the significant details. The technique of giving tests is, in this respect, much like the game of chess. One who is not familiar with the game may watch its interesting moves for hours without comprehending their meaning. To give a psychological examination without awkward moves, simple though it appears, is a game which, like the game of chess, requires explanation and rules. The psychological examiner must acquire the technique of this game.

One of the most important features of this technique is the matter of giving directions. Something has already been said about this in the paragraph on starting the test.

However, before a test can be properly started, it must be properly understood by the subject who is taking it. To give directions that will be *misunderstood* is one of the easiest things possible. One never discovers the many possible meanings a word can assume until he uses that word in giving directions to a large number of people. One of many experiences of this kind will serve as an instance. In developing the directions for the number checking test (8) described in the first experiment, the examiner originally directed the subject to put a *mark* after every number that contained both a "1" and a "7". Some subjects put down a V-shaped check, while others put a dash like this "—". Obviously, the first took a longer time than the second, and since the purpose of the test was not to test a person's ability to make marks, this was a source of error. Consequently, the directions were changed to read: "Put a *straight* line after each number," etc. This resulted in the attempt on the part of certain subjects to make a mathematically straight line in every case. This also was an undesirable feature, because the purpose of the test was not to discover the subject's ability to draw straight lines. Moreover, some subjects made long and deliberate lines, while others made them short and dashing. If all the words necessary to make these directions absolutely clear and unmistakable had been included in the final directions, the result would have been something as follows: "Make a quick, straight dash, about an eighth of an inch long, after each number," etc. Obviously, such directions would have defeated their end, because, by the time they had been given, the subject would have forgotten the most of them. Therefore, a part of the directions was given by the examiner as an actual demonstration. The examiner would say: "Make a

quick dash like this"—and here he makes a quick, straight line, about an eighth of an inch long, in the appropriate place—"after each number which contains," etc.

The instance described is only a single, small detail in the process of developing directions for a certain test. Every set of directions is filled with minute details of a similar nature. In fact, it is practically impossible to work out a set of directions which shall be perfect at the outset. In developing the directions for the tests which were used in the present experiments and which are given, in part, in the Appendix, it was the practice to keep a blank card of directions for each test. This card was carried with the test to which it belonged, and whenever a mistake or a possible ambiguity in the wording of the directions was noted, that fact was recorded on this card. In this manner, through a long series of tests and actual experiences, the best possible set of directions for a particular test was arrived at. It is safe to say that a set of directions for any one test can not be made perfect or *fool proof* until it has been tried on at least fifty different subjects. No one, more quickly than the psychologist, learns the richness of meaning which even the simplest word contains. No one, therefore, should be better able to guard against mistakes arising from this source.

To minimize the mistakes likely to arise from the ambiguity of words, the psychologist has several courses open to him. One of these has just been illustrated. It consists of supplementing his words with the action which he intends the subject to perform. A simple demonstration like this is often more lucid than a paragraph of words. However, whenever the examiner assumes the burden of demonstrating his own directions, care must be taken always to demonstrate according to some standard

practice. This practice should be written up in the most detailed and accurate form, and illustrated with examples so far as possible, so that other examiners, giving the same test and using the same directions, may likewise be giving the same demonstration and thereby obtaining the same standard results. As a supplement to this step, it is always advisable to give the subject a short preliminary trial in the test which he is about to take. Only in this way can the examiner be sure that his directions have been fully comprehended. To the unsophisticated mind, it may seem sufficient if the examiner, after having given the directions as clearly as possible, asks the subject: "Now do you understand?" and, upon receiving the answer "Yes," proceeds with the test. However, no matter how intelligent the subject may appear, it is never safe for the psychologist to assume that his directions are grasped until he has had an actual preliminary demonstration on the part of the subject showing that they are. Many subjects only *think* that they understand, when, as a matter of fact, they do not; or they understand the wrong thing. Therefore, it is always advisable to give a very short, but characteristic sample of the test, in order to insure perfect comprehension on the part of the person being examined. This sample should always be of the same length and kind, to insure every subject the same degree of instruction and practice.

Sometimes it is impossible to make the directions for a test clear enough. In that case, the difficulty probably lies with the test itself. This was the case in the Bogardus fatigue test described in Chapter X. The number of reactions made possible by this test were so numerous and variable, that it was also impossible to score the results. In such a case, it is necessary either to give up the test or

modify it until directions can be given which shall cover its scope of possibilities. The simplest solution of this problem is to perfect a test until it is self-explanatory. That is, make the test so perfect that it can be given with a minimum of directions. The most successful tests in this respect are the form-board tests and the machine operator's test. When a form board is placed in readiness before a subject, it is almost possible to comprehend the task to be performed without any oral directions. The empty spaces in the board are apparent, and the pieces are there. Nothing is more natural than to pick up the pieces and put them in the spaces where they seem to belong. In the machine operator's test described in Chapter X, it is perfectly obvious that the task is to drop the steel balls through the opening at the proper instant.

In the performance of the tests themselves, there are many details to be watched. When the assembling tests were being given to assemblers, one of the difficulties to be overcome was due to the oil which clung to the hands of those who were assembling oily parts. The men taking the form board test which requires placing triangles into their proper spaces frequently had difficulty because this oil caused the very small triangles to stick to their fingers, making it very difficult to do the act quickly. The same difficulty is likely to arise in warm weather, due to hands that are moist with perspiration. It is advisable, therefore, always to have a good wiping and drying cloth at hand, so that those who are being tested may not suffer from an unnecessary handicap.

Another point which may seem quite trivial but which is very important is the use of pencils. In every test which does not depend entirely upon the subject's ability to handle a pet pen, it is advisable to use pencil. The pencils

used should be of a uniform hardness—a number two hardness is probably best—and should always be kept sharpened, though not so sharp as to make them likely to break off. It is also very important that they be *without erasers*. This seems like a strange condition, but any one who has given tests knows how likely a subject is to make a mistake and then to use up time trying to erase it. In order to obtain more uniform results, and in order to avoid including in the test a trial of the subject's ability to make erasures, it is better to have pencils without erasers, and to instruct the subject to cross out his mistakes.

Much can be surmised about the education and training of an applicant by observing the manner in which he uses a pencil. Frequently, there are applicants for certain kinds of work who can hardly read or write, and who handle a pencil very clumsily. These applicants may fall down decidedly in certain tests. Nevertheless, if given a trial at actual work, they may succeed very well. For this reason, tests which require a certain amount of education, and skill in the use of a pencil, should never be held against an applicant unless he is being tested for that very thing. For example, in these experiments, there were inspectors who did very poor work in the number-checking test, the cancellation test, and the card-sorting test. Still, they were excellent inspectors. They were girls who had come to this country very recently and had not had time to learn how to read English, or how to use a pencil, or how to scan a printed page. Where the tests themselves are inadequate, that fact should be recognized, and due allowance made. It has been our practice always to recommend such applicants for a trial, using the best possible empirical judgment to supplement the limitations of the tests.

As the use of tests becomes more and more prevalent, it

will become increasingly necessary to prevent duplication. A person, making application for a job a few months after having been examined and rejected for the same position, is likely to do much better work in the tests. If a second and even a third trial is allowed, the essential nature and meaning of the tests will be radically changed. Therefore, some definite decision must be made on the course to be pursued in such a contingency. Should a second or third trial be allowed, and should an individual be graded on the basis of his improvement during the interval? The answer to this question must be Yes and No. As will be pointed out in greater detail further on, tests are of two general kinds: first, tests designed to bring out an individual's innate ability; and secondly, tests designed to make clear his degree of training, education, and experience. As instances of the first type, we may mention the cancellation test, the form-board test 51, and the tachistoscope tests. Although training does play a part in the performance of these tests, nevertheless native quickness and alertness are the most important factors. As examples of the second type we may name the multiplication and division tests, the spelling test, and the dictation tests. These tests are intended to measure the degree of education which has been secured by the applicant. Where tests to determine native ability have been given, no second trial should be allowed, except in so far as the second result is used to show the effects of practice. Where the object is to discover the degree of education, any number of trials should be allowed. A stenographer, for instance, ought to be allowed a second trial after an interval of two weeks or a month, because, during that time, she may have learned much and acquired a decided increase in speed. However, in order to avoid deception

and also the improvement which comes entirely through a familiarity with the tests, it is highly advisable to have alternatives—three or four, if necessary—for every test. These alternatives will be very much like the originals, with such differences as will make it impossible for anyone who remembers any details of the first one to profit by this experience in taking the second one.

The increasing numbers in which psychological examinations are being given has made it necessary to pay an increasing amount of attention to the problem of wholesale examination. Until recently, nearly all mental tests were given to one individual at a time, and each individual was allowed as much time as he required to complete the test. This enabled the examiner to devote his entire attention to one individual. The advantages of this method are obvious. Not only is it possible to give the most careful and immediate directions, but it is also possible to observe any accidental feature which might arise, such as the breaking of a pencil point. However, it has become highly desirable, at times, to give the same test to a group of several subjects at the same time. This method has the advantages and disadvantages connotated by the word *wholesale*. It makes possible a larger number of examinations in less time, but it also reduces the possibility of close individual attention on the part of the examiner. It can not be used with all tests, but only with paper tests, or with tests for which the necessary apparatus can be provided in large quantities. The manner in which *group tests*, as they are technically known, are given has already been partly described.

This method makes it advisable to allow to everyone a limited amount of time, instead of permitting each individual to complete the test. For instance, in giving the

topical filing test to a class of high-school students, some signal, a whistle for example, can be given at the start, and then, at the end of three or four minutes, this whistle can be blown again as a signal to stop. Since each subject is allowed the same time, it becomes unnecessary to consider the time factor when correcting the tests. The grade will consist entirely of the amount of work done correctly in the time allotted. In some cases it is desirable to give a group test and still allow each individual in the group to complete the test. There are various ways in which this can be done. One, is to have a large clock with conspicuous minute and second hands, from which each individual can read his time and note it as soon as he completes the test. Another way, and one which is less liable to error through mistakes in reading the clock, is to record the time on a blackboard in large numerals at five-second intervals. This method has been found very successful. It requires two to carry it out; one to read the time, the other to chalk it up. In order to anticipate the time required by the individual finishing the test to look up at the blackboard, find the number, and then write it down, it is advisable to record the time in such a way as to have the number on the board three seconds beforehand. Although this method provides for only five-second intervals, this will not create a large error in tests which require two minutes or more.

The phases of the psychologist's technique described here are by no means exhaustive. They state only certain important details with which any one who wishes to give psychological tests must be familiar. There are many more details of a similar nature, some of them far more refined. The object of all these details in technique is to promote scientific accuracy and to reduce ambiguity.

As has been explained in the opening chapter, science consists of the application of an exact and refined method to the study of the facts, in order to produce knowledge which shall be: first, knowledge which is free from the inaccuracies and prejudices of the unguided human faculties; and secondly, knowledge which is standard; that is, knowledge which can be transmitted in unambiguous and indisputable terms from one person or time to another. Psychology is the science which attempts to apply this method to the facts of human nature. To be sure, there are loopholes in the technique which has been described and illustrated in the preceding chapters. This, however, can be said of any science. There is no science, not even the most exact, from which the errors due to the human equation can be entirely eliminated. However, the technique described in this and in other books on psychology are ample proof of the care with which the scientific method is being applied where only home remedies were used before.

XV

THE VOCATIONAL VALUE OF TESTS

Every industry is to-day a vocational center. Formerly, when each industry consisted of only a small number and variety of tasks, only a limited choice of work could be offered to an applicant by any one organization. Now, however, most industries comprise such a variety of work that a great range of choice is provided. These industries, therefore, make it possible for workers to achieve success in the field which appeals to them most or for which they are best adapted. Not only do industries offer the opportunity for choosing and developing a certain vocation, but they frequently make it their business to help applicants and employees to choose the right vocation and to acquire the knowledge and practice which go with it. This is not done from a sense of duty or charity but from a strictly economical point of view. The commercial success of an industry depends largely upon the character of its *human equipment*, and the use to which it is put. In fact, the importance attributed to-day to vocational selection and training is largely due to the fact that industries have recognized its commercial value. And the industries, far more than educational and other institutions, are setting the pace in its development. As a single example of the general recognition given this subject, may be cited the National Association of Corporation Schools, an association composed of representatives of many of the largest industries in the country, which is devoted to the

development of vocational and educational work in industries.

The vocational activity of an industry has two aspects—first, the selection of new candidates for the work for which by training and education they are best fitted; and second, the selection from new applicants and old employees of those who are to be given special training for certain kinds of work. The first phase is more strictly an employment activity, while the latter, although also a phase of employment, is more strictly an educational activity. Almost every industry of any importance has its own educational department or function. The work of this department varies with different organizations, but in general, it may include the following activities: First, an apprentice course in which boys are given a three or four year training in tool making, drafting, pattern making, or some other trade, depending upon the particular kind of work which predominates in the industry. Secondly, training shops or vestibule schools, in which workers are given a short course of training covering the immediate work to which they have been assigned. This work may be office or clerical work, salesmanship, assembling, telephone-switchboard operating, bench work, machine operating, or any work which is characteristic of the particular industry. Thirdly, periodic classes in subjects which are of general or particular interest and value to employees of the company. Classes in gardening, millinery, cooking, basket weaving, telegraphy, stenography, English, mathematics, slide-rule reading, mechanical drawing, are characteristic of this phase of educational work. Fourthly, special "Training Courses" like those now conducted by many of the railroads and larger industries which aim to give a small group of well-

educated and specially qualified young men a general knowledge of the work of the organization, with a view to preparing them to fill the higher executive positions.

In the first flush of enthusiasm with which various organizations adopted an educational program, the work of education was often carried on in a most profligate and indiscriminating manner. Often it was done entirely without consideration for the needs and benefits of the organization fostering it, and as if the industry were obliged to educate and uplift, regardlessly, every one of its employees. The result of these attempts has been a most unfavorable discrepancy between the energy expended and the results achieved. Instead of solving the vocational problems of the organization, the practice created new problems which the organization was left to settle. Out of these earlier unsuccessful trials, the following principles have emerged: First, the primary aim of the educational work carried on within an industrial organization is to train employees for immediate usefulness within the organization itself. Secondly, the more general forms of education can be better carried on and, from every point of view, should be conducted by community rather than private enterprise.

Even when vocational education is considered in its most practical aspect, the organization still raises the questions: How far shall our educational facilities be extended? How shall we guide the right employee into the right course of instruction? How can we guard ourselves against wasting effort by teaching the wrong thing to the wrong man? These are exactly the questions which the employment manager must also ask when he is in the act of hiring a new employee; for nearly all work involves a certain amount of training and education, and any mistake

in selecting applicants for jobs has the same result which arises from selecting the wrong man for a certain course of instruction. Employment and education, therefore, present the same problem, the problem of how to select the proper individual for the proper vocation or vocational training. It is in its contribution to the solution of this problem that the vocational value of tests resides.

For the purpose of vocational selection, all individuals may be roughly divided into four classes, according to two factors, ability and training. We may show the four possible combinations of these two factors by means of the following table:

Natural ability	Natural inability
Good training	Poor or very little training

The four possible combinations to be deduced from this table are: (1), those with natural ability supplemented by special training in some special field; (2), those with natural ability but with no particular training; (3), those with poor natural ability but a thorough training in some particular activity; (4), those with neither training nor ability. The word *training* is used here to cover both education and experience. All individuals, however, whether they are already enrolled in an organization and looking for or being sought for other work, or whether they are new candidates, first applying for a position, may be roughly classified under these four heads.

The first task of vocational selection or training is to

discover these facts. Until they are known, no intelligent choice can be made. For instance, when a boy, either within the organization or without, applies for admission to the apprentice course, a course which occupies a period of years and which is very costly, the question as to whether this boy has the necessary prerequisite education and the natural ability to succeed is sure to arise. He has undoubtedly had some education, but whether his education has gone far enough, or whether he has profited by his educational opportunities to the extent of being able to handle the necessary mathematical problems, is a matter which must be carefully determined. In addition to this it is necessary to know whether the boy possesses the natural ability which will enable him to succeed as an apprentice. How shall these two very important facts be determined? This is just the question for which psychological tests provide the answer.

All tests may be divided roughly into two kinds: Those designed to discover an individual's degree of innate ability in certain directions, and those designed to measure the extent and quality of an individual's previous training and acquired ability. This distinction is by no means a clear and sharp-cut one, for every test whatsoever involves to some extent both natural or innate ability and the ability due to training and education. The tests described in preceding chapters have already made this fact clear. However, for practical purposes, tests may be divided into these two general kinds. When, therefore, the question of vocational training or selection arises, the application of these tests makes it possible to discover what the natural and acquired abilities of an individual are and under which of the four heads given he is to be classified. Let us take, for instance, the case of the candidate for appren-

ticeship. It is necessary to discover, first of all, what this candidate's training has been, particularly his education in mathematics. In order to ascertain this he is given a mathematical test. This test will indicate quite clearly whether the boy has had the necessary preliminary education and whether he is sufficiently well up on what he has studied to warrant immediate admission into the course. However, in addition to this it is desirable to know whether the boy possesses the right kind of natural ability to make him a successful journeyman. This is a more subtle problem; but in order to obtain a forecast of the boy's development, tests which have previously proved their significance in this respect are given. These tests, described in the chapter on tests for apprentices, do not involve education or training in any particular subject but rather the ability to think and act quickly and appropriately in certain desirable directions. When these two facts have been ascertained; namely, the boy's education or acquired ability, and his capacity or innate ability, it can be intelligently decided whether or not he should be taken into the apprentice course and trained in the vocation of a tool maker or some other trade.

To take another illustration, let us consider an applicant for the position of stenographer. Such a candidate may be said to have already chosen her vocation. However, it is nevertheless a question whether her choice and her training make her valuable enough in that vocation to justify her selection by the employment office. In order to decide this question it is necessary to know, first of all, whether she has the necessary education in the fundamentals of her work. To determine this, spelling, grammar, and punctuation tests are given. Besides this, it is necessary to know whether she has had the necessary training

and practice in stenographic work, and in order to discover this, the dictation and transcribing tests are given. If these tests show that the candidate possesses the requisite education or acquired ability, it may be advisable to engage her. However, in order to know still more accurately her real value, it is desirable to give her tests calculated to gauge her innate or natural ability. The number-letter substitution test and the alphabetical-filing test are generally given for this purpose and are tests of speed and accuracy of a kind usually involved in stenographic work. The topical filing and hard-directions tests are tests to measure the individual's reasoning or analytical ability. If the candidate does well in all of the tests, she is quite valuable, for being well trained and possessing natural ability, she is likely to develop into a very capable worker.

Now, let us suppose that the candidate shows by her performance in the tests for acquired ability that she has had a very poor training in dictation and transcribing. Shall she be engaged or not? If, in addition to her poor training in these respects, she also shows lack of education in spelling, grammar, and the fundamentals of the common-school education, it would probably be unwise to engage her for stenographic work. And, if in addition to her poor education, she displays a lack of innate ability by her performance in the group of tests given for this purpose, the decision would be quite obvious. On the other hand, if the applicant has natural ability, a good common-school education, and is lacking only in ability to take dictation and transcribe, it is very advisable to engage her for a trial, or for special training in the fields in which she is weak. Her inability in dictation and transcribing may be due to poor training or to poor opportunities, and may

therefore be deficiencies which, under favorable conditions, the natural capacity of the worker can easily overcome. Workers of this kind are of the utmost potential value, and should be given the most careful consideration by the employment and educational branches. It is in discovering cases of this kind that the use of tests can be of great value in helping industrial organizations to make the best possible use of the human material at their disposal and in providing for the vocational adaptation of their employees.

Wherever tests indicate that an applicant for a certain kind of work is poor in both ability and training, it is unwise and unprofitable, from the point of view both of the individual and of the organization, to hire him for that work. It is advisable, in such cases, to try out the applicant with other tests in order to discover whether he is better fitted to learn some other kind of work. All employment managers and educational directors are troubled with the urgent pleas of candidates who, in their opinion, are unfit for the work or training they demand. Hitherto there has always been a sense of injustice or apparent injustice in situations of this kind because the disappointed candidate felt that he was not being given a square deal. And as long as it was a question of one man's judgment against that of another, there was always a measure of truth in this suspicion. The use of tests makes it possible to decide, with much less ambiguity and on much more impersonal grounds, whether a person shall be chosen or not. Often, however, when an applicant is particularly insistent upon a trial at a certain kind of work or training, it is advisable to give him the opportunity even though his performance in the tests is poor. This is because the presence of a genuine and driving ambition will sometimes

take an individual over the most difficult obstacles. In one of the experiments already described was a girl whose performance in the most significant test proclaimed that she would most decidedly fail at the work she was trying to do. As a matter of fact this girl succeeded, but it took her about four times as long as the average success. However, due to her dominant ambition, she did finally succeed and became one of the most successful workers in the room.

While it is highly advisable to recognize ambition and to give it its just deserts, it is just as desirable to detect *impulse*. Very many candidates apply for a certain kind of work or a certain course of training, not because they are extremely ambitious in that direction, but because they have heard from some successful friend how pleasant the work is and how easy it is to make a high wage in a short time. The new candidate does not stop to consider that what is pleasant and profitable to his friend may not be equally pleasant and profitable for him. In cases of this kind—and every employment office and industry meets them in abundance—the verdict of the tests should be followed. If it is not, and the ill-adapted applicant is hired, the result is quite likely to be another turnover. For as soon as the new worker discovers that the work is not quite as enjoyable and remunerative for him as it is for his friend, he will probably leave. The vocational value of tests is particularly great in this respect. Many useless and costly vocational experiments can be eliminated by their application, and successful ones made possible instead.

When a candidate has a good training but poor natural ability, the question of his vocation becomes a grave one. If the individual has himself recognized his tempera-

mental or natural unfitness for his original work, the case becomes still more complicated and urgent. Shall he be given a new course of instruction or shall he be allowed to continue with his original work? The answer to this question evidently depends upon a large variety of factors, such as: Can it be determined whether or not he has natural ability in some other direction? Will the new kind of work be sufficiently satisfying and profitable to justify the change? Is the individual's age, physical condition, and so forth such as to make the change advisable? Most important, however, is the necessity of determining beforehand whether a person's ability in some other direction is such as to justify the change. Here again, there are innumerable cases which arise in every large industry, and the chances for haphazard and expensive experimenting are all too obvious. Every precaution must be taken by an organization, both for its own sake and for the sake of its workers, that experiments in vocational readjustments—transfers, as they are frequently called—be conducted with discrimination and care.

One of the most important factors in vocational selection is the factor of the individual's choice. Many reasons determine the individual's choice of a vocation, but nearly all of them rest upon some individual peculiarity or bias. One boy may want to be a blacksmith because his father was one. Another, for the very same reason, may want to be anything but a blacksmith. Another boy may want to be an automobile mechanic because he likes to ride around the country. Still another may wish to become an electrician because he has seen an electrician doing some work at his house and the electrician good-naturedly allowed him to help with some of the work. This boy's companion may want to become an electrician also be-

cause he wishes to remain in the company of his friend. In a great many strange ways, boys and girls acquire a deep-rooted desire to be or to do some particular thing. This desire, whatever its origin may be, is one of the most potent factors in the vocational direction of the individual, and many individuals are made unhappy because circumstances have prevented them from following out their chosen vocation. An industrial organization, however, can not be guided in its selections by this factor except in a superficial way. Every organization is limited in the number of jobs and positions it has to offer, and the vocational guidance and training which it gives are strictly limited accordingly. The institution which can best turn this dynamic force of desire and dislike to account is the primary and secondary school, working in conjunction with all the industries of the community. In the schools, where the emphasis is not primarily on the production of material things, there is sufficient leisure and opportunity to give every pupil a trial at his favorite work. And there should also be sufficient opportunity for the pupil at other kinds of work in order to provide a basis upon which to guide his likes and dislikes into the most promising channels.

The kind of guidance which should be attempted must be determined largely by a consideration of the kinds of work which the community is doing, and for this purpose the closest coöperation between the educational and industrial organizations is necessary. Until recently educators have been so much concerned with the defense of the disciplinary and cultural tradition that they have lacked either the inclination or the energy to adjust the educational program harmoniously with the industrial changes of the times. As a result, there are to-day in-

numerable misfits, or rather, *nofits*, men and women without any special training or occupation, or with a training that leads to nothing in particular. As long as only a fraction of the population was required to work, this fact was not flagrantly evident; but as soon as the stress of war made some kind of work incumbent upon everybody, the discrepancy became plain. Because of the unreadiness of educational institutions, the work of refitting and reëducating a people fell upon the industrial world. The success with which the problem was met by industries in all countries is one of the outstanding features of the war and a standing lesson to all educators. In the future there will be a much closer coöperation between educational and industrial institutions, and the problem of vocational guidance will receive much more careful attention. The application of tests in this connection will be of considerable value.

In addition to the selection and training of workers for the more advanced types of work, work which requires special ability and training, there are many kinds of work in every large industry which do not deserve the name *vocation*. A vocation implies work which requires a certain degree of education, experience, and training, such as are required by a business, a profession, or a trade. It implies particularly the presence of features so interesting that they are capable of engaging a man's entire attention and ambition. A vocation is often desired as much for its own sake as for the sake of the financial reward which it brings. However, there are many kinds of work which do not possess these characteristics. A job analysis which covered the work of over eighteen thousand people showed that seventy-six per cent of the jobs required no particular previous experience or

training and could be learned in periods varying from one hour to one month, the average being ten days. This is typical of the modern industrial development in the division of labor. Many jobs are dull and monotonous, involving the same petty round of activities day after day, and hour by hour. They fail to engage the worker's entire mind and they do not stimulate his imagination. In fact, they lack nearly all those characteristics which give permanency to a vocation and which encourage continuity of effort. To be sure, some people are fitted by nature or by temperament to just such work. On the other hand, there are many who tolerate it only because circumstances have prevented them from doing anything better.

Now, although jobs of this kind can not be called vocations, the vocational value of tests is probably greater here than in any other sphere. For vocation must in this instance be defined in terms of *financial success*. The true vocation of these workers consists not of the work which they actually do but of the pleasures, over and above their work, which their wages at that work enable them to gain. In other words, they are interested in work, not for its own sake, but as a means to an end. The best part of the day to them is the part which comes after work, when they can be with their wives and children, when they can work at their own houses, putter around their own gardens, or tinker at their own automobiles. It is in the pursuit of the hundred and one activities of this kind that the true and only vocation of this numerous body of workers exists. Therefore, the vocational value of tests in instances of this kind consists in the selection of men and women in such a manner that they shall be assigned at once to the kind of work at which they can

most quickly succeed and at which they can make the largest wage of which they are capable.

In this day of scientific management this is by no means an easy task. The fine subdivision of labor and the various piece rates or bonus rates which the task setters and time-study men have set for these operations have made it very necessary that laborers be chosen with equal care and accuracy. As a matter of common experience, it is well known that not every worker can succeed at the various tasks which have been set. This is largely due to the fact that tasks for various kinds of work are set on the basis of a study of a group of workers who have already been chosen for that particular kind of work by a process of natural selection. When studies are made, they are never based on workers who have given up the work because of their inability to succeed, but always on workers who have had at least a measure of success. When a task is set, therefore, it is not intended to be within the reach of every individual regardless of what his qualities may be, but only within the reach of certain types of workers. The task of the psychologist and the employment office is to select for the distinct types of work which exist in a factory, the type of workers who are most likely to succeed.

The method which the psychologist applies in this problem has already been thoroughly described in previous experiments. By finding significant tests for different types of work, the psychologist is enabled to guide the various applicants into those kinds of work for which their natural and acquired ability best fits them. And in doing this, psychological tests make it possible for each new worker to begin at the task at which he is most likely to succeed and at which he is likely to earn the highest

wage of which he is capable. In this manner, tests fulfill a distinct vocational function; for they make it possible for the applicant to realize most quickly the happiness which constitutes his real vocation. To be sure, tests will discover many workers whose exceptional ability, either natural or acquired, will warrant their selection for a course of training which will ultimately give them genuine vocations. However, in the present stage of industrial development, there must constantly be a large body of men and women to do routine and monotonous work, and it is in this large field that tests will have an extensive quasi-vocational value; for their use will enable the worker to achieve most fully those enjoyments in which his genuine vocational interests may be said to reside.

A closely allied vocational problem is the assignment of defectives to industrial work. During the course of these experiments, a small number of high-grade morons and workers of a low mental age were discovered. Frequently these workers were doing work of which they were entirely incapable. The work of shell inspection, at which some of these defectives were engaged, requires a memory for about twenty-five different kinds of possible defects and a constant and alert attention in order to catch these defects as the shells pass by. Manifestly, even a high-grade moron would fail to possess the qualities necessary for carrying on this work. However, it must not be thought that the purpose of giving tests is to eliminate such individuals entirely. There are many automatic machines which require an operator with only the most elementary kind of intelligence and attention; and there is a large amount of manual work which involves only the learning of a few simple movements which are continuously

repeated in exactly the same way and which, when once acquired, can be performed without the aid of attention. For such work, mental defectives are often well adapted. Indeed, they are often better fitted for it than individuals of a higher intelligence because, having very few ideas and very little mental activity, they are unable to perceive the monotony and dullness of their work. They are themselves quite automatic, and can almost wholly lose themselves in the work which they are doing. What better solution of the problem of idiocy and undeveloped mentality can there be, from both an economic and a social standpoint, than to detect such applicants and assign them to work for which they are peculiarly adapted?

There is, however, a strong tendency to confuse lack of education with lack of intelligence, a tendency which has promoted much trouble. Foremen and employment managers are too prone to think that an illiterate Pole or Russian or Italian is far down in the scale of intelligence. Consequently, they can not understand why these *stupid foreigners* should object vigorously when they are put at some low grade of work, work which requires no manual or mental ingenuity and which is often merely dirty and monotonous. One of the problems of the psychologist is to find tests which will enable him to divorce intelligence from education, or rather intelligence from a particular language. This difficulty will not be so acute when immigration decreases or when the learning of English is compulsory. In the meanwhile, however, it is a genuine difficulty which must be dealt with. The form boards which have been described in the course of these experiments are especially valuable for this purpose, for they can be given to subjects regardless of education, race, or language. Their meaning is so obvious that

almost no explanation is required. The use of form boards with special reference to this problem has been described in Chapter XV. Elaborations of this test will undoubtedly help to solve this problem.

The vocational value of tests in industries may now be briefly summarized. The problem of every industrial organization is to select and train its workers in such a manner as to make the best possible use of their abilities. In order to do this successfully, it is necessary to discover the exact ability, both innate and acquired, of each individual. Unless these facts are known, it becomes impossible to assign the individual to the work for which he is best fitted or to give him the training which he deserves. The application of psychological tests in those fields where their value has been verified is the only method, short of the laborious and costly method of trial and error, which makes it possible to discover these facts. Once the potential and actual ability of an individual has been discovered, the vocational selection or training of that individual can be decided with a measurable degree of intelligence. Whether we interpret vocation in terms of work for its own sake or work for the sake of the reward which it brings, the application of tests makes it possible to promote both the interests of the organization and the welfare of the individual workers.

XVI

THE SCOPE OF PSYCHOLOGICAL TESTS

WITH SPECIAL REFERENCE TO THE SELECTION OF EXECUTIVES

At the conclusion of the section on psychological tests, the question regarding the scope of such tests as applied to problems of employment naturally arises. This question may be divided into two phases. First, over how great a variety of individuals and types of work may the use of tests be extended? Secondly, how much can tests tell us about an individual? The first question concerns the quantitative value of the tests. It raises the point as to the extent in classes of work and varieties of people to which tests can be successfully applied. The second question is concerned largely with the qualitative value of tests. It raises the point as to whether the information about an individual which tests afford is sufficiently comprehensive and reliable to form a basis for judging that individual.

The first of these two questions has already been answered, in part, in the preceding chapters. In the experiments described it was seen that tests were successfully applied to inspectors, assemblers, machine operators, office clerks of various kinds, stenographers, computing-machine operators, time-study men, draftsmen, tool-makers and tool-maker apprentices. This is by no means a comprehensive list of kinds of work, but it is neverthe-

less comprehensive in the sense that it includes some of the most common and representative types. It also indicates the broad range over which psychological tests can be applied if the psychological method is carefully observed. Other types of work have already been successfully dealt with by other psychologists, and as time goes on, this range will undoubtedly increase very greatly.

The question which is probably of most interest to industrial leaders and to organization heads is the choice of men for higher positions, executives, planners, organizers—the so-called *big men*. Can tests be applied which will make it possible to discover men of large caliber and large capabilities; men who have the ability to plan and execute great projects; men who stand head and shoulders above their fellow men? Can tests make it possible to select the exceptional man, the genius? This question must frankly be answered in the negative. The psychological method is at the present stage of its development unable to select men who possess the exceptional qualities required by the exceptional position.

The reasons for this limitation have already been furnished in the description of the psychological method contained in the preceding chapters. In the first place, psychology, like every other science, must proceed from the simple to the complex. The psychologist must first seek to apply tests to the more ordinary kinds of work, work which he can analyze and understand. The experiments described here deal, for the most part, with work of such a nature. Although it is conceivable that the psychological method be applied to types of work which the psychologist does not understand, still, such a procedure will be, at the best, haphazard and unreliable. An intelligent application of tests requires, on the part of the

experimenter, an intelligent grasp of the essential characteristics of the work. Work, for instance, which is characterized by the frequent repetition of the same movements (like the work of operating hand-feed dial machines, inspecting, and assembling) lends itself particularly well to the application of tests; for work of this kind presents certain constant and outstanding features which serve as valuable guides in selecting the appropriate tests. On the other hand, the higher we go in the scale of positions, the more intricate and involved are the tasks concerned until it becomes finally impossible for the ordinary layman to comprehend adequately what the fundamental characteristics of a given job are. It is not strange that the psychologist should be unable to grasp the features and details of such positions; for even the occupants of the positions themselves are frequently unable to describe adequately the work which they so successfully perform. One of the pleasant diversions of successful men is to give out, for the benefit of the striving youth, public interviews on the nature of their work and the qualities which enabled them to succeed; but the striking feature about these confessions is the inadequacy of the qualities given for the success obtained. Few sophisticated men, least of all psychologists, attach much importance or scientific reliability to personal statements of this kind. Such interviews are calculated to inspire the young rather than to afford a comprehensive basis for making a scientific analysis of the factors actually involved. Therefore, both because of his own inability to understand, and the inability of the highly successful man to describe adequately the essential features of his work, the psychologist is prevented from intelligently applying tests in this field.

A second impediment in the way of selecting big men by tests is the necessity of trying out preliminary tests on a large group of individuals all doing exactly the same kind of work. Unless tests are tried on a large scale, the probable errors are likely to make the results worthless; and unless all the individuals involved are doing the same kind of work, it is impossible to compare their relative ability as workers with their relative ability in the various tests. In the experiments described here, there were generally twenty or more subjects in each group. And in most cases, the members of the various groups were engaged in exactly the same kind of work. This condition is very common in factories, where quantity production and the fine division of labor have made it necessary for large groups of individuals to engage in the same process of production. However, the higher we go in the scale of work, the more difficult it is to find this condition. Very few men in important positions are engaged in tasks which are exactly the same, and therefore, it is almost impossible to compare them with each other so as to obtain a record of their relative abilities. Even where the *names* of a number of positions are alike, it by no means follows that the tasks performed are also alike. No one is more familiar with this condition than the employment manager whose duty it is to secure men for a large number of important positions alike in name but very different in fact.

Finally, even if the members of a group are engaged in the same kind of work, it is essential that the work be of such a nature as to furnish an objective measure of production. By an objective measure of production is meant simply an impersonal record of the amount and quality of work done by each individual. We have seen

that records of this kind are frequently available, especially in the case of piece-workers. Such records, in spite of the varying conditions of production and management which may tend to destroy their impartiality, are far more reliable and uniform than any other record which can be obtained. The personal opinions of foremen, instructors, or other superiors are at all times a poor substitute for such an objective-production record. However, the higher we go in the scale of work the less likely are we to find workers doing the same kind of work under conditions which make it possible to measure and compare their relative output or production. Imagine trying to estimate and compare the work of the manager of one department with that of another. Manifestly, it is impossible to make such a comparison except in the most general terms, and in terms of personal opinions rather than in terms of an impersonal measure of units of work actually produced.

These three conditions, therefore—first, the necessity for dealing with work which the psychologist can understand, secondly, the necessity of trying preliminary tests on a large group engaged in the same kind of work, and thirdly, the necessity of an objective or impersonal measure of the work—set a distinct limit to the scope of psychological tests, particularly with regard to the selection of *big* men. Psychologists, in their eagerness to live up to all the demands which have been put upon them, have sometimes hesitated to admit this limitation. They have allowed themselves to be credited, by the too interested friends of psychology, with a technique which enables them to select men for higher types of work. No one, more quickly than the employment manager, will recognize the inadequacy of this technique when it is given

an actual trial. The psychologist who presumes to apply tests to kinds of work which he understands only superficially to groups of men whose work is alike only in superficial details, and in cases where the reliability of the results rests not upon an impersonal record of actual work but upon a concoction of personal opinions, is indeed taking a very grave risk of bringing his medium into disrepute among those whose business it is to be familiar with the complexities and intricacies of employment work. No doubt all of these faults have occurred in the experiments described here; but they are recognized as weaknesses and the results discounted accordingly.

The virtue of the psychological method consists in applying to the abilities of people certain scientifically accurate tests, tests whose value has first been determined by means of experiments which meet the conditions described. The superiority of such measures over the ordinary haphazard measures of common sense is obvious. However, this very virtue is also the weakness of the psychological method or, in fact, of any scientific method. Tests and measures are only significant when applied to cases which conform to standard conditions. The diagnostic tests applied by the physician, for instance, enable him to determine the nature of an illness like measles which, because of its invariable symptoms, we may call standard. However, as soon as an extraordinary illness occurs, his tests become useless. They do not enable him to diagnose the nature of the disease, and it becomes necessary to call in specialists who, in many cases, are also unable to determine the exact nature of the trouble. The more complicated and exceptional the disease, the less applicable are the ordinary laws and measures of the physician. Exactly the same condition prevails in

the case of the psychologist. His tests are adapted to the selection of the more ordinary variety of workers, the nature of whose work conforms to certain fairly well standardized forms. However, the farther away he gets from these forms—that is, the more complicated and exceptional the work becomes—the less applicable are his tests. This tendency is characteristic of all scientific progress. It is well expressed in the trite saying: "Genius knows no law." Not that the genius is beyond the scope of the law. He is governed by law as much as any other man. The scientist, however, or the psychologist does not *know* the law or the rule which applies to the exceptional being. Therefore, he has little if any advantage over the ordinary manager when it comes to selecting exceptional men. The technique of medicine may make a man of poor ability a relatively successful physician. However, as soon as he encounters a case distinctly beyond the scope of his technique, his remedies are almost on a par with the ordinary house remedies. This is much more true in the case of the psychologist whose technique is as yet in a less highly developed state. Up to a certain point, his technique enables him to select people with special success. Beyond that point, his success is a personal matter, distinct from his technique, and depending more largely on his individual ability. In so far as the psychologist is a good manager, he may also be successful in selecting big men. In so far as he is a poor manager, he is bound to fail in his attempt. Where the scientific method stops, the strength and weakness of the personal equation must again have the last word.

XVII

THE SCOPE OF PSYCHOLOGICAL TESTS (*Continued*)

The second important question dealing with the scope of psychological tests is concerned with their qualitative value. How much can tests tell us about an individual? And how much importance may we attach to the facts which they reveal? Is it possible to say that, because an applicant passes the tests for a certain kind of work, that applicant will make good? And is it possible to assert, with equal assurance, that the reverse will be true, and that one who fails in the tests will fail in the work? Here, again, a distinct limitation must be immediately admitted. The application of psychological tests does not make it possible to predict, without qualification, that a certain individual will succeed at a certain kind of work and that another will fail. They only enable one to say that the chances for success of a particular individual or group are better than the chances of another. In brief, psychological tests do not make it possible to discover *all* that it is desirable to know about an individual, or, consequently, to prophesy infallibly what an individual is bound to do.

In the first place, there are innumerable factors which enter into the history of each individual which no method whatsoever can take cognizance of, and which, therefore, no method can control. Every employment manager is familiar with the many reasons other than the item *failure*

or success which enter into the coming and going of workers. Any comprehensive labor-turnover report contains as reasons for employees leaving items such as the following: illness, moving away, needed at home, marriage, not enough pay, dissatisfaction, cannot stand the strain, too far to come, better job elsewhere, and so on indefinitely. These and similar factors are beyond the control or domain of the employment psychologist. If an applicant who was successful in the tests leaves his work for one of the above reasons, it does not follow that the tests were at fault. On the other hand, if individuals who failed in the tests for a certain kind of work become successful workers nevertheless, it is an indication of at least three possibilities: First, the standard in the tests may be too high; secondly, the tests may be useless; thirdly, the individuals in question may possess other qualities which compensate for their inability in the tests, for instance, unusual ambition or a dire need for money. One of the most conspicuous examples of the third possibility arose in the course of an experiment carried on with inspectors. The experimenter was asked by the foreman to test a certain girl who had caused him considerable perplexity. This girl, the foreman stated, was an excellent worker in every way except ability to turn out a sufficient quantity of work. She was industrious, accurate, cheerful, and steady, but not productive. During the course of the psychological examination this inspector did very well in every test until she came to the last and most significant. In this test, her performance was far below the required standard, so far, in fact, that she would not have been hired for inspection work if she had applied after these tests were established. Nevertheless, this girl finally succeeded and became one of the best inspectors in the

room. To be sure it took her two months to succeed whereas the ordinary girl requires only two weeks. However, her ambition and her other excellent moral qualities were such as to enable her in time to overcome the initial handicap with which she began.

This raises the second important point in respect to which psychological tests are at present inadequate; namely, the discovery of the moral and emotional qualities of an individual. In the example cited, the presence of certain moral forces discounted a certain lack of natural ability. Now, such qualities as ambition, reliability, enthusiasm, punctuality, honesty, cheerfulness, determination, loyalty, forcefulness, excitability, tact, deliberateness and an infinite number of similar traits are generally classified as moral and emotional qualities. However, although the existence and concrete character of these qualities is generally conceded, their exact psychological nature is very little understood. The common-sense point of view and the psychological method are equally at a loss when it comes to defining and measuring these qualities. Some attempts have been made to devise tests by which to measure them. One, for example, is based on a series of ethical questions. The subject is given a number of printed cards, each one proposing an action which is generally considered wrong or immoral. Following are some sample acts:

Stealing a loaf of bread when hungry.
Neglecting to pay one's carfare.
Walking off with somebody else's umbrella.
Telling a lie about one's income.
Passing on a slanderous story.
Breaking a speed law.
Taking illegal rebates.

The subject is then asked to arrange these cards in the order in which he considers the actions named most reprehensible, placing the least reprehensible first and the most reprehensible last. The value and significance of such a test are extremely doubtful. Without going into a detailed criticism of the efficacy of this test, it may be said that the core of its weakness consists in the fact that words and actions do not necessarily coincide. Intellectual morality and practical morality are two distinctly different things. For a time it did seem as though the word association tests, made famous by Hugo Muensterberg's book "On the Witness Stand" could bridge these two realms of thought and action. However, it has been found since that the connection between them is so subtle as to make such tests entirely too ambiguous. Even if tests which require the subject to express himself in terms of deeds rather than opinions could be devised, the results would be extremely doubtful. Few individuals could be made to reveal their objectionable moral traits during the course of an interview or a psychological examination. And on the other hand there are few individuals who cannot, when the occasion demands, assume a virtue which they do not have. Whether looking for the negative qualities, such as dishonesty and laziness, or tracing the positive virtues, such as honesty and industry, the psychologist, in common with all other seekers of facts, is laboring under the great disadvantage of the ability of all individuals to minimize or to exaggerate their good and bad points. In none of the moral qualities are there the relatively stable and measurable factors which are to be found in the more elementary activities to which tests have been so successfully applied.

Since psychological tests are unable adequately to

discover and measure the ethical and emotional qualities it is obvious that they do not provide an infallible method for selecting the right man for the right place. In the absence of knowledge about certain of an individual's most important characteristics, no reliable deductions can be made about that individual's future, or his desirability for a certain kind of work. This is, indeed, a serious shortcoming, and one which gravely limits the usefulness of psychological tests. However, it must be remembered that all other methods are equally helpless in the face of this difficulty, even while not admitting it, and that the psychologist has at least the advantage of recognizing the intricacies which the problem presents.

The limitations of psychological tests as applied to the individual having been recognized, wherein does the real value and scope of these tests lie? Briefly, in their ability to discover the presence and measure the extent of the specific abilities or *faculties* which an individual possesses. This knowledge makes it possible to select from a group of applicants those who possess at least one of the two fundamental requisites for success; namely, ability to do the work of a given job. Aside from all moral qualifications, every job requires a minimum of ability or intelligence. Those who possess the necessary moral qualities are not fitted for a job unless they possess also the necessary mental qualities, the necessary ability or technique. On the other hand, those who possess the required ability but not the right moral traits are equally unfitted for the job in question. Those who possess neither ability nor character are least of all fitted, while those who possess both are of course best fitted. We may show the four possible combinations of these two fundamental elements by means of the following table:

Possessed of the necessary ability.	Possessed of the necessary moral traits.
Without the necessary ability.	Without the necessary moral traits.

The four possible combinations are as follows: (1) Those with the necessary technique and also the necessary moral traits. (2) Those with the necessary ability but without the necessary moral traits. (3) Those without the necessary ability but with the necessary moral traits. (4) Those without the necessary ability and without the necessary moral traits.

Now, it will be seen that psychological tests, by being able to discover and measure ability or technique, immediately make it possible to reduce the number of possible mistakes in selection by fifty per cent. By means of tests we are enabled, in the first place, to separate those who have the requisite ability from those who do not, regardless of the existence of the moral qualities. Therefore, the large number of applicants who have not the necessary ability to succeed at the particular job in question are rejected at once. Those who have the necessary ability may now be divided into two classes, those who have the necessary moral traits and those who have not. Because psychological tests cannot definitely discover the presence and degree of the moral qualities, the psychological examiner is likely to recommend both of these groups for work. Of the number, some will undoubtedly fail because even though they have the requisite ability they lack the necessary moral traits. There remain, then, those who have

both the ability and the character necessary for success and who do succeed. Therefore, in spite of the fact that psychological tests do not suffice in the discovery of one of the two most important factors about applicants they nevertheless make it possible to eliminate those individuals who do not possess the other known factor. Thus they enable us to consummate a very great reduction in the number of possible errors, and to bring the process of selection much closer to the region of accuracy and certainty.

The best and most authentic example of this process which has been obtained is that described in Chapter III. Here it was seen that a considerable number of inspectors who did not pass the tests but who were hired nevertheless were failures. This number corresponds to the first large class of those who have not the necessary ability, and who can be eliminated at the outset by means of the tests. Next, there was a group who passed the tests but who nevertheless failed. This group probably failed because it did not possess the necessary moral qualities. Finally, there remained the group which succeeded and which worked for a period of from one to four months at piecework production. This group undoubtedly possessed the necessary moral traits and ninety-four per cent of them had passed the tests, showing that they had the necessary ability. This is a very good example of the practical scope and value of tests when applied to employment work, even though that scope does not embrace the discovery of every fact about an individual which the employment office would like to know. (Moreover, the example is an exceptionally valuable one because both those who did not pass the tests and those who did were hired. Therefore, it became possible to show the enormous amount of work

and expense which were invested on the hiring and training of candidates who were destined from the outset to fail.)

Much has been said in deprecation of the scope of tests, and one of the most frequently repeated statements is that tests do not enable the employment office to select those who will succeed, but only make it possible to eliminate a percentage of those who are bound to fail. Therefore tests have only a negative value. In a sense this is true; but it is equally true of any selective process whatsoever. All selection proceeds by elimination. In fact, elimination is selection and selection is elimination. The main question about such a process is: to what extent does it reduce the number of possible mistakes? It has been seen that the psychological method does not make it possible to avoid all mistakes in selection, and in this sense it can be called negative. However, it has also been seen that the use of tests provides a systematic and effective way of reducing the number of mal-selections, and in this sense, therefore, it is decidedly positive.

In attempting to make clear the exact scope and limitation of tests when applied to the individual, this discussion has erred, if anything, on the side of fairness. It has been stated that psychological tests are unable to detect moral characteristics. As a matter of fact, tests are not nearly as helpless in the face of this problem as has been suggested. One of the great errors which employment managers, foremen, superintendents, and all other people, including teachers, ministers, and religious workers fall into, is the belief that the moral qualities are *absolute* qualities. They believe that if a man is lazy he *is* lazy. If he is industrious he *is* industrious. If he is cheerful he *is* cheerful. If he is disloyal he *is* disloyal. If he is ambitious he *is* ambitious.

If he is good he *is* good. And if he is bad he *is* bad. In other words, they labor under the belief that the moral qualities are constant qualities which are an inseparable part of a human being as scales, fur, and hide are an inseparable feature of the fish, the dog, and the elephant; and further, that no matter where people are and what they are doing, their moral qualities are an invariable part of their nature. Nothing could be farther from the truth. The moral qualities are not absolute. They are not blanket qualities which cover an individual's entire range of life no matter under what circumstances he may live. On the contrary, moral traits are *relative*, and their nature depends upon a very wide variety of external economic, social and bodily conditions.

Nowhere is this fact more obvious than in the selection and retention of employees. The experiments described have demonstrated nothing more conclusively than the relativity of the moral qualities. It has been found repeatedly that the listlessness or laziness of an individual at a given job was due not to any permanent moral flabbiness, but to the fact that the individual did not like the work or had not been able to do it because he lacked the necessary mental qualifications. In cases of this kind, it frequently happens that when an individual is transferred to another type of work, more nearly within the reach of his capacities and inclinations, he develops a most admirable degree of industry and energy. The same may be said of most other moral traits. Initiative is a moral quality which a worker may reveal while he is engaged in work for which his training and preparation fit him, but which may be entirely absent if he is placed, by mistake, at work which does not come within the scope of his ability. The same may be said of punctuality and

steadiness, qualities upon which industries are now placing every conceivable premium. As long as a large number of employees are engaged at work which does not interest them and for which they have not had any particular training, it cannot be expected that they will strive to avoid all tardinesses and absences. The quality of *loyalty* is to-day one of the most stressed in industry, for it includes a large number of other desirable moral traits. However, the very foundation for loyalty is a liking for one's work or for the resulting rewards, and this, in turn, is dependent upon the manner in which the individual is chosen for his work. It is extremely difficult for a worker to be loyal when the work he is doing does not call into exercise a knowledge of the trade which he has learned, or when he is unable to earn a fair week's pay.

In this connection, a statement in one of the reports by the Committee on Industrial Training in British Munition Factories is of unusual significance. According to the report of this committee, the successful factory worker was one who had the factory temperament; and the factory temperament was defined as: first, the patriotic loyalty aroused by the country's need, and, secondly, the ability to earn a desirable week's pay. The latter, it was affirmed, was almost more powerful in effect than the former. If this was true at the time when this report was made, how much more will it be true when the patriotic stimulus is lessened?

An unusual opportunity of observing the relativity of moral qualities in a general way was afforded by a training course, consisting of about fifteen college men who were being shifted from one shop and department to another in a systematic attempt to acquaint them with the fundamental aspects of the industry. These men

were naturally sufficiently interested in their work to maintain the required moral level. Nevertheless, their interests and moral traits varied noticeably as they were shifted from one shop or office to another. Certain men were very enthusiastic about one place and quite the contrary about another. They were anxious to finish some shops as soon as possible while in others they were anxious to remain even longer than the allotted time. Not only their enthusiasm but their daily attendance, their attentiveness, and the quality of their work were governed in a marked degree by these changing factors. Whereas one kind of work elicited the most desirable moral traits in one man, it had quite the opposite effect on another. At the end of the course all of the men found permanent positions of widely differing kinds, and, in most cases, their work was such as to elicit the best qualities in them.

There are, to be sure, certain individuals who have a constitutional dislike for any work whatsoever, and there are still others who have a fixed dislike for certain kinds of work. There are also a few who manifest industry and determination at any kind of work to which they happen to be assigned. Their number, however, is scant. In the vast majority of cases, the moral traits an individual displays are determined by two variable conditions. These conditions are first, a liking for a certain kind of work for its own sake, and, secondly, a liking of the work for the sake of the rewards which it makes possible. The former is effective in the case of workers with a trade or a vocation. The very fact that they have completed the term of apprenticeship which is required to learn their trade indicates that they possess at least some of the necessary moral qualities. In order to engage and further develop these qualities, it behooves the employment office to

place men of this kind in positions where their training and experience may be utilized to the utmost and given their fullest opportunity for expansion. In the case of workers without a trade and unwilling to learn a trade, the desirable course is to assign them to the work which will enable them most quickly to earn the wage which they require for the satisfaction of their outside interests. If applicants of this kind are given work which comes within their abilities, they are likely to exhibit industry and energy. If they are given work which does not, they are very likely to exhibit indifference, laziness, carelessness, and other undesirable moral traits; and, in addition, they are likely to leave as soon as they see an opportunity elsewhere for making a larger wage. At the risk of repetition, this matter will be discussed from a slightly different angle in the chapter on vestibule schools. In the meanwhile, it can be seen that, by making it possible to assign workers to the work for which, both by nature and by training, they are best fitted, psychological tests contribute largely to the solution of the problem of selecting employees with the right moral traits.

From still another point of view, the use of tests is an aid in developing the desired moral qualities and a means of *preventing their exhaustion.* The statement has been made that moral traits are relative. This is true not only in a qualitative sense but in a quantitative sense as well. For instance, an individual may begin work with a certain degree of natural enthusiasm and industriousness. If he succeeds at his work within a reasonable length of time, he is likely to maintain and even augment these qualities. If he fails, he may gradually lose them. His moral resistance and energy may be exhausted by the difficulty and unfitness of the work to which he was

assigned, whereas the opposite may be true when he is assigned to work for which his abilities fit him. As a concrete example of this fact, we may cite the results of the tests given to inspectors described in Chapter III. A large number of inspectors, both such as were acceptable according to the tests and such as were not, finally gave up their work or were discharged. Nevertheless, those who were acceptable according to the tests worked for a period nine times as long as those who were not, thus indicating that they were, on the whole, a more determined group. In other words, their greater ability for the work of inspection removed from their path certain obstacles which would otherwise have absorbed their moral resistance in a much shorter period, as did happen in the case of those who remained only a week but had not passed the tests. And of the number who remained at work for two months or more and who may therefore be said to have manifested the most desirable moral traits, ninety-four per cent were acceptable on the basis of the tests. The conclusion which we are forced to draw is that those who possess the necessary ability, as ascertained by the tests, are more likely to develop the desirable moral traits or to retain for a longer time those with which they set out.

There is one more aspect in which tests may contribute materially to the solution of the question of moral qualities. The power of suggestion is a well-known psychological fact. A suggestion, properly made, frequently has the power to change entirely an individual's course of action. Obviously, the value of a suggestion depends upon the intelligence with which it is made. It frequently happens that new employees are so diffident and lacking in assurance that they fail at work for which they undoubtedly

possess the necessary ability. This is due to the fact that they are not conscious of their ability, and lack that bit of extra energy which might enable them to put themselves to the test. In cases of this kind, the psychological examiner is in a position to suggest to his subject that, beyond a doubt, he possesses the necessary ability for success. In several cases, the experimenter has suggested to a subject who did well in the tests but whose work was not so satisfactory that he could unquestionably make good if he only would. However, it was inadvisable to do this during the course of experiments which were being conducted precisely with the view of finding the value of the tests upon which such a suggestion was based. It remains as an interesting field for experimentation for some one to discover to what extent the power of suggestion may neutralize or augment the natural differences between individuals as shown by tests. In the meanwhile, it seems safe to prophesy that the development of tests which make it possible to discover the innate and acquired faculties of individuals will at the same time provide a more scientific basis for the employment of the powerful stimulus of suggestion. And by accomplishing this, another great contribution will have been made to the process of selecting individuals who are adapted for their work both mentally and morally.

SUMMARY

The scope of psychological tests has been discussed largely from the standpoint of their limitations. It has been pointed out that the extent to which tests may be applied is determined by three conditions: (1) An understanding on the part of the psychologist of the work to which they are to be applied in order that he may

select tests which are appropriate; (2) a preliminary experiment with a large group of workers engaged in the same kind of work in order to determine the value of the tests selected and the standards which shall be used; (3) an objective or impersonal measure of the work done by the members of the group in order to provide a reliable and accurate basis upon which to compare both the individuals and their performances in the tests. The difficulty of meeting these three conditions makes it impossible to apply tests intelligently to executives in the higher and more specialized positions. However, there is a vast and ever growing field where these conditions exist and where tests may therefore be readily applied, and some indications of the scope of this field have been given in the previous chapters.

With regard to the qualitative scope of tests, or their degree of reliability, it has been seen that their chief value lies in detecting the innate or acquired mental ability of the individual. Tests do not reveal the moral qualities and in this sense their value is limited. But even with this limitation, they make it possible to select the man who is most likely to possess them. For, as has been seen, the moral traits are relative, and depend in large measure upon the ability of an individual to make good; and this ability does come within the scope of tests to determine. Finally, the knowledge which tests can give us about the abilities of individuals offers, for the first time, a scientific or objective basis upon which to use the powerful stimulus of suggestion. By the use of suggestion, much can be done to arouse and to create the moral qualities which are desirable in a worker and which will make the worker not only more valuable to the industry but to himself.

PART II

TRADE TESTS AND OTHER APPLICATIONS OF EMPLOYMENT PSYCHOLOGY

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There are certain broad phases of employment which are the original and constant nucleus from which all subsequent ones develop. These are: (1) observing an applicant's appearance; (2) obtaining information through questions; (3) job analysis; (4) introducing the new employee to his job. Employment psychology has much to contribute toward placing these hitherto haphazard aspects of employment on a more scientific basis.

One of the most interesting of recent developments is the perfection of the question method. The so-called "trade tests", devised for use in the army, are the best example of this development. These tests consist partly of a series of questions based on a particular trade, with the answers that are to be expected. The method by which they are developed will be described in the chapter on "How to Ask Questions".

Trade tests are sometimes spoken of as something quite different from psychological tests. As a matter of fact, the difference between them is merely verbal. Trade tests are a subdivision of psychological tests. Their distinguishing feature is that they are based almost entirely on the acquired knowledge or ability which is supposed to go with a recognized trade.

Trade tests often appear to the lay mind as comparatively simple and direct, easy to devise, and easy to apply.

However, unless these tests are worked out with the care and thoroughness which the psychological technique applies to tests in general, the results are sure to be very disappointing. This fact will become clearer in the ensuing chapters.

XVIII

HOW TO ASK QUESTIONS AND THE DEVELOPMENT OF QUESTION TRADE TESTS

Next to observation, the oldest method of forming impressions is through oral questions. The first act of the interviewer is to look at the applicant and get an instantaneous impression of his general appearance. After this the almost universal sequence is the question: "What's your name?" This question is followed by the more or less stereotyped set of questions relating to address, age, previous history, and so on, which forms the body of the interview. A great part of the information which forms the basis on which an applicant is hired or rejected is the result of the questions which are asked him.

The text around which this chapter is written is: The value of the answers obtained is directly proportional to the value of the questions asked. At one time, school teachers were almost alone in recognizing the truth of this statement. Pedagogues have long been agreed that one of the most important factors in teaching is the art of asking questions in such a way as to bring to light the knowledge and the ability of the pupil. In the work of employment, the importance of questions cannot be overestimated, for a large part of the knowledge upon which the applicant is selected is obtained in this way. And yet, important as is the matter of asking questions, it, like most other phases of employment, has been left entirely to chance and to the unguided discretion of individual inter-

viewers. For this reason, the same general failings which have already been attributed to any method which rests primarily upon the unaided judgment of the individual can be attributed once more to this phase of employment. These failings are in sum, lack of consistency, inaccuracy, liability to the moods and prejudices of different individuals, and in general the errors due to the variable and uncertain factors of the personal equation.

There is one notable exception to this arraignment of the question method; that is, the application blank. The application blank represents, in most cases, a standard set of well thought out questions which are given to all applicants in exactly the same fashion. It is an attempt to arrive at the most important facts about an individual in the most specific and lucid manner. That it does not always succeed in this respect, and that there are grave objections to many items on most application forms, need not be questioned. In any event, it has procured information of inestimable value, and it is, without a doubt, far superior to the method which leaves the obtaining of this information to chance or to the discretion of the individual employment-office clerk.

However, there is a large number of applicants who cannot read or write English and many who cannot even understand it. In such cases oral questions must be resorted to. Either the employment interviewer must fill out the application blank himself or it must be discarded entirely and the applicant interviewed orally as well as is possible. In such cases, the most simple and obvious questions may be a stumbling block rather than an aid. As an example of this possibility, the following incident is related. Almost always the first question which an interviewer puts to an applicant is: "What's your name?"

The next question is: "Where do you live?" And after that, usually, "What kind of work do you want?" One interviewer, who was surprised at the consistent intelligence with which illiterate applicants answered the first three questions and the complete obtuseness which they usually displayed to subsequent questions was inspired by an idea. The next interview which he conducted was something as follows:

Interviewer: What kind of work do you want?
Applicant: Antonio Digigli.
Interviewer: What's your name?
Applicant: Fifty-four William Street.
Interviewer: Where do you live?
Applicant: Machine job.

These three questions had become so stereotyped through constant use that their meaning and order had come to be commonly known and illiterate applicants could, as a result, often mislead the interviewer for several minutes. However, aside from these simple and stereotyped questions, there is a large number of questions which may be asked even of applicants who have already filled out a complete application blank. This is due to the endless variety of circumstances which surround the choosing of a new employee. Every applicant is different from other applicants in one or more ways. The difference may lie either in his previous history or experience or in the kind of work for which he is applying. The questions which are necessary to bring out these differences are one of the most important phases of employment.

A very large industry, well known for its employment methods, provides on its application blanks a series of items as a guide to the interviewer in selecting candidates.

These items refer to qualities in the applicant which are to be determined either by observation or through questions. The former are enumerated and discussed in the chapter on Observation. The latter are as follows:

Willingness to Work: Past record good.....Wants this kind of work.....Passive.....Has tried other things and not liked them.....Poor.....

Knowledge of Work: Years experience at it.....Well trained.....Fair.....None at all.....

Loyalty: Stands by all former first-class employers..... Moderately good.....Poor, but thinks well of us.....

Team Work: Booster.....Knocker.....Neutral.....

Sobriety: Total abstainer ..... Temperate ..... Periodic drinker ..... Moderate drinker ..... Hard drinker.....

Desire to Improve: Correspondence schools.....Night schools.....Other study.....Ambitions.....

Stability: Longest period in one place.....Chronic floater.....

Among the above items there are many which are very important and about which valuable information may be obtained either through observation or through asking questions. However, the value of the information obtained through asking questions on these points will be directly in proportion to the value of the questions which are asked. In the first place, it must be remembered that, on some of these subjects, it is to the interest of the applicant to color the truth to his own advantage. Take, for instance, the item, *willingness to work.* If the interviewer asks: "Are you willing to work?" or "Do you like to work?" is there any applicant who would answer: "No. I only want a job?" It is not very likely. The

only way in which this knowledge can be obtained is through the applicant's past record. If the applicant has a past record in the same company this is a simple matter. If not, it will be necessary to write for information to past employers whose names are given as references. However, answers to questions of this kind must invariably be discounted. Unless an employee has been flagrantly lazy or committed an outright crime, a previous employer will hardly ever have the courage or desire to say anything detrimental about him, especially when he is trying to make a new start elsewhere. While this is a tribute to the generosity of the ordinary employer, it is at the same time a fact which generally discounts the value of all references. It may almost be stated as a rule that an interviewer should never give much weight to endorsements from other sources unless the exact nature of these sources is known. As for the item, *has tried other things and not liked them*, nearly every man who has failed in previous positions will give this as his answer. He is quite unlikely to say: "I have tried several kinds of work, but I was a failure every time."

Another extremely important item is *loyalty*. The presence or absence of this popular quality is evidently to be determined by questions concerning the applicant's attitude toward former employers. There are various ways in which the interviewer may ask these questions, but the substance of them all must inevitably reduce itself to something of the following form: "How did you like your last employer?" What answer may the applicant be expected to give to such a question? If he was laid off for lack of work, he may simply say: "I haven't any kick coming. I was laid off when the work ran down." However, if he was discharged for incompetency he is

hardly likely to answer: "Oh, the foreman was all right. It was all my fault." Obviously not. If an applicant is looking for work elsewhere, it is very often because there was a hitch in his relations with his previous employers. But to stand up for these is to discredit himself, and as an ordinary human being, in search of another job, it is expecting too much of the loyalty of any individual to have him cast reflections upon himself. And as for the item, *poor, but thinks well of us*, can an applicant do anything but think well of the company with which he is trying to find work? Would any applicant be likely to say: "I don't think much of this company, but I need a job so badly that I am willing to take it anywhere"? Questions of this kind are obviously not worth asking.

In questions of all kinds, the effect of *suggestion* cannot be overestimated. The interviewer may ask his questions in such a way as really to predetermine the answer which he shall receive. In the item of *sobriety*, for instance, the interviewer may look sternly at the applicant and ask, in an almost threatening voice: "Do you drink?" The inevitable answer to a question asked in such a way is a horrified: "Oh, no, sir!" There are innumerable ways of asking this question. One might ask, following the items mentioned: "Are you a hard drinker or a moderate drinker?" The inevitable answer to this question will naturally be: "Moderate." And one would hardly expect an applicant to answer to his detriment the question: "Do you get drunk often or only once in a while?" On the other hand, if an interviewer asks, with a disarming smile: "About how much do you drink?" he may get an answer somewhere near the truth. However, even this is very uncertain. Where an industry is known to refuse all applicants who are anything but total abstainers, the

interviewer is only wasting time by asking questions on this subject; for no one would apply for work at such a place who was not determined to swear on his honor that he never touched a drop.

These instances may be slight exaggerations, but they nevertheless serve to point out the absurdity of some questions. Moreover, they also point out the importance of the element of *suggestion* in an employment interview. One of the greatest discoveries of psychologists has been the part which suggestion plays in ordinary life, and the mechanism by which it works. In the case of the ordinary applicant, anxious to obtain a job, there is usually a great deal of room for the operation of this factor. The applicant is naturally very desirous of pleasing the interviewer as far as possible; for with him rests the decision as to whether he will obtain a job or not, and whether it will be a poor or a good one. Consequently, the applicant watches the interviewer for the least little sign. He literally hangs upon his word and expression. He answers as nearly as possible what he thinks the interviewer would like to hear from him. He will praise the present company and condemn its rivals. He will insist on his willingness to work. He will be deferential and courteous. He will enlarge on his experience and training. He will describe his studies and call attention to his ambitions. In short, he will put his best foot forward. If, during the interview, he exaggerates slightly or distorts the truth, it is hardly fair to call him dishonest. He is simply giving himself the benefit of the doubt, and he is trying to represent himself as the kind of a man that the interviewer, at the moment, would like him to be,—is, in fact, *suggesting* that he should be. If this is remembered, a great many questions which are now asked would be omitted,

and others would be asked in a different manner. To ask questions without this fact in mind is to invite answers which will contribute very little valuable data to the ensemble of facts upon which the selection of an applicant must ultimately be based.

Finally, these principles apply also to the higher types of work for which psychological tests are as yet inadequate. If it is difficult to interpret appearances and to ask intelligent questions of ordinary candidates, it is infinitely more difficult to do so with applicants whose work is far more complex and intricate. For this reason, it is the customary practice of the employment office to send applicants of this type to men who are themselves in higher positions, on the assumption that the superior knowledge which these men have of the work in question will enable them to conduct a more satisfactory interview with the prospective employee. This assumption is undoubtedly well founded. The man who is familiar with a certain kind of work is in a position to ask questions about that work which are far more intelligent than those which an interviewer not so familiar with the work can ask. However, even here there are grave possibilities of error in the same direction as those to which the ordinary employment interviewer is liable. The man higher up is likely to be just as subject to prejudices and incidental signs as the employment manager, and often more so. Although more familiar with the requirements of his work, he may be less able to tell whether the candidate before him has the ability to meet those requirements. He may not have the experience or the technique necessary to ask just those questions which will give him the knowledge about the applicant which he would like to have. In short, it does not follow, simply because a man has been successful at a

certain kind of work, that he will be able to select others who will succeed. A successful industrial, production, or mechanical engineer is by no means a successful employment interviewer. He may be a good judge of human nature and he may not. His success may rest largely on other grounds, such as special experience, education, or ability in a certain field. It is most often the case that if asked to state just what are the requirements of his position or what factors in his own make-up have enabled him to succeed, he is unable to give a clear and unambiguous answer. Although he knows what his work is and although he possesses the qualities necessary to succeed at it, he is still unable to state them.

At this point the significance of *trade tests* or, to use the more inclusive term, *occupational tests*, becomes once more apparent. One of the commonest forms of the occupational tests is a series of questions relating to the duties of a particular occupation. Accompanying these questions is a set of answers which may be expected from an applicant who knows the work under consideration. The development of such a series of questions for industrial use is by no means a simple task. The faults pointed out are only too likely to be committed, as the following incident will show:

A foreman of unusual ability in handling men, who had once been an employment manager and had interviewed many hundred of applicants, was asked to answer the following request: "Please put down ten questions which you consider the most important that might be asked a candidate for the position of gun assembler. These questions should be asked with a view of drawing out the candidate's knowledge of his trade and show his skill as a thoroughgoing assembler. Give also the correct answer

to each question, such as you would expect from the applicant who was being interviewed." Following are the actual questions and answers which were given by this foreman:

1. Q. What experience have you had as a gun assembler? A. More than five years on various makes, both rifle and shotgun.

2. Q. What experience have you had as an assembler other than on guns? A. Have had several years' experience on sewing machines and typewriters.

3. Q. What kind of work requiring particularly close filing have you done? A. Small-tool work.

4. Q. Have you any trouble with your eyes. A? No.

5. Q. Are you nervous? A. No.

6. Q. Have you had such experience in shooting guns as to be able to determine the requirements of a finished gun? A. I have had both rifle, target, and shotgun practice.

7. Q. How long have you held each job? A. More than a year.

8. Q. What are your habits? A. Sober, and never lose any time.

9. Q. Have you had much trouble with the foremen for whom you worked? A. No.

10. Q. Does gun assembling particularly appeal to you? A. Yes.

Two of the above questions are obviously very good questions, and require specific answers. However, two others can be answered very vaguely, while six of the ten are of absolutely no value. These are questions numbers four, five, seven, eight, nine, and ten. If a man is applying for work as an assembler, and is asked whether such work appeals to him, he can hardly be expected to

say, "No, it doesn't, but I need the money." Neither can a large variety of answers be expected to such a question as: "Have you had much trouble with the foremen for whom you worked?" The question: "Are you nervous?" will certainly not encourage an applicant to admit the fact even if it is true. When the attention of the foreman who made out this list was called to these points and the real purpose of the questions explained to him, he was very much chagrined and said: "I ought to have known better, but to tell the truth, I made them out in a hurry and did not give them enough thought. Leave them with me, and I will make out another set which will be closer to what I think you want." The second attempt was a very great improvement on the first. It is given below in full because it will serve as a basis for the method of asking questions which is advocated here and which has already been developed to an unheard-of extent in connection with the classification of personnel for military and industrial purposes.

1. Q. What experience have you had as a gun assembler? A. More than five years on various makes, both rifle and shotgun.

2. Q. Name the most important adjustments on a gun. A. Breeching, locking, trigger, chamber, firing pin, barrel and sight alignment.

3. Q. Why do you consider breeching important? A. Because if the gun is not breeched correctly the cartridge will be loose and cause unnecessary wear on chamber.

4. Q. Why lock? A. If lock is not correctly adjusted the gun may fly open and injure the operator while shooting.

5. Q. Why trigger? A. If trigger pull is too light, gun may jar off and injure some one, or if too heavy will cause poor targeting.

6. Q. Why chamber? A. If the chamber is too large the shell will swell and cannot be extracted in the regular way.

7. Q. Why firing pin? A. If the firing pin is too long there will be the danger of premature fire, if too short, of misfire.

8. Q. Why barrel? A. If there is a seam in the barrel when shot it will burst open and if the barrel is not straight the gun will not shoot straight.

9. Q. Why sight alignment? A. The alignment of sight is essential to correct shooting.

10. Q. What experience as an assembler other than on guns? A. Have had several years' experience on sewing machines, typewriters, etc.

11. Q. What kind of work requiring particularly close filing have you done? A. Small-tool work.

These are valuable questions because they require specific answers about concrete and specific elements in the work of gun assembling. However, definite as they are, they could not be used as they stand with any certainty as to their value. It is first of all necessary to experiment with these questions on a sufficient number of men actually engaged in this work, in order to find out whether the questions are such that the best workers obtain the highest grade in the test and the poorest workers the lowest grade. In other words, it is necessary to find the *correlation* between the performance of the men in the test and their actual ability at their trade. Moreover, it is also necessary, by the process of trial and error described in previous chapters, to eliminate ambiguous words, catch questions, "guess" answers, and questions which permit a lengthy or indefinite explanation. In short, trade tests, whether in the form of questions or any other form, must

be developed by means of the technique of psychology if they are to be at once practical and reliable.

A further development of the question method is to base the questions asked on pictures or blueprints. A tool maker, for instance, might be shown a group of blueprints calling for operations on different machine tools and asked to name, offhand, various machines which are required for each. A machinist might be shown a picture of a collection of machine parts and tools and asked to name them. A third method is to give the applicant an opportunity to demonstrate his ability by giving him some representative task to perform. This type of test will be more fully discussed in a following chapter.

In formulating and standardizing tests for trades and other technical occupations, too much emphasis cannot be placed upon the close coöperation between the technical expert and the psychologist. The former alone can supply the facts necessary for the meat of a test. However, it is equally true that the technical expert cannot, as a rule, use his knowledge in the manner required by an employment test or interview. This deficiency must be supplemented by the psychologist, whose assistance in formulating the details and standards of a test and in giving it an experimental trial, is indispensable to its success.

Even when the tests to be used have already been devised by experts elsewhere, their installation in another company should be handled with equal caution. Technical experts from that company should be called on to examine the proposed tests and to see whether they really apply to their work. After the necessary revisions have been made, the tests should be tried out according to the usual method to see if they actually correlate. It is

at this point that the difference between valuable and useless tests will be discovered or overlooked.

The following occurrence will help to show the importance of preliminary trials. A set of trade tests for tool makers developed and standardized in a certain industry were installed in the employment office of another company. After they had been in use for a few months, three of the former expert tool makers of that company who had left to work with another concern returned and asked for their old positions. They were given the trade tests and two of the men failed to obtain even an apprentice rating while the third made a low journeyman's rating. All of these men had been considered among the best in the shop, and their failure in the tests therefore aroused the suspicions of the employment manager. He decided to give the tests to the seventy-four tool makers in that particular shop, and out of that number forty-seven failed completely, twenty-one were rated as apprentices, and only six obtained a journeyman's rating. An analysis of the causes for this low correlation showed that the methods pursued in this shop were slightly different from those used in the shop where the tests had originated. Not until the tests were actually tried out under the new circumstances did the real nature of this difference become apparent.

Trades and occupations are different in almost every industry to-day, and the practical significance of these differences for employment will be revealed only by means of experiments and actual trials such as have been described.

Valuable as trade tests are, it must not be forgotten that they are limited in their scope. As their name indicates, they apply only to trades; that is, to occupations which involve a certain body of standard knowledge such as may be acquired during the course of an apprentice-

ship period. However, the dominant tendency in industry is the breaking down of the trades into specialties. The overwhelming majority of jobs to-day can be learned in from one day to three weeks. It is little more than useless to develop trade tests for such a variety of quickly learned tasks. It is much more valuable to find tests for innate specific abilities, for the lack of trade knowledge is not a serious hindrance for a task which takes only a short time to learn.

In order to obtain the most efficacious results from the use of question tests it is highly advisable to ask the questions in connection with an actual demonstration in a prepared demonstrating room. However, it is well to have a short series of prepared questions for use in the employment office, in order that the more flagrantly unfit and ignorant applicants may be eliminated at once. Those candidates who pass this preliminary set of technical questions will then be allowed to pass into the demonstrating room, where they will be asked to demonstrate certain important activities of their trade under the eyes of a skilled observer. In this connection, a further series of questions can be held in readiness, questions which concern the actual work in hand and also the various tools which must be used for that purpose. As a preliminary demonstration and set of questions, a very successful procedure is to have displayed before the applicant a set of tools, both appropriate and inappropriate. The candidate can then be asked to select those tools which are commonly used in his trade and to name them as he picks them out. This is a very simple test, but one which has been found very effective in separating the sheep from the goats. The suggestion made by one of the workmen and related in Chapter VI is also a very useful device. A great

many occupations require a certain ability in filing. To discover something of an applicant's ability in this direction, he may be placed before an assortment of files and parts and be asked to do one or more pieces of filing. The files which he picks up and the manner in which he handles them will be a token to the expert of his ability in this respect.

Naturally, it cannot be expected that these devices and tests for choosing and rating applicants can be perfect or final. Not until the worker is actually engaged at his task and confronted with definite and unexpected problems will his genuine ability and experience be fully displayed. The logical step after those which have now been described is a period of approval, during which the new worker is given actual work and closely observed under conditions of normal activity. However, this phase of employment must be left for another discussion. In the meanwhile, the methods suggested if carefully worked out and conscientiously applied, will greatly facilitate both the classification and the rating of applicants before they are turned into the larger organization. And in working out the technique for a procedure covering these phases of employment, the psychologist can be of great value to the experts who will be required to work out the details of the demonstration and the questions to be asked. For the psychologist, aside from his knowledge of the workings of the mind, is familiar with the requirements of an exact technique such as will be essential if these phases of employment are to be placed upon a sound and scientific basis. When the questions to be asked an applicant are given the careful attention and experimental study described, then the answers obtained will have a genuine value.

XIX

THE OBSERVATIONAL METHOD

OBSERVING APPEARANCES

Judging by appearances plays a large part in all employment work, and yet, of all methods of estimating character, it is the most unreliable. Every language is full of proverbs to the effect that beauty is only skin deep, fine feathers do not make a fine bird, and handsome is as handsome does. That appearances must be relied on to some extent, nobody will deny. There are innumerable instances in daily life in which the only method open to us is to judge people by means of a fleeting impression. As long as not much is at stake in such judgments, we may indulge in them as far as we like without suffering any consequences more serious than an occasional blow to our self-esteem on discovering that our original impression has been totally wrong. Mistakes like these are easily forgotten by the ordinary optimistic human being. However, in the case of large organizations, where the process of estimating individuals involves very important stakes, the observational method is extremely dangerous and inadequate. The mistakes which such organizations make in their estimates cannot be forgotten but are automatically translated into an economic loss.

Let us take some instances to illustrate this statement. Most people would probably not hesitate to assert that they can pick the healthy individuals of a group in the majority of cases—let us say nine times out of ten—by

means of mere observation. But can mere observation gauge the beat of a man's pulse, or the pressure of his blood, or the temperature of his body? Can it detect any one of the hundred and one ailments which may afflict an individual healthy to all outward appearances? What should we think of an insurance company which selected its risks by mere observation, or of an army which selected its men by giving them only the "once over"? The physical examination, with its thoroughness, its mechanical aids, its chemical analysis, is a standing testimony to the unreliability of observation. To guess correctly nine times out of ten may be possible, especially to those who are gifted with the knack. However, an insurance company which guessed correctly nine times out of ten would be bankrupt in a very short time. And an army which made only one mistake in ten would in all probability break down at the crucial test. Industries, until recently, have labored along under the economic burden which their mistakes in this respect imposed on them. However, there are now signs in the recognition of the importance of the labor-turnover problem that these mistakes will not be tolerated much longer.

The phrase, *observational method*, is used here to mean making an estimate of an individual on the basis of a cursory scrutiny of his general appearance and of those actions which are likely to appear during the characteristic short employment interview. Naturally, the longer an observation is continued the more things about an individual it can include and the more reliable the resulting judgment will be. But, even prolonged observations are not necessarily reliable, and it often happens that, after having known friends for years, we find that we have not really known them at all. The employment interview

is necessarily very brief, and permits only the most superficial observation.

During the course of some of the experiments described, it was the practice of the experimenter to note, on one side of the record card, his personal impressions of the subject being examined. These observations, as already described in Chapter III, were recorded under the following heads:

General Intelligence
Attention
Rhythm
Personal Appearance
Physique

The object of this practice was to find out by means of a later comparison how well the estimates based upon mere observation tallied with the actual production records and also with the records in the tests. At the end of the first experiment, this comparison showed a fair if not a remarkable agreement with the more reliable production records. The experimenter, who had had considerable experience in selecting people by means of mere observation and who had a certain degree of confidence in his ability as a judge, was naturally pleased by this agreement. However, upon comparing his estimates of inspectors with his estimates of gaugers, he found, to his surprise, that they were almost alike. In short, he had estimated the girls in one group as good, poor, and indifferent, and had estimated the girls in the other group in the same way. But there was nothing in his estimates which made it possible to separate the successful *gaugers* from the successful *inspectors*, although *nearly all of the gaugers were girls who had first tried inspection and had failed.*

What we really do when we judge a person is to express a peculiar feeling of liking, indifference, or dislike. We are impressed either favorably or unfavorably, or we receive a neutral impression. Sometimes we can account for this impression, frequently we cannot. Often the most trivial fact or happening determines it. This impression we are likely to interpret in terms of industry, attention, and other personal attributes. However, as will be pointed out in the chapter on job analysis, general qualities of this kind have little significance when applied to the process of choosing particular individuals for particular jobs. In the instance given, two groups of girls were observed and the estimates expressed were, in general, correct. So far as unaided observation could judge, these two groups were almost on the same level. Sitting on opposite sides of the same room, there was very little observable difference between them. If they had been lined up before the employment interviewer, they would have had equal opportunities of being chosen for either inspection or gauging. And yet, there was a difference between these girls which divided them, after a number of trials in the shop, into two distinct groups. One group was best fitted for one kind of work, the other for another kind.

Now, when we consider that this is only a single instance, and that a modern industry comprises an almost endless variety of tasks and people, the inadequacy of the observational method with its general likes and dislikes, its loose classifications made on broad lines, becomes increasingly apparent. It is not enough for an applicant to make a good general impression when he is applying for a position as accountant. He should be able to show or to demonstrate concretely that he has the training and

ability necessary for an accountant. What an industry is interested in is not so much general qualities as specific abilities. This is an age of specialization in every field, of the utmost division of labor and talent. The task of the employment office of a large or a small industry is to classify applicants into groups which are as specific as are the various jobs which they are called upon to perform. For this task the old method of observation, even in the hands of the most skilled observer, is entirely inadequate.

However, it may be claimed that observation, even if limited to general impressions, has a valuable place in the process of employment. This may be admitted and it may still be said that the place which at present it holds is far *too* valuable. Far too much weight is placed upon the results of observation. As one instance typical of the emphasis on observation are quoted the following items which, together with certain other items discussed in a previous chapter, appear on the application form of a very large industry well known for its progressive employment methods:

Personal Appearance: Dress, neat.....medium..... or slovenly.....Carriage, alert.....medium.....or slouchy.....

Initiative: Wants to lead in everything.....Creative .....Quiet pusher.....Prefers to be led.....Good Mixer.....

Activity: Live wire.....nervously quick.....moderate.....phlegmatic.....slow but steady.....

These items are headed "Interviewer's Impressions", and constitute the chief basis upon which the applicant is hired. They are so characteristic and so frequently met

with in employment work that it is worth while considering them in a little detail. The first item, *personal appearance*, is one of the most common and at the same time one of the most unreliable points of criticism. Many an accountant whose books are the acme of neatness and accuracy may wear a shiny coat and a collar which is frazzled around the edges. And many a mechanic who turns out his work with dispatch and completeness has a slouchy and sometimes even slovenly carriage. There are certain kinds of work in which appearances are particularly important as, for instance, in the case of salesmen, floor walkers, solicitors, and others whose success depends largely upon the impression which they can make in a momentary interview. But, for the large majority of factory and office jobs, these traits must be given a very liberal interpretation. Many a worthy man who has been in too great a hurry to shave or whose laundry has not arrived in time to contribute to his appearance in the employment office, will otherwise be lost to the organization.

The qualities listed under the head of *initiative* might have some general value if their presence or absence could be detected; but how they are to be discovered by mere observation or by a short interview is a question difficult to answer. Even if the applicant does have the mysterious sign of creativeness stamped upon him in some observable way, it means very little. The important point is: What is the nature of his creativeness? Is it a faculty for creating *objects* or *methods* useful to the particular work in which he is engaged, or is it a peculiar faculty for creating a disturbance among his co-workers? And as for being a *quiet pusher*, an applicant may be very quiet and give indications of being full of restrained energy during an inter-

view; but once established in a position, he may be a loud "knocker", and his pushing may consist of trying to push other people "off the map". *Preferring to be led* and *wanting to lead* are also two pretty and time-honored distinctions, and very valuable ones when properly made. However, there is nothing in a brief interview which will justify making such a distinction. And a man's own word in this respect is the last thing to be trusted. Not many men will acknowledge that they prefer to be led, and that they are passive, or lack energy. Closely allied to these items are those given under the head of *activity*, namely, *live wire*, *nervously quick*, *slow but steady*, *phlegmatic*. These descriptions are very commonly applied in daily speech. But how is a live wire to be detected by mere observation? Because a man jerks out his words, bites his finger nails, keeps his hands and feet in constant motion, and gives many similar signs, it may be proper to call him a live wire or nervously quick. But the question which such nice phrases do not answer is: How does this life and nervous energy transform itself? Does it do work or does it only expend itself in motion? Is it constant or is it only flickering? Is it backed by ability, or is it only a mannerism, an eccentricity? The same thing may be said about the epithets *slow but steady*, and *phlegmatic*. An applicant may have a slow but steady way of answering questions and filling out an application form but he may be a live wire when it comes to planning a shop layout, or setting up an intricate machine. There are many workers who give the appearance of being very phlegmatic who produce an uncanny amount of work. The saying that still waters run deep applies to men in the employment office as well as elsewhere. The quality of being a *good mixer* is one which is most uncertain. Human relation-

ships, when long continued, depend on such a large number and variety of subtleties, that it is reckless to call a man a good mixer simply because he has a bluff and hearty manner. Many men can mix well with others during the first few hours, but very poorly as soon as the first impression they make has been supplemented by a more prolonged acquaintance.

In all these instances, it is apparent that observation relies upon signs, and that in order to form an estimate of a man, the interviewer must be able to read the proper meaning into the signs which are revealed to him. Here lies the crux of the weakness of this method. This weakness is implied by the single word *interpretation*. Before the observer can arrive at an estimate of an individual, he must first interpret the signs which this individual reveals. But how is he to interpret them? What standard or rule or system is there which will guide him in his interpretation? There is none. It is entirely a matter of judgment or knack on the part of the interviewer. And, as a consequence of this fact, all the objections which were raised in the introduction against the unscientific method and against any method which is open to the variables of the human equation, can be raised against the observational method. In the absence of any plan or standard of interpretation, each interviewer must be his own standard, and the manner in which he interprets the signs he sees will depend entirely upon the kind of man he is. The observer will be guided by his previous experience, by the mood he happens to be in, by his racial and social prejudices, and by the hundred and one other factors which unconsciously go to make up his attitude. Moreover, when one interviewer in an employment office is replaced by another, he brings with him a new and probably en-

tirely unlike set of ideas and notions about human nature, so that his manner of interpreting observed signs will be quite different from the practice of his predecessor. These facts have already been sufficiently discussed in the introductory chapter. There is, however, one more variable factor in the observational method which has not been discussed but which is very important.

According to the experience of the writer, and according to the testimony of various employment experts, there is a very strong tendency at times to become entirely oblivious to the appearance and actions of those who are being interviewed. The process of hiring becomes at such times almost wholly mechanical. The mind of the observer becomes almost a blank, and all faces take on the same general appearance. The differences in dress, actions, and appearance which served as some guide to the interviewer before seem to fade into a dim haze, as if the observer had become intoxicated with too much gazing. The sole remaining thought is to fill the necessary requisitions as expeditiously as possible. This phenomenon has been verified by the experience of employment experts who have interviewed thousands of people, and, although apparently fantastic in the extreme, becomes only natural upon second thought. It is inevitable for the mind of the observer to become tired and confused toward the end of a busy morning or afternoon. And at such times, it is no longer possible to see the distinctions between applicants which were plain before. When this condition arises, employment degenerates into mere routine and an enormous number of costly mistakes are made.

In spite of the large number of weaknesses which the observational method possesses, and even though it is thoroughly unscientific in its method or rather in its lack

of method, attempts have been made to transform it into a reliable and scientific method of character analysis. In fact, there has been no hesitation on the part of those making this attempt to dignify their method by calling it a science. This so-called science has received wide publicity and has been accepted by many prominent and hard-headed business men. It attempts to place observation on a scientific basis by assuming that certain observable physical characteristics are identified with certain definite mental qualities, and by asserting as a corollary that a visual observation and measurement of the physical characteristics enable the observer to gauge a person's mental, moral, and emotional qualities. The smattering of scientific phraseology in the presentation of this method is just sufficient to impress those who have only a superficial knowledge of the scientific facts involved. For instance, one of the statements made is that scientists have proved that a large head indicates a large brain and consequently a capable mind. Now, as a matter of fact, scientists have worked over this point for fifty years or more without reaching such a conclusion. After having measured thousands of heads and investigated thousands of cases, their general conclusion is that, although there may be a general agreement between size of the skull and intellectual ability, the agreement is too indefinite to apply to individual cases or to use as a basis for practical predictions. (For a short and comprehensive account and bibliography on this point, see G. M. Whipple, "Manual of Mental and Physical Tests", Vol. I, pp. 79–91.) On the other hand, biologists and physiologists tell us that mental power is determined not so much by the size of the head or the expansion of the brain, as by the convolutions and the quality of the brain structure. Another claim advanced is

that a skin of fine texture indicates a mind of fine texture and consequently an intellectual mind. The scientific fact advanced to support this view is that the brain is originally an ingrowth of the skin. This is true. However, it by no means follows, because the skin of the embryo turns inward and later develops into the nervous system, that there is any functional connection between the two. To say that a fine skin betokens a fine mind is nothing more than a pretty play upon words.

Scientists are agreed on the fact that there are certain broad mental functions which are localized in fairly definite parts of the brain. We know, for instance, that certain motor areas are located along the fissure of Rolando, and certain kinæsthetic sensory areas in the same region. Other areas are also generally defined. However, these areas refer to regions in the brain and not bumps on the head. Moreover, no scientist has as yet established a definite relation between specific parts of the brain and specific mental, moral, and emotional qualities, such as initiative, will-power, and artistic temperament; and certainly not between such traits and physical characteristics as the color of the hair and the position of the eyes. These facts are entirely in the field of conjecture. If any fact stands out as prophetic of future developments, it is the fact that the mind or nervous system is so interwoven and integrative in its action that definite locations for definite or rather indefinite personal qualities will never be found. Sherrington's work on "The Integrative Action of the Nervous System" is a great contribution toward establishing this fact. It follows, therefore, that the fundamental assumption on which the so-called science of observation rests is an assumption entirely unwarranted by the facts. (NOTE. A more complete discussion of this

subject is given in H. L. Hollingworth's book on Vocational Psychology under the head of "The Pseudo-Science of Physiognomy," pp. 32–56.)

However, even if there were a specific relation between mental and physical characteristics, the observer would still be unable to make accurate use of this fact. Human observation, from the scientific standpoint, is one of the most unreliable of all faculties. Any student of elementary psychology knows the limits of the powers of perception and the many errors to which they are subject. Observation depends upon the eye, and the eye is a very imperfect instrument. It cannot be relied on in estimating sizes or judging textures, or in gauging colors, or in making due allowance for perspective and distance, or in a large number of other respects. The effect of habit and suggestion in creating optical illusions is a well-known fact. The same liability to error is true of all the senses, —tactual, visual, auditory, kinæsthetic, smell, and taste. How, then, can the observer distinguish between those comparatively slight differences in size, shape, color, texture, and so forth which are supposed to make up differences in character? And if the individual is liable to error in this respect, what about the judgments of two or more observers, observing the same person? The inequalities in the observations of different people have been shown by thousands of careful experiments. Every psychological laboratory contains standard tests by which to demonstrate these facts, and the first experiments which the beginner tries are calculated to show the inaccuracy of visual, tactual, and auditory observation. In this respect, the psychological laboratory only elaborates what is already accepted by the practices of common sense; for no buyer would think of allowing the merchant

to substitute for the scales and the yardstick his own unverified observation. It is impossible to build up a science of observation in any field except by getting away from observation as such, and supplementing it with scientific tests or measures like those which have been already discussed.

But, even if observation were accurate and reliable, it would still be under a great handicap. For example, what a great change in the shape of a man's head and the height of his forehead is made by a hair cut. A man who, to the observer, looks like a ferocious round-headed simian one day, may become a mild-featured, sedentary, long-headed bookkeeper the next—after a hair cut and a shave. What a remarkable difference may be wrought in the texture of the skin by a hot bath! How comparatively easy it is to govern one's appearance and to act the part for which one is aspiring. The practical significance of this contention is shown by the substitution of the Bertillon finger-print method for the photographic method of identifying individuals. The former is far the more accurate.

Even if the three weaknesses outlined above did not exist, there would still remain the following great difficulty. The method which we have been discussing judges character by analyzing and comparing the parts of an individual with other parts of the same individual. Is the head long in proportion to its width? Is it high in proportion to its length? These and similar questions show how the individual is compared with himself instead of with other individuals. There is no standard of shapes and sizes to which the observer can compare individuals and with reference to which he can form his conclusions. There is nothing to correspond with the exact standards set by

psychological tests. It has been seen how the use of tests makes it possible to compare applicants in an exact way *with each other* and with a mathematically exact standard which has been experimentally determined beforehand. The observational method does not provide such standards, and makes it impossible to compare people with each other except in the crudest way. Nor does it provide a standard type, based upon a careful-job analysis, to which applicants can be compared. Sometimes, the picture of a man, well known as a success in a particular field, is given as an example. But such pictures are not scientific standards, and can not be used as a basis for making measurements and exact comparisons. The pictures of George Washington and Abraham Lincoln can not be used as a guide in the election of other presidents. Moreover, it is absurd to expect an observer to carry standards in his head, and to compare sizes, colors, textures and so on in his mind. This is the very antithesis of the scientific method.

Finally, the method of observation described does not rise above describing character in terms of generalities and abstract personal qualities. Since its fundamental measurements are of the crudest sort, the terms in which it estimates people are necessarily equally crude. The great variety of distinctions and the many concrete differences in abilities which must be taken into account in modern industry are covered here only by generalities. It may be that observation is better calculated to bring out the extreme differences between men, to select the genius or the exceptional man from among the large and colorless mediocre class. This would indeed be a boon to mankind. However, a scientific procedure which can attain to this height has not yet been

developed. Psychologists will be the first to admit this. The higher we go in the scale of success, the more numerous and complex the factors which have to be taken into consideration. Until we master those fields of employment where the activities involved are comparatively simple, it will be presumptuous to leap at a problem infinitely more difficult. If the observational method is inadequate to analyze the character of ordinary individuals, it would be rash to assume that it is able to analyze the exceptional man.

OBSERVING RELEVANT ACTIONS

As a matter of fact, the observation upon which most of us rely is not so much the observation of appearances as the observation of actions. In this respect, as in the field of pictures, we prefer the moving picture to the old-fashioned photograph. The amount of knowledge about a character which a picture can impart is almost directly determined by the number and kind of actions in which the character takes part. In meeting people, we are undoubtedly impressed at the very outset by their appearance. However, we are quite prepared to modify this impression in the light of their subsequent actions, thus living up to the adage that handsome is as handsome does. Examples of this kind are probably vividly present in the minds of all. One which the writer remembers in particular is that of a young girl about sixteen years old, who came to apply for work as a stenographer. She was below normal size, her face was small and childlike, her hair was in a braid down her back, her manner was exceedingly diffident. When she sat down to take the typing test her feet did not reach the floor. So far as appearances went, she looked like anything but a capable girl,

certainly not like a capable stenographer. And yet she picked up a notebook and took down the dictation given her with a rapidity and assurance that were most convincing. And when she began transcribing her notes, she did so with a vigor and confidence that left no mistake as to her ability. The capability which this girl displayed in action was entirely out of harmony with her general appearance.

The employment interviewer is usually on the lookout for actions which will enable him to form a better estimate of an applicant. Even if he is not consciously looking for such actions, he is influenced by them nevertheless. The candidate's language, his manner of expression, his general attitude, his walk, and a number of other acts which may express themselves during the course of an interview, all play a very important part in the final conclusion. However, the usual interview is so short as to make it impossible to watch more than a very few of the applicant's activities, and the knowledge of the individual which they reveal is therefore very superficial and fragmentary. The most important objection to forming judgments in this way is the fact that the actions which the candidate reveals during an interview are in most cases totally irrelevant; that is, they are actions which have little or nothing to do with the work for which the candidate is applying. An applicant for the position of tool maker, for instance, may stutter his replies and act very awkwardly during an interview, thus producing a very unfavorable impression on the interviewer. However, his clumsy actions in this respect are no reliable indication of his ability as a tool maker. The lack of activity and alertness which the girl just described manifested while she was being interviewed was not a good indication of the energy and ability

which she later displayed. An electrician's ability to write as shown by his application blank is likely to be a very poor sign of his ability to set up motors. At best, the process of employment is a staged process, and the activities which an applicant is likely to manifest under these staged conditions are not the activities which go to make up his truest self. And to judge him by the irrelevant acts which he commits under these unnatural conditions is to do him and the industry concerned a grave injustice.

The difficulty just described is a fundamental difficulty and one which has been universally recognized. Nevertheless, it can be in a large measure overcome. One way in which to mitigate it is to make it possible for the applicant to express his true self in terms of *relevant* rather than *irrelevant* actions. The interview and the employment mechanism must be so arranged as to enable him to give an actual demonstration of his ability. For instance, if a man applies for work as a lathe hand, a lathe should be in readiness and the man should be given a few representative tasks under the eyes of an expert mechanic. The manner in which he goes about these tasks—it will not be necessary to complete them—will enable the expert to place an estimate on the ability of the applicant. A man who claims to be an all-round tool maker can be given a similar trial. In fact, it is advisable to have in the immediate vicinity of the employment office a complete equipment of representative machines and operations which can be used for this purpose. In this way, a large number of applicants can be given an opportunity actually to demonstrate their ability, and thus furnish a fairly reliable basis upon which to make an estimate.

The probable objection to this plan is that it ties up a

large equipment for infrequent use. However, if this equipment is used not only for demonstrating purposes but for the purpose of training new operators as well, this objection will disappear. The training of new workers is an employment function which will be discussed more fully in the chapter on vestibule schools. In the meanwhile, it may be said that the same experts who are used as instructors in the training school may be employed as expert observers when candidates are giving demonstrations of their ability. It may also be objected that the length of time consumed in allowing applicants to show their skill makes such a method too clumsy and expensive. But, when it is remembered that the cost of breaking in a skilled or semi-skilled worker, both in the amount of scrap which a green worker makes and the amount of supervision he requires, varies between fifty and three hundred dollars, this objection falls to the ground. Obviously, a little more pains at the outset, and corrective training for the weaknesses which the candidate manifests during his demonstration, would amply justify itself. It may be objected that such demonstrations should be conducted in the shop and under the direct supervision of the foreman. This method, however, would shift the burden of employment work back to the source from which it was taken. In order to standardize the methods of employment and of rating applicants, it is quite essential to have all these functions, including the training of new employees, under the direct supervision of the employment office.

A final objection which may be made to this method is that it still remains *stagey;* that is, the entire process is one which is arranged for that particular purpose and which therefore prevents the applicant from doing justice to

himself. This is quite true. However, no employment process can ever get beyond this state of artificiality. Its degree of staginess can only be lessened. The important fact about the outlined procedure is that it stages the interview or demonstration of an applicant in the field in which he is most at home. It enables him to act in the manner in which his trade or occupation has taught him to act, and, in this way, it greatly decreases the degree of nervousness or embarrassment to which the applicant is subject.

The logical culmination of this method is found in the psychological examination. This is the final step in choosing relevant actions on the part of the applicant and in placing the proper estimate upon these actions. First of all, the psychological method finds, by means of an experimental process, just what the relevant activities in an occupation or an operation are. This it does by means of tests which are tried out on workers whose ability is known and with whose work the tests can be compared and correlated. In this process, it also discovers the standard which ought to be met in the significant tests by those who wish to succeed at the kind of work in question. It then standardizes the manner in which these tests should be used, so that every applicant for a particular kind of work will be examined in exactly the same way, and his ability determined according to the same formula. In this way those uncertain factors due to the human equation which are present to a greater or lesser extent in all the methods described are largely eliminated; and the method of observation is finally supplemented in such a way as to make it indeed a science.

From this discussion it becomes clear once more that the entire trend of employment psychology is to subordinate irrelevant appearances to relevant actions, and the

show to the *reality*. To one familiar with the history of employment methods, this is a most fascinating development. In concentrating upon the relevant actions of a person, the irrelevant details are almost entirely lost sight of. Facts about an applicant such as religion, race, society, mannerism, which in the mind of the ordinary observer are likely to be most important, are here of secondary importance. The main emphasis is upon action and ability.

XX

JOB ANALYSIS

Much has been said and written about character analysis, but very little, in comparison, about job analysis. However, in the process of selecting employees, the latter is as important as the former. Obviously, it is useless for an employment manager to be able to analyze people unless he is able to analyze equally well the positions in which he intends to place them. We have, therefore, these two distinct aspects of selection, the analysis of the man, and the analysis of the job, equally necessary in the selection of the right man for the right job. And the successful employment manager or employment system must be able to meet both of these necessities.

This is a much more difficult and complicated task to-day than it was a few years ago, and vastly more difficult than it was before industry reached its present stage of development. In times past, trades and occupations were limited in number, and consequently it was a much simpler task to be familiar with them. Since that time, the great mechanical discoveries and inventions, and the consequent division of labor, have brought about an almost unlimited increase in the number and variety of trades and occupations, so that the problem of job analysis to-day is one of utmost complexity. Particularly true is this since the growth of industry has brought under one organization many different trades which were formerly split up into small shops and factories. Before this cen-

tralization took place, it was the custom of each shop foreman to hire his own men. The shop foreman was at least fairly familiar with the jobs in his particular shop, and could interview applicants with direct reference to the work which he expected them to do. His intimate knowledge of jobs was of inestimable value in selecting the right man for the right job. However, the growth of large industries, with the consequent centralization of functions, has brought with it the centralization of all employment functions. Consequently, instead of ten or a hundred different shop foremen, each hiring his own men in his own way, we have one employment office in which a few men do all the hiring for every shop and office in the organization and for nearly all of the dozens and often hundreds of varieties of jobs which may be found there.

The advantages of the centralized employment office in standardizing rates, records, clerical methods, and in making the most economical use of the labor available are unquestionable. There is no longer a doubt that a central control of all the factors in the relation between an industrial organization and its employees is indispensable. However, it is equally certain that in giving up the old form of decentralized employment, industry lost also the one most valuable feature of the old method. This was the firsthand knowledge of the different jobs under his control which the foreman of each shop had and which he was able to apply in hiring new men. When the functions of hiring were centralized, the knowledge of these jobs was to a large extent lost. This is only natural, since it is manifestly impossible to maintain a force of interviewers who shall be experts in all of the jobs concerned. And for the employment manager or his employment clerks to have this knowledge is still further beyond the

bounds of possibility. Consequently, the work of employment has been carried on with only a superficial knowledge, in most cases, of the jobs affected. There is no doubt that, in the first flush of ease with which this method functioned, the importance of this factor was largely lost sight of. And it is equally certain that this oversight has played a considerable part in the high labor turnover which has characterized industry in recent years.

This difficulty has not gone entirely unrecognized, and various attempts have been made to overcome it. Among them is the retention, as employment interviewers of men who are experts in certain kinds of work. Their first-hand knowledge of the work presumably fits them to recognize during the course of an interview the applicant's qualifications for it. This method, while decidedly better than one in which interviewers are not experts, has certain shortcomings. In the first place, the increasing variety of jobs makes it cumbersome and uneconomical, if not impossible, to maintain expert interviewers in every one of them. Moreover, it is one thing to be an expert at a certain job and another to discover by means of an interview the presence or absence of the necessary ability in a stranger. Expert workers are seldom expert interviewers or judges of human nature.

As an alternative, especially where the more skilled trades are concerned, it is often the practice to send applicants directly to the proper shop, and to let the foreman of the shop hold the decisive interview. This method has certain advantages, but it really defeats the very purpose of a centralized employment system in that it tends to delegate its powers of discretion to the foreman. At the same time, it places back on the foreman a

burden of which he should, to a very large extent, have been relieved. In exceptional cases the employment office may be obliged to ask some expert in the shops to interview an applicant; but in the majority of cases the employment office should be able to make and be responsible for its own decisions.

Another plan, and one which is also commendable, is to give prospective interviewers a special course of training in order to acquaint them with the kinds of work for which they are to hire applicants. This is a vast improvement over the plan which allows mere clerks to conduct the interviews. However, it also has its drawbacks. In the first place, a man trained in this way is likely to have only a superficial knowledge of jobs; and while this is better than none, it is still too fragmentary to make his estimate of an applicant's ability in a certain direction very authoritative. Moreover, as long as the knowledge of jobs is based upon the impressions which a group of constantly changing interviewers gain in this manner, there is certain to be a trouble-breeding variation and inconsistency in their methods of employment. This difficulty has already been pointed out in Chapter I and elsewhere.

None of the plans mentioned provide for a permanent and reliable solution of this problem. What, then, can be done to meet this difficulty? The plan which seems most hopeful and which is gradually being adopted is the one which provides for a standardized description of all the jobs involved, based upon a thorough and practical analysis of all jobs by persons entirely familiar with them. It can readily be seen that once such a set of job specifications has been drawn up, it will serve as a comparatively permanent and reliable basis for reference in all

the work of the employment office. Such an analysis will meet the very objections which have been raised to the alternative proposals in that it is economical, substitutes an authoritative analysis for a casual opinion, and centralizes rather than decentralizes the employment functions.

There are several ways in which such an analysis and set of specifications can be made. One of these is to describe jobs in terms of the human qualities which are required in their performance. This has been, until the present time, the most prevalent method. It does not describe the job itself but gives an outline of the personal qualities which are considered necessary for that job. The job of a bookkeeper, for instance, is described as a job requiring accuracy, patience, application, neatness, a routine temperament, not much initiative or creative ability, unwavering attention, and so forth. The job of tool maker is described as one requiring accuracy, patience, application, mechanical ability, not much initiative or creative ability (as the case may be), steadiness, and so forth. The work of an executive is described as requiring initiative, tact, energy, concentration, creativeness, and so forth. In every case, the job is described in terms of this kind; that is, in terms of broad human qualities. A formidable array of qualities is available for such descriptions. In addition to those already mentioned, the following are typical of those met with: dynamic, static, large-dimension or small-dimension worker, industrious, intellectual, volitional, manual, deliberate, impulsive, rapid or slow in mental coördination, adaptable, self-centered, roving, settled, loyal, sincere, directive, dependent, responsible, irresponsible, phlegmatic, live wire, slow but steady, nervously quick, and so on ad infinitum.

There are several serious objections to this kind of job analysis. To begin with, it is not job analysis at all but a kind of thinly disseminated character analysis. Anybody can make a hasty tour of inspection, gather a superficial knowledge of a number of jobs, and then describe them in such comprehensive terms as those just enumerated. In the next place, these qualities are so general and vague that they mean very little when tied up with a particular job. Any number of jobs can be described equally well by such words and phrases as industry, patience, accuracy, application, routine temperament, loyalty, static, and so on. But these words mean little or nothing at all as they stand. They are detached and theoretical. Patience as such, for instance, is an abstract and meaningless quality. A man may be very patient in one way and very impatient in another. A tool maker may be patient in watching a slow and very important cut but very impatient with his family or his foreman. Therefore, it is useless to call for a man of patience unless it is possible to distinguish between different kinds of patience and then specify which kind is desired. The same thing may be said of every one of these general qualities. A man may be very energetic or dynamic at one kind of work but very lazy or static at another kind. Suppose a man asks for employment in a position requiring marked initiative, energy, and executive ability. The person conducting the interview may decide that this applicant is possessed of these qualities, and consequently recommend that he be hired. The man is hired and set to work. After a few weeks he discovers that his work is not at all what he expected but is outside the scope of both his training and desires. Instead, therefore, of developing initiative, energy, and executive powers, he becomes plodding,

dependent, and passive; in fact, anything but what he was expected to become. This common and well-recognized instance helps to illustrate what is meant by the statement that personal qualities such as have been enumerated here are abstract and can not be used in describing jobs. Different jobs have very specific and characteristic differences, and it is impossible to describe them except in terms of qualities that are equally specific and concrete. It is quite apparent that the personal qualities of a worker also are not general and abstract, but are particular and very closely tied up with the specific characteristics of a particular job. In the instance just described, the man did not manifest the expected qualities for the job at which he was placed, but it is quite likely that he *would have* manifested those qualities if he had been assigned to the particular kind of job for which his abilities fitted him.

Another way of making clear the abstract and general nature of the personal qualities is to say that they can not be accurately gauged or measured except in terms of some concrete job activity. How is it possible to measure patience? or attention and application? or mental acuity? or industry? or loyalty? or initiative? or any one of the many qualities previously named? As a matter of fact they can not be measured when stated abstractly. All that can be said is that an individual either has or does not have certain of these qualities. No fine distinctions are possible except, perhaps, the distinctions between good, bad, and indifferent. However, the day has gone by when it is possible to describe people or jobs in terms of "yes" or "no". Even if it were possible to say whether an applicant had or did not have certain qualities, such a decision would fall far short of the requirements of the present

complex varieties of work. It is indispensable to separate applicants according to the *degree* of ability which they possess; for there is an infinite number of jobs requiring infinite kinds and degrees of ability. Therefore it is entirely inadequate to class people by their possession or lack of certain qualities. Unless some method of measurement can be applied to the qualities which are sought after, some reliable and standard gauge, then the detection of these qualities is of little value. They are too indefinite and too general to be of practical use.

Another phase of the same tendency to describe jobs in terms of personal qualities is that represented by the so-called experts in character analysis. Aside from the absurdity of being able to make experts in this art through a correspondence course of a few months, are the difficulties which have been outlined. The character experts describe jobs in terms of personal qualities, and the qualities they enumerate are much the same as those mentioned. They also include such points as the size of the head, texture of the skin, such terms as mental, motive, and vital, and a variety of other equally general and personal qualities. Even if the expert in character analysis could surely detect the qualities he deals in, he would still be far from being an expert in fitting men to jobs. For the qualities in which he deals are just as vague and far removed from the practical aspects of employment as those which have been named. They are abstract, general, and they can not be scientifically measured. Consequently they mean nothing when applied to the practical task of hiring specific men for jobs requiring specific abilities.

In contrast with the method of analyzing and describing jobs in terms of personal qualities, is the psychological

method. This method has already been described. To begin with, it makes a thoroughgoing analysis of one job and then, on the basis of this study, selects a set of tests which seem to involve the same ability as that required by the job. These tests are then tried out on a large number of workers whose ability is known in order to find those tests which do this to the highest degree. When tests which are sufficiently significant are found, the result is a standard and scientifically accurate measurement of those specific abilities which are required by that specific job. It is unnecessary to name these abilities even. The qualities required by a successful inspector, for instance, need not be called good visual discrimination, quick-reaction time, and steady attention. These names are also general and serve merely as a starting point. The requirements of this job may be stated simply as the *ability to reach such and such a standard in tests number two, six and eight.* There is nothing vague, abstract, or general about an analysis of this kind, any more than there is about the chemical formula $HnO3$ or the formula in physics, $mass = \frac{weight\ in\ lbs.}{32.16}$ The job has been analyzed in a scientific manner, in such a way that the abilities required by that job can be definitely and mathematically gauged.

A job analysis of this kind is a long and careful process, and can be made only by persons equipped with the proper technique. In the meanwhile, a temporary job analysis must be made to meet the immediate needs of the employment office. In making such an analysis, the application of psychological principles will be of utmost value.

Let us suppose that a representative manufacturing

organization desires to make an analysis of the various jobs and positions which it embraces. This analysis is to be made for the purpose of facilitating the work of the employment office in selecting the right man for the right place, and must therefore be an analysis of the most practical kind. What are the conditions which such an analysis must meet? In the first place, it must be comprehensive; that is, it must include all the important factors which enter in to make each job what it is. Second, it must be brief; that is, it must give only the most necessary and fundamental facts concerning each job. Third, it must be made in standard terms; that is, in such a way that the various elements which the jobs have in common are stated in common terms and not in a different manner each time. Fourth, it must be concrete; that is, it must describe the job not in terms of general and abstract qualities, but in terms of measurable abilities, and in terms of facts that have a concrete and specific significance.

These principles served as a guide in making an analysis which covered over eighteen thousand employees and over nine hundred varieties of work. In order to make this analysis generally applicable, it will be described in terms of these four principles.

The first principle, that an analysis must be comprehensive, is self-evident. The question which it suggests is: What can be considered a comprehensive analysis of a job? The following outline upon which the analysis mentioned above was based is given as a tentative answer to this question:

Name of job——————————————

Physical characteristics of job:

1. Machine——————————Number of——————
2. Hand work——————————————
3. Heavy——light——medium——
4. Lifting——hauling——climbing——standing——sitting——walking——
5. Clean——dirty——hot——cold——
6. Kind of eyesight required——.

Mental characteristics:

1. Educational——————————————
2. Prerequisite experience——————————————
3. Ability in English: Read——write——spell——talk——
4. Ability in mathematics: Copy figures——add——subtract——multiply——divide——decimals——.

Miscellaneous:

1. Earnings
   a. Day-work——maximum——minimum——average——
   b. Piece-work——maximum——minimum——average——
2. Hours——————————————
3. Possibilities of promotion——————————————
4. Time required to break in new man——————————————
5. A brief statement of any other essential features of the job——.

———————————————————
———————————————————
———————————————————

The above outline is a comprehensive plan to which the description of the large majority of factory jobs conform. To be sure, this outline does not contain many items which are important for certain kinds of work, especially the more highly skilled trades. These trades require in addition a more detailed and technical analysis such as has been taken up in the foregoing chapters. It does, however, embrace the most fundamental and important elements which characterize most factory jobs, and which

are the foundations upon which any more thoroughgoing analysis must be built. Moreover, it includes certain other items which are not usually considered part of a job analysis but which are nevertheless genuine parts of a job and of the utmost importance. Notable among the latter is the item of earnings. Earnings are, from the applicant's point of view, the one most important feature of any job, and it is absolutely essential that the employment office, in trying to fit certain applicants to certain jobs, be in a position to state exactly what the initial and possible earnings for each job are. Many an applicant has quit work at the end of the first week because the employment office intimated that he would receive one rate and the job to which he was sent paid him another.

The outline is divided into three general sections; (1) physical characteristics, (2) mental characteristics, and (3) miscellaneous characteristics. Under physical characteristics are included such items as those relating to heat, cleanliness, strenuousness, and other physical features, some of which may seem, at first glance, quite irrelevant to a job analysis. However, from a psychological point of view, from a medical point of view, and from a common sense and business point of view, these facts are essential phases of a job and are of the utmost importance. The importance of physical fitness has been increasingly realized during the past few years, as is well shown by the large and growing number of industries giving physical examinations. So far, however, physical examinations have been aimed more particularly at preventing those with serious defects or contagious diseases from getting into the shops. Not much attention has been paid to the kind of work to which those men who passed the physical

examination were assigned. In this respect, a job analysis giving the physical characteristics of the work is very important because it will enable the employment service and medical service to coöperate more closely in assigning men to the work for which they are physically best adapted. It will prevent the choosing of men with a hernia for work requiring heavy lifting. It will reduce the chances for giving pedestrian work to men or women who have a tendency to fallen arches. It will prevent a large number of accidents, and will greatly lessen one of the most important causes of labor turnover.

From the psychological point of view, nothing does more to upset a worker's state of mind and make him discontented with his job than physical incompatibility. However, unless the employment interviewer has a clear and definite knowledge of the physical aspects of jobs, he can not avoid producing misfits. Moreover, unless there is a thorough understanding between the interviewer and the applicant about the nature of the job, trouble is sure to follow. It may seem foolish to tell an applicant that a job is hot or dirty; but here honesty is the best policy. If an applicant is hired for a dirty job without having been acquainted with that fact beforehand, he may start work but quit after a few days or a few weeks, and thereby cause the loss of a considerable amount of time and effort, as well as make it necessary to go through the whole process of hiring once more. If an applicant is told that a job is dirty, he may accept it nevertheless and not mind it; while, if he refuse the job, not much has been lost. Naturally, some discretion must be used in this matter. A job which would be considered dirty by one man would not necessarily be considered so by another man. The relativity of sensations and feelings is one of

the most important and practical principles which psychology has to teach.

Under the head of mental characteristics, the most important items are education, prerequisite experience, and ability in mathematics and English. Many jobs of the laboring kind can be done by workers without any education whatsoever. Others require a minimum of education in certain lines. For instance, an expert tool maker must be able to use arithmetic to a considerable extent, and a correspondence clerk must have a certain mastery of the English language. In addition to the general ability and level of knowledge implied by certain kinds and degrees of school education is the matter of preliminary experience. For certain types of work such as that of plumber, electrician, accountant, such experience is an essential, and the determination of this experience forms a very important item in choosing the right applicant for the right position.

The division headed "Miscellaneous" embraces several very important and often neglected items. One of these is "Possibilities of Promotion". The future to which a job leads is one of the most important and concrete elements about that job. Some jobs lead logically to other and better ones, so that the worker knows that, if his work is satisfactory, he is sure, within a reasonable time, of being promoted. Other jobs are only blind alleys into which the unwary applicant is likely to stumble and from which there is no escape except by an unwelcome *tour de force*, usually the man's giving up in disgust and going elsewhere. This item, therefore, not only makes it possible for the employment interviewer to tell an applicant definitely what the possibilities of promotion are; it also serves as a reminder to the shop foreman that it is his duty

to see to it that the jobs under him are arranged in such a way as to make promotions the logical thing. It is sometimes asserted that frequent promotions, such as are made possible by the rapid labor turnover, tend to lessen production. Those who believe this do so on the assumption that it is wiser to break in one new man for one job that becomes vacant than to break in two or more old men on new jobs, as would be the case if promotions were made. However, the fallacy of this argument is only too patent. To begin with, if men were logically promoted, the turnover would not be so high. And it is safe to say that production at present is obstructed much more by a rapid labor turnover than by an undue number of promotions. It is also said that it is almost impossible to arrange all jobs in a logical or chronological order. This is undoubtedly true. However, it is probably still truer that the necessary attention and effort to accomplish this have not yet been devoted to the task, and that much more can be done than has been done hitherto.

The time required to break a new man in is one of the most important of all items. As work is divided under the present manufacturing methods, a large number of jobs are such that they can be learned in a very short period of time, varying from a few days to a few weeks. Moreover, industries are undertaking to train in their own schools those who are needed for their work. In such cases, the employment office must show particular care to choose those who have the necessary fundamental ability to receive the training which it is intended to give them.

If, in addition to the items named under the captions of Physical Characteristics, Mental Characteristics, and Miscellaneous Characteristics, it is necessary to add any further facts, this can be done under the last

item which provides for just such a contingency. There are, to be sure, many jobs which require ability of a very high degree, and in order to get any comprehensive idea of this ability, it is necessary to go into much greater detail concerning the work than has been done in the foregoing analysis. However, the discussion of job analysis has been here confined to the more fundamental and common elements and the more advanced kinds of trades are discussed in other chapters.

Now that it has been made clear what is implied by a comprehensive job analysis, the three remaining conditions can be taken up in comparatively brief form. The second condition named is that such an analysis must be brief. Brevity is always a self-evident virtue. But as applied to the work of interviewing and choosing applicants, the importance of brevity becomes even more obvious. When an interviewer needs to look up the characteristics of a job, he must be able to find them in the shortest possible time and with the least possible trouble. All the items contained in the outline given can be put on a single card four inches by six inches in size. Conformity to a standard, the third condition named, contributes to brevity although this is not its only merit. The importance of having jobs described in standard terms is almost the same as having people make out application blanks which are standard. It promotes simplicity and definiteness, makes sure of the essential features and excludes the non-essential, and in fact fulfills a large number of requirements. Unless the description of jobs is made to conform to some such standard, the results will be a heterogeneous mass of facts and figures which can be used only with the utmost inconvenience.

The fourth condition calls for a description of the job

in terms of the concrete and measurable facts which characterize it, and in terms of specific ability rather than in terms of vaguely defined and unmeasurable personal qualities. That this has been done needs little further demonstration. The items contained in the outline are concrete and measurable, and concern the job which is relatively fixed rather than the individual applicants whose number and variety are legion. It may be insisted that education and experience are strictly personal and general characteristics. Not in the sense in which they are used here. It is the job which requires a minimum of ability such as is supposed to be concomitant with a certain education and experience; and when this minimum has been determined, it is possible to measure, either by tests or by a well-prepared set of questions, approximately how far these minimum essentials are present in a given applicant. In some cases, a diploma or an apprenticeship certificate are sufficient guarantee that the applicant has the education required by a given job. Where a job requires specific ability in the various branches of English, mathematics, and other subjects which are acquired more or less thoroughly in school, tests given under psychological conditions can definitely determine to what extent the applicant possesses the necessary abilities.

The question which still remains to be answered in the practical carrying out of this work is: Who shall make this analysis? It stands to reason that this should be done by those who are most familiar with the jobs, and that is the various foremen or overseers. In this way, that knowledge which has been lost to the employment office through centralization will be to some extent regained. It is claimed, and with evident justice, that the foreman is

frequently the last man who can analyze his jobs adequately. The fact that he knows them so well prevents him from describing them in any but technical and colloquial words. However, this danger will be largely avoided if every analysis is made according to the outline of specifications furnished. This outline serves to confine the analysis to certain channels and predetermined essentials. Moreover, the entire process should be under the supervision of a group consisting of the employment manager, the medical examiner, and the psychological examiner; for the very purpose of the analysis is to provide a guide by which these different agencies will function together in choosing the right applicants for the right place.

After such an analysis has been made, how is it to be used? At the present time, whenever a shop needs men it is customary to send to the employment office a requisition calling for six men, or three machinists, or five millers, or seven edgers, as the case may be. This manner of calling for men by such general names and in such a wholesale fashion suggests the very evils which have just been discussed, namely; a very loose connection between shops and employment office. After the specifications for the various kinds of work have been made out, they can be arranged and indexed for convenient reference in the employment office. At the same time, the different shops will retain possession of the specifications which affect them in particular. Whenever, now, it becomes necessary for a shop to make a requisition for men it can do so in terms of these specifications. In order to simplify matters still further, the various kinds of work which are only superficially different can be summarized under a common head, and a system of symbols can be employed to expedite

the making of requisitions. The employment office receiving a requisition can find in its own records what the proper specifications are and select its men accordingly. To be sure, it will not always be necessary for the employment interviewer to refer to these specifications. One of the virtues of such a standard practice is that it facilitates routine and soon becomes unobtrusive. However, it will remain a source of information which can be referred to whenever the need arises, or whenever a new interviewer is being initiated into the work.

This chapter began with the statement that job analysis is as important as character analysis. Now that this statement has been amplified and a practical outline of such an analysis been given, we may point out one of the queer anomalies of employment work. Whenever an applicant applies for a job he is requested to fill out an application blank. This has been the custom for many years, and serves as the basis, to a greater or lesser extent, upon which the applicant is hired. Now, if it is necessary for the applicant to give his own specifications, why should it not be necessary for the job to give its specifications? In order to bring together the right worker and the right job, it is just as necessary to have an application or set of specifications concerning the job as it is concerning the worker. One is of little value without the other. If the analysis is conducted as outlined, the employment office will be provided with a set of standard job specifications to which requisitions from the shops can refer. The application of the worker and the *job application* can then be fitted together in such a way as to produce the best results. Only when the man applies for the job and the job for the man, will there result the best union between them.

XXI

THE VESTIBULE SCHOOL

Mental and physical tests make it possible to detect in individuals those qualities which are essential for certain kinds of work. Observation and questions help to determine the possession or lack of certain other important traits. However, none of these processes makes it possible to discover completely and conclusively all that it is desirable to know about an applicant. The shortcoming of them all is their necessary brevity. For example, an examination by the methods outlined may show that a man possesses the abilities of a first-rate operator. Nevertheless, this man, despite his ability, may turn out to be a very poor operator. His failure may be due to such reasons as dislike for the work, dissatisfaction with the pay, lack of ambition, etc. These qualities may be called moral qualities, or qualities of character, and they must be distinguished from the qualities of technique or ability manifested by the employee in the tests.

At the present time, very little is known or understood about the origin and operation of the moral traits. Enthusiasm, determination, cheerfulness, reliability, and their opposites are moral qualities which, at the present stage of science, can neither be definitely located nor accurately gauged. A casual observation of an individual may give some hint as to their presence or absence. Tests will give a much better indication because tests require work and in work moral qualities are more noticeably

manifested than at rest. But neither a momentary observation nor a brief psychological examination can actually determine which qualities the individual possesses or to what extent.

Although brief tests give no certain indication as to the nature of the applicant's character, it may be said with certainty that whatever valuable moral qualities an applicant possesses will be most likely to develop if the applicant is assigned to the work for which he is best qualified. Again and again it has been demonstrated, in the course of these experiments, that the qualities of laziness and discontent shown by a worker were not inherent qualities, but were due to the fact that the worker was not fitted for his particular task. When transferred to another kind of work which, as indicated by a psychological examination, was more suitable, it also appeared time and again that the same employee would become a satisfied and consistent worker. On the other hand, there have been many workers, according to their performance in the tests well fitted for their work, who still were disgruntled and lazy. How can we account for the moral traits which these workers manifested? Here, again, the root of the trouble may be mal-adaptation. A further examination, either by tests or by an inquiry into a worker's antecedents and ambitions, may show that he is better qualified for some other type of work as well. His present failure may be due not to inherent laziness but to an ambition to do something else. If this worker is given the kind of work which he prefers and is just as able to do, he may manifest an entirely different set of moral qualities.

To be sure there are cases where laziness, unsteadiness, dishonesty, etc., are inherent and manifest themselves

regardless of the work which the individual is doing. On the whole, however, it is not safe to regard the moral qualities as *blanket* qualities which every individual either has or has not. It is much nearer the truth to regard them as variable *quantities*, largely contingent upon the environment in which the individual is placed. The purpose of the employment manager is to place applicants so far as possible in the most favorable environment.

In order to consider this problem more in detail, we may arbitrarily divide all workers into two broad classes, the skilled and the unskilled. The skilled workers have attained their skill through a long process of education and experience. The very fact that they are skilled compels us to assume that they have determination, ambition, and other desirable moral traits. Moreover, the expert workman is usually interested in his work for its own sake, and, although he, too, is influenced by the size of his wages, the character of his work is an important factor in eliciting his best qualities. The problem here obviously consists of placing the skilled workman at the work for which he has been trained and at which, therefore, he is most likely to manifest his best traits.

In the case of the unskilled workman—and by far the larger class is comparatively unskilled—the love of work plays a very small part. In fact, the work is often regarded as monotonous and unpleasant, and is tolerated only because of necessity or as a means to some more pleasant end. The end which the work is made to serve may be family comforts, or pleasure in any one of its various forms. As long as the work of the day brings these outside interests within reach it is tolerated. If it curtails them, it is likely to elicit the negative moral qualities such as distaste and listlessness. It is a well-known fact

that a large part of the labor turnover consists of those who, after being hired, come for a day or a week, and then, because they are disgusted or discouraged with their progress, never appear again. Therefore, it is most desirable to assign unskilled workers to the work at which their natural abilities will enable them to succeed most quickly and where they can, in the shortest possible time, earn a satisfactory week's pay. To do this it is necessary, in the first place, to test applicants with great care in order that the natural abilities which they possess may be immediately applied where they will most quickly bring success. And in the second place, it is desirable to supplement this preliminary examination by means of the more prolonged observation which is made possible by a period of training in the so-called vestibule school.

The vestibule school is what its name implies—a preliminary training school in which to observe and coach new employees. The vestibule school is to the industrial organization what the vestibule is to the home. In the home it is a place where the entrant stops, wipes his shoes on the mat, adjusts his garments, and performs those duties which prepare him to enter the house proper. In the factory or office it is a place which detains the incoming employee until he has become adjusted to a new environment and has been prepared to handle the essential elements of his prospective work. Having passed through this preliminary stage, he is the more ready to enter upon the work of the main shop or office. The vestibule school, therefore, answers two main purposes. First, it provides a means for bringing an unskilled employee most rapidly to the stage in which he can earn a desirable week's pay.

Second, it provides an opportunity to observe the moral qualities which the individual develops in the course of his work.

A third and extremely important function which the vestibule school serves is to give applicants a certain amount of choice in their work. As has been already indicated, one of the most fruitful sources of trouble in the selection of workers is the fact that they do not like the work for which they are chosen. If an applicant develops an emotional aversion for a certain shop or job, it is almost certain to result in the loss of that worker. No matter how well qualified the applicant may be so far as ability is concerned, he is likely to leave at the first opportunity. This is a factor which employers have not taken sufficiently into account. Too often the attitude has been: "Here is a job, take it or leave it. Next!" and the result of hiring applicants in this arbitrary fashion has been to add measurably to the immense labor turnover which has characterized industry in general.

The vestibule school offers a means by which this difficulty can be in part overcome. The applicant will be hired, to begin with, according to the best judgment which the employment manager can bring to bear. He will be given the benefit of a physical and psychological examination, and of a sympathetic interview. After the employment office has selected an applicant for a particular position, he will be sent into the vestibule school to be trained for the work of that position. During this period it will become possible to determine whether or not the worker shows the necessary degree of interest and liking for the task.

In short, the vestibule school is a sort of laboratory in which the employee may be handled and observed under

controlled conditions for a comparatively extensive period of time.

Vestibule schools may be divided into two general kinds, the office vestibule and the factory vestibule. Both schools have the same purpose. However, there are likely to be considerable differences between them in equipment and size, and consequently in method. Each of these types of vestibule schools will therefore be considered separately.

THE OFFICE VESTIBULE SCHOOL

In describing the office vestibule school, it is unnecessary to launch out into theory. One need only point to the office training school of the Larkin Company of Buffalo, one of the first and most successful schools of the kind in the country, to see a complete example of the methods and results of such a school. (See report of the Committee on Office Training Schools, J. H. Puffer, chairman, in the fourth and fifth annual Bulletins of the National Association of Corporation Schools.)

In general, the vestibule school is built around those classes of work which are most characteristic of the particular office which the school is intended to serve. The following classes of work are typical of almost all large offices:

Typing
Correspondence
Counting-machine operating
Filing
Bookkeeping
Messenger service.

Each class of work is taken up separately by a group of new workers. Let us suppose, now, that a female appli-

cant without any special training applies for some indefinite kind of office work. The first step is to give her some general clerical tests, then some more specific tests such as the filing tests and arithmetical tests. On the basis of these tests it is possible to assign her at once to the work for which she seems best fitted, and also to establish a tentative rate of compensation. Once assigned to a certain kind of work in the vestibule school, the new employee is instructed in this work with the view of preparing her to assume that work as soon as possible in the main office. So far as practicable, the work of the vestibule school should consist of actual routine work taken from the main office, in order that all practice and instructions may have an immediate practical bearing upon the future work of the pupil.

The same general procedure applies to a new employee who claims previous education and training. Take, for example, a stenographer who claims to be a graduate of some business school and to have a considerable amount of experience. Such an applicant is tested, first of all, for her ability to take dictation and transcribe, in order to discover the degree of proficiency which her training and experience have enabled her to acquire in these essentials. Besides this, she is given certain clerical and special intelligence tests, in order to determine what her natural capabilities are. On the basis of her performance in these tests, she is assigned to a certain type of work and given a tentative rating, after which she is given instructions in the work for which she seems best fitted. In all cases, the duration of the period of training depends entirely upon the initial ability of the pupil and the rapidity with which the pupil learns the work assigned.

During this period each pupil is under continual ob-

servation, and certain very significant moral qualities can be detected. For example, the instructor may find that a pupil is very impatient under instruction, a quality which augurs badly for future usefulness. Or a pupil may betray signs of impatience with her work, such as tearing up sheets upon which she had made a mistake, banging at her typewriter, answering sharply, etc. She may show signs of inattention and constantly repeat mistakes which have been pointed out to her. It may be discovered that a pupil has certain objectionable habits which, if not eliminated, will create havoc among the girls or men in the main office. She may frequently be late in arriving, or consume too much time in personal attentions. These and a hundred other negative qualities may appear during this period, and every one of them is a source of labor turnover. However, under the special conditions of the vestibule school, these traits may be discovered in time, and at the hands of competent instructors many corrections can be made.

If an individual is incorrigible, that fact can be ascertained and the pupil dropped. One of the great sources of difficulty in the present day large organization is the presence of *driftwood;* that is, incapable employees who have slipped past the employment manager and obtained positions, and whom the office heads have not the heart to discharge. The writer has seen numerous instances of this kind. Such employees are often sent from post to post in the organization, a constant source of trouble not only to their superiors but to themselves. Finally, some merciful chance does for the organization what should have been done at the outset. The employee either happens to light on some congenial work or gives up in despair. Even if the tests fail, the vestibule school is

almost certain to prevent an individual of this kind from getting into the wheels of the organization. And if there is any possible way in which to make use of a chronic misfit, the systematic methods of the vestibule school would be much more likely to find it than the haphazard stabs of the main office.

We have discussed the detection and correction of negative qualities. As has been pointed out, the negative qualities are very often merely the reverse side of latent positive qualities. They may be due to the fact that the worker is assigned to work which is not really suitable. The vestibule school offers a splendid opportunity for discovering such misfits and for adjusting them properly. For example, if a pupil is assigned to the work of indexing and card filing, she may show inattention, dullness, and general dissatisfaction. If she is transferred to the work of correspondence filing, these negative qualities may entirely disappear and the pupil become enthusiastic, deft, and cheerful. The vestibule school, therefore, provides an opportunity for discovering and eliciting the positive moral qualities. Initiative, determination, patience, tact, amiability, and many other desirable moral traits reveal themselves during this period and immensely facilitate the process of assigning new employees to permanent positions.

The prolonged and careful observation made possible by the vestibule school also makes it easier to discover those finer differences between personalities which play so large a part in the selection and retention of employees. A great number of workers is required for routine work, work which requires speed, accuracy, and many other good qualities. However, the employment manager and the various department heads are continually on the

lookout for individuals with that "little more", that extra faculty of being able to assume responsibility and handle problems which have not been explained to them from A to Z beforehand. In other words, they are looking for assistants who can think for themselves. This quality is none too common. Mental tests can usually give indications of its presence, but the vestibule school can follow up these indications and determine to just what extent the desired ability exists.

The vestibule school may therefore be truly regarded as a laboratory in which employees are tested and trained under controlled conditions. All work should be done as nearly as possible in quantities that can be measured and by methods that have been standardized. Where the nature of the work makes this impracticable, actual tests from time to time may be used as standards. For example, five or ten clerks may be doing various kinds of counting-machine work. On the basis of their performance in their work, therefore, they can not be compared. However, if they are using the same type of machine, a periodic test can be given to the entire group to determine what progress its members are making in speed and accuracy. Periodic tests of this kind can be given to typists, filing clerks, ledger clerks, and other groups. By means of such tests a very complete control can be exercised, a control which will make it possible not only to watch the progress of individuals with reference to themselves but also the progress of individuals with reference to the progress of others in the same group. Such a control also makes it possible to promote students on the basis of merit rather than on the basis of seniority. Certain standards can be set in various kinds of work, and the student who first attains those standards will be eligible for the first position

open, regardless of the fact that other students may have entered the school at an earlier time.

This method also provides an element of competition which is a very healthy asset to the work of novices. It is a well-known psychological fact that a few minutes of actual competition daily will do more to increase a person's ability than hours of steady and uninspired routine practice. Competition, therefore, contributes toward making the new employee competent with the least possible delay, and serves to bring out all the more quickly whatever latent moral qualities the pupil may have in reserve.

The work of the vestibule school should be so far as possible work that is actually taken over from the main office. For instance, girls who are being trained in typing or in filing should be trained largely upon the work of typing or filing as it is actually being done in the larger office for which they are being prepared. In this way, not only will the preparation of the individuals be most closely tied up with their prospective duties, but at the same time a considerable saving in the cost of conducting the school will be effected.

In order to attain the maximum effectiveness, the instructors of the vestibule school should be clerks of a high grade who have not only had actual experience in the routine which they are to teach but who also possess the ability to impart their knowledge to their pupils. An instructor in every distinct type of work ought to be provided. The manager of such a school must be a man or woman of exceptional character, ability, and experience. He should be, first of all, a good employment manager with the necessary ability to examine and select applicants. Even if this selection is controlled by means of a specialist

in psychological examination he must still be able to deal with his pupils in a sympathetic and understanding fashion. In order to conduct the various courses of study contained within the school curriculum, he must have a knowledge of the principles and methods of education. Added to this, he must be experienced in the methods of office work in order that he may continually adapt the work of the school to the changing needs of the office.

Besides fulfilling the three principal purposes outlined, the vestibule school contributes toward the solution of employment difficulties in several other ways. In the first place, such a school can serve as a center to which clerks already employed can be sent to brush up on some particular operation. Frequently, an employee becomes discouraged with his work, or his supervisor becomes dissatisfied with him, and it appears that the employee is to be lost to the company. If such an employee is sent into the training school, a little supplementary coaching, or a trial at a different kind of work, may result in a renewed and valuable worker, good for another period of contented usefulness. In the Larkin Company, the manager of the school alone is authorized to discharge an office employee. If the services of an employee are unsatisfactory, the school first of all tries to bolster up that employee or fit her for some other kind of work. In this way, a great conservation in human material is effected and the labor turnover is materially reduced.

Such a school can further act as a safety valve or a shock absorber for the office as a whole. Frequently there is a surplus of help in one part of the office and a scarcity in another part. The office vestibule school can equilibrate this condition by serving as a center from which

trained help can be drawn and into which surplus material can be withdrawn.

Third, such a school can serve as a center in which the various forms and practices obtaining in different departments and offices will rub elbows and tend, in consequence, to become more uniform and consistent. Very frequently it is found that different parts of an organization have quite different methods of handling the same kinds of work. Manifestly, not each of them is correct; neither is it possible to send out pupils trained in all of the idiosyncrasies of the various departments. The work of the school therefore may be a constant source of standardization and improvement in methods.

THE FACTORY VESTIBULE SCHOOL

In general, the same principles which apply to the office vestibule school apply to the factory or shop vestibule school. The purpose of each is, first, to discover so far as possible those moral qualities and those special abilities which can not be fully determined by the initial tests; second, to train new employees under controlled conditions in order to enable them to succeed most quickly at a given task; third, to discover the work which is best fitted to their particular abilities and dispositions. However, the shop vestibule school may be conducted in two ways. First, it may be conducted as a centralized school; that is, a school which is equipped with typical machines and in which typical operations are taught in a central place. Second, it may be conducted as a decentralized school. Instead of having representative machines and operations grouped in one place, a certain part of the physical equipment of each individual shop can be set apart

in the shop itself and given over exclusively to the task of training incoming employees. Each of these methods has certain advantages and disadvantages.

The first method has all the advantages consequent upon physical concentration. The centralized school makes it possible for one expert personnel worker to supervise the training of all novices, and thereby removes the diversities and inconsistencies which are sure to arise under a decentralized scheme. Second, it facilitates the process of trying novices out on different types of work in the event of their initial failure. Third, it serves as a kind of reservoir or safety valve by which to regulate the excess of workers in some shops and the shortage in other shops. Fourth, it acts as a reclaiming station to which old employees who have failed or outgrown their work can be sent for new instructions and encouragement.

This method has its disadvantages as well. They appear in an analysis of the advantages of the decentralized school. Under the latter scheme, the applicant, after having been tested and selected for a certain type of work, is at once sent to the shop in which this work is being carried on. There, at machines or benches reserved for that particular purpose, the applicant is immediately instructed in the exact work for which he is intended. The advantages of this method are as follows: First, the proximity of the pupil to the actual work of the shop enables him to see at once what his environment and work are to be. If this environment and work are unsatisfactory, the pupil will know it quickly, whereas if he is coached in a central school, at some distance from the shop and under slightly or considerably different conditions, and then dislikes the shop to which he is sent, all the time spent on preliminary training becomes lost effort.

One of the large causes of labor turnover in factories is the dislike for particular kinds of work, and consequently, every effort should be made to acquaint the applicant with the intended work before he is actually hired to do it. It may be said that the centralized training school will prepare the new worker for these very conditions. But the actual shop conditions are hardly ever as ideal as the conditions of a centralized training school are likely to be; consequently the change from the centralized training school into the shop itself may bring with it a certain degree of disillusionment and consequent dissatisfaction. This contingency can not arise if the new employee is sent immediately to the shop in which he is expected to remain. Second, the fact that an applicant is chosen for a certain type of work and sent at once to the shop in which he is expected to succeed, places a moral obligation upon the new employee which no other method can produce. It puts it up to him to succeed or fail at that particular job. If, on the other hand, the employee is sent to a central school where all kinds of operations are being taught to a considerable number of applicants, the moral obligation no longer rests with the employee but with the school and its instructors. It now becomes the duty of the instructors to try the novice out on various types of machines and work until he is suited. This process manifestly involves the utmost degree of effort and attention. The difficulty may be stated in still another way. Many applicants do not know specifically what kind of work they wish to do. However, when an applicant chooses to go to a specific shop and a specific job, his mind is made up and his doubts are to a large extent settled. This state of mind is conducive to his success at that job. But if the individual is placed in a school the whole attitude of which is experimental, his

original uncertainty and indecision will be increased rather than cured, and he will therefore be deprived of one of the most powerful factors in his success. In the third place, when a new employee is sent to a shop, the sole duty of the instructor in the shop is to help that employee to succeed in a particular line of work. In the centralized training school, however, the general attitude of the instructor will inevitably be experimental and he will be obliged to train his pupils by the "trial and error" method. In this way a great deal of time may be lost in the process of "trying out" pupils on various types of work before the right kind of work is finally hit upon. This will defeat the very purpose for which the school is established; namely, the making of successful operators in the shortest possible time. Fourth, the decentralized school is less likely to raise unfavorable contrasts between the various classes of work. If a variety of operations and machines are collected in a central school, there will be a very strong gravitation on the part of all employees toward the cleaner and more desirable kinds of work. This difficulty can be largely avoided if the novice is not placed in an environment which encourages him to draw such disturbing contrasts.

The suggested objections to the centralized training school may evoke the warm protest that this is the only method which is democratic and fair to new employees, since it is the only method which allows the employee to make an intelligent study and selection of the various kinds of work being done. It may be said that the other plan is too paternalistic, too coercive, and that it is morally unsound in so far as it fails to give every individual complete freedom of action in the choosing of an occupation. While admitting the partial truth of this contention, the practical

issue must not be lost sight of. From the viewpoint of the factory, there are certain kinds of work for which workers must be supplied. Some types of work are less desirable than others. A certain and usually limited number of applicants is available. With these, all the positions must be filled, the poorer as well as the better. The object of the training school is to fill them as expeditiously as possible. Therefore, the qualifications and preferences of every applicant will be consulted so far as possible. This is a problem which can not be formulated or solved abstractly. Indeed, it is too broad a problem for any particular factory to handle. It must be attacked by the state or by the community, because it is fundamentally a problem of vocational training. In the meanwhile the practical needs of the particular industry, in conjunction with the natures of particular individuals, must determine the degree to which the selection of jobs is left to the worker himself.

In answer to the objections that the centralized school will encourage too critical a comparison between the more and the less desirable kinds of work it may be contended that this inequality can be overcome by means of paying higher rates for less desirable types of work. This is usually done, at least in intent. Still, a certain degree of inequality will always remain, and the centralized training school will encourage and facilitate the detection of these inequalities by incoming employees. This, however, may well be considered as an advantage rather than as a disadvantage.

The method adopted will depend largely upon the character of the problem to be met in different organizations. Whatever method is chosen will have to take into consideration certain fundamental factors which enter

into the selection and retention of an employee. One of these is the effect of novelty. A new employee who is plunged suddenly into a totally new environment is very likely to lose his confidence and to become discouraged to the point of giving up his work. This tendency is more marked in women and girls than in men. The training school should be conducted in such a way that the new employee is placed, from the outset, under the encouraging care of a sympathetic instructor. The presence or absence of a sympathetic instructor in an enormous number of cases is the difference between success or failure on the part of the new employee. Again, a new employee plunged into the midst of the work which he is intended to do is likely to become discouraged when he sees the great difference between his own clumsy efforts and the highly skilled actions of the experienced workmen who surround him. A training school shields a new employee against such a damaging contrast until his own skill more nearly approaches the skill of those with whom he is destined to work. Again, a preliminary period of training makes it possible to instruct the new employee in the customs and practices of shop work in general. For example, he can be taught the meaning and use of the lot system, how to make out a time ticket, how to make a claim for short pay, how to arrange for absences, and numerous other details which play so important a part in making the employee feel at home in a shop.

Finally, the presence of a vestibule school removes the necessity of hiring applicants for the immediate needs of the moment, and thereby makes possible a much wiser and more farsighted selection. Under the present system, it usually happens that some office or shop suddenly needs a stenographer or a group of operators, and needs them at

once. Consequently, the employment office must choose from among the first applicants who present themselves, even if these are not quite as good as they should be. Moreover, instead of being able to select applicants for the work which fits them best, it becomes necessary to say, in effect: "Here is a job. It is the only thing we have at the moment. Take it or leave it." This is not conducive to successful hiring. Moreover, there are frequently highly desirable applicants when no jobs are available. It is a pity to have to turn them away, because quite likely they will have found work elsewhere before new jobs become available.

The function of the vestibule school in overcoming this opportunistic and hand-to-mouth method is obvious. The vestibule school can hire applicants with an eye to the future. If exceptionally desirable applicants present themselves while there is no urgent demand for their services, it can hire them nevertheless, and begin training them for the future. It can also keep enough pupils in training to make it unnecessary to hire applicants for jobs which they are not fitted to do and which they take only as a jumping-off place to something else. In fact, the vestibule school provides that *favorable balance* of supplies which is necessary for the proper management of any establishment, whether it be a household or a large industrial organization. It is strange how principles which are so obvious in the management of the small affairs of life are so often neglected in large establishments where management has acquired the dignity of a profession.

We may now briefly enumerate the services which the systematic training of a vestibule school renders the process of employment.

1. Makes it possible to discover more fully than was

indicated by the psychological tests the ability of new employees.

2. Provides an opportunity to observe the moral qualities of new workers.

3. Provides the mechanism for bringing unskilled or untrained workers to the desired point of efficiency with the least possible delay.

4. Makes it possible to assign people more carefully to the work for which they are best fitted.

5. Permits the new employee to exercise a certain amount of choice in his work.

6. Makes it possible to break in new workers by easy stages instead of with a sudden plunge.

7. Promotes a better selection of employees by decreasing the necessity of hiring only for the immediate needs of the moment.

8. Makes it possible to pay and to rank workers on the basis of actual work done under controlled conditions.

9. Stimulates the development of new employees by making possible competitive trials.

10. Provides a center in which old employees can be renovated and unsatisfactory employees eliminated. That is, it can act both as an outlet and an inlet.

11. Acts as a shock absorber to prevent the accumulation of too much help in one department and the lack of help in another.

12. Tends to promote standard practices in all parts of the shop and plant, and provides an excellent avenue for the plans of the industrial engineer.

13. By using actual work as a basis for its instructions, the vestibule school both reduces its cost and prepares the employee for the work to come.

For the sake of clarity, it may be added that the vesti-

bule school has been discussed here almost entirely as a supplementary means of selecting the unskilled and semi-skilled workers which go to make so large a part of the present supply of labor. The education of skilled mechanics and highly skilled workers of all kinds has not been touched upon. The need for such education is obvious, but the methods to be used belong rather to the field of industrial education than to the field of employment psychology. Now, however, and for some time to come, there will be an enormous class of workers who have no particular trade or skill; and there will be an enormous number of jobs which require no particular skill or education. The task which confronts industry, therefore, is to select and to fit applicants for the work which is to be done. For this purpose, the vestibule school with its brief course of training is almost indispensable.

PART III

SELECTION AND RETENTION

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A very common notion among industrial and employment managers is that all their problems will be solved when a scheme has been devised which will make it possible to select *the right man for the right place.* A scheme which will do this, they believe, will do away with the enormous labor turnover which is so characteristic of industry to-day, and which adds such tremendous difficulties to the problems of production. The right man in the right place is a slogan to conjure with in commercial circles. It sounds as though it might well be the broad and genuine remedy for industrial as well as all other social ills. However, at the risk of seeming sensational, it must be said that industries to-day, especially the larger organizations, are suffering not so much from inability to select the right man for the right place as from inability to know when the right man for the right place *has been* selected. To such an extent is this true that it can further be said that even if industries were in possession of a perfect system of selection, and were able to use it perfectly, their labor turnover would still remain mysteriously high. Moreover, this high labor turnover would be in a very large measure due to the inability to recognize when the right man for the right place had been chosen.

The business man will not let these statements pass unchallenged. In anticipation of his challenge the following question is proposed for consideration: How is it possible

to tell when the right man has been selected for the right place? One of the first and most obvious answers which suggests itself is one which can be stated in terms of labor turnover. A selection can be called successful when the worker selected does not leave his job at once and make it necessary to obtain someone else. This is the answer of the employment manager, because he assumes that if he does not have to continually replace the men whom he hires his selections are successful. This conclusion, however, is by no means an infallible one. Many an employee remains not because he is the right man for the place but because he is able to *get by*. His inability or unfitness may not be gross enough to arrest his supervisor's attention for a long time. Again, the worker may become lost in the wheels of the organization. There are innumerable other reasons why a worker who remains at his work may not be the right man for the right place; and yet, as long as he does remain, it is usually assumed that he is.

Another answer to this question may be stated as follows: A selection is successful when the man chosen succeeds at the work to which he has been assigned. True; but this does not answer the question. It simply restates it in a slightly different way. *How do we know when a man has succeeded?* It is perhaps apparent that the purpose of this question is to bring out the fact that the success of a selection, or of the worker who has been selected, depends upon the judgment of somebody who is in authority to express such judgment. Brown succeeds at his job, not if he does his work well, no, but only if his foreman *thinks* that he does his work well. Jones fails in his work, not necessarily because he was poorly selected or because he did his work poorly, but because his foreman *believed* that he did his work poorly. From the lowest to the

highest, from the most ordinary to the most extraordinary member of an industrial organization, this fact applies. In the last analysis, whether or not the right man has been chosen for the right place depends upon what somebody *thinks* about the employee after he has been selected just as much as upon what the employment manager thinks about him at the time when he is being selected.

It is apparent, therefore, that choosing the right man for the right place has two aspects; first, the process by which he is selected, and second, the process by which he is retained. If the methods of selection in use at the present time deserve a very thorough revision, it is safe to say that the methods of retention deserve an equally thorough overhauling. The methods by which men are being fired are every bit as haphazard as the methods by which they are being hired. This is a fact of which employment managers in particular have been made painfully aware. It is unnecessary here to go into the details of present-day methods of laying off and discharging workers. It is only necessary to point out the fact that even where only three or four interviewers hire applicants, fifty or a hundred foremen and supervisors may sometimes fire them. As a result, the varieties of temper, intelligence, and personality which workers meet after they leave the employment office tremendously increase and complicate the number of uncertain factors upon which the success of selections hinge.

The purpose of what follows is to lay the foundations which will make it possible *to know* when the right man has actually been chosen for the right place. This attempt is directed along two lines: first, a system which will enable the employment manager to follow up the results of

his selections, and discover whether or not they are successful; second, a method which will guide the worker's superiors in determining when a worker has been successful and when he has not; in other words, a standard method by which to determine retention as well as selection.

XXII

THE MEASURE OF COMPARATIVE PRODUCTIVENESS

Every case of employment has two aspects; namely, selection and retention. Selection rests on the judgment of the employment manager as to the fitness of an applicant for a particular position. Retention depends upon the judgment of some superior officer as to the degree of fitness which the applicant reveals after he has been employed. When the judgment of the employment manager regarding a man and that of the man's superior agree, we have what is termed a *perfect correlation*. If their judgments are entirely at variance the correlation is negative.

One of the most important and at the same time one of the most difficult problems in the selection and retention of employees is the determination of the *degree* of *correlation* which exists between selection and retention, between the employment manager on the one hand, and the various officers such as foremen, superintendents, etc., who control employees after they have been selected on the other hand; in other words, to determine the extent to which the agencies of selection and the agencies of retention agree in their judgments. In the large majority of cases there is no reliable or impersonal standard for estimating the correlation between these two factors. A general practice, when a question as to the success of a selection arises, is to "pass the buck". The employment

bureau claims that its choice was a good one but that the man selected was not properly handled. The foreman or superintendent maintains that the choice was a poor one. Each side claims to be in the right, but since there is no definite basis or standard upon which to rest a decision, the matter remains indefinitely unsettled. Moreover, in the very nature of the case it must remain unsettled, because the personal opinion of one man is balanced against the personal opinion of another. In the long run, however, the employment bureau is usually found at fault, not because the final fault necessarily rests there but because the weight of numbers is against it. The employment bureau is like a man surrounded by accusers on all sides, and for the lack of any reliable criterion, the majority rules.

In order to illustrate roughly the intricacies of this problem, the following series of typical situations is given:

1. The employment manager may select an applicant whom he considers the right man for a place, but the foreman, for any number of reasons, may object to the selection.

2. The foreman may accept the man, but discharge him at the end of a week or a month as unfit or undesirable.

3. The foreman and employment manager may both agree on the value of a man, but the man himself may leave because of dissatisfaction with his work or salary, or for some other personal reason.

4. The employment manager may hire a man for one kind of work and the foreman may put him on a different kind of work, causing him to leave.

5. The employment manager may refuse to hire a man because he judges him to be unfit. In this case all trace is usually lost.

6. The employment manager, the foreman, and the

man hired may all agree and the man may become a valuable employee.

These very typical cases all indicate how large a part personal judgments may play in the selection and retention of employees. The agreements and differences involved in these hypothetical situations make it necessary to ask: Who is right or wrong, the foreman, the employment manager, or the applicant? We are obliged to take the word of some one. Either the foreman is right and the employment manager wrong, or vice versa, or both may be right and the employee wrong, or both may be wrong and the employee right, or all of them may be wrong. At the present time, many companies require the foreman to give a reason for laying a man off, and in fairness to the employee, the latter is also asked to state his reason for leaving or being laid off. Practical experience has shown that there is very little agreement between the two sides of the story, and that the reasons given are very often entirely worthless. Again, it is one personal opinion against another. Some companies have committees to determine whether a man shall be laid off or promoted. These committees consist of the foreman, employment manager, fellow workmen, educational manager, etc. Such committees are conducive to greater deliberateness and care; but nevertheless, their decision must also rest largely upon a basis of personal opinions and impressions, rather than upon some definite objective basis. Obviously, any attempt to fix the degree of correlation between the selection and retention of employees is bound to be almost valueless as long as it depends upon such precarious grounds as these. Even if the individuals governing selection and retention were of the most reliable character and ability, the continuous change in the per-

sonnel of the employment bureau and especially in the ranks of the foremen, would entail a constant change in the standards and methods upon which selection and retention are based. The larger the organization, and the greater the separation between the employment office, superior officers, and employees, the more complex this problem becomes. In some organizations the employment office must select applicants for a thousand kinds of work, and the success of its selections depends upon the judgment of dozens, or even hundreds, of superintendents and foremen. In such places it becomes all the more necessary to reduce to a minimum the numerous variables involved in personal judgments and to devise a standard of measurement which will make it possible to base the selection and retention of employees on uniform grounds.

The process of standardizing the methods of selection has already been carried to a considerable extent in the use of psychological tests. The use of these tests promises, in a comparatively short time, to place all selection on a more uniform basis.

However, with regard to the *retention* of employees, very little uniformity of method exists. The old method, and the method which is still quite prevalent, is that which gives the foreman complete powers of discharge and promotion. The defects of this method have already been indicated and are so obvious as to need no further elaboration. Many large companies have taken this power away from the foreman and allowed him only the right to *recommend* promotions or dismissals. The final decision has been left with the employment manager or a committee such as that described. The superiority of this method is more apparent than real. Theoretically the final decision is taken from the foreman. However,

the employment manager or the committee which is supposed to assist in the decision is still largely dependent upon a set of extremely variable personal opinions. It must rely either upon the word of the employee in question, or upon general impressions of its own, or upon the word of the foreman. In the midst of this conglomeration of personal opinions, that of the foreman is bound to have the greatest weight, because it has the authority of one who is most closely in touch with the employee and who, even if he does not know the employee well, is at least supposed to know him better than anybody else.

Most companies endeavor to cast light upon this problem by computing their percentage of labor turnover, and by trying to analyze and interpret this percentage. This is a valuable step in determining the degree of agreement between selection and retention. However, up to the present time labor-turnover figures have remained very largely an unfathomable mystery. Although it has been possible to give roughly some of the principal reasons for labor turnover, it is generally acknowledged that an extremely large proportion of reasons for leaving hinge upon personal factors which, in the present scheme of things, can never be adequately determined. As long as the process of retention is based principally upon a large variety of constantly changing personal equations instead of upon some standard and impersonal basis, turnover figures will retain their sphinx-like inscrutability. Many companies have an attendance record and a few are now keeping a record of the work done by each employee; but on the whole, these records are still very haphazard and their full value is not yet grasped. Nevertheless, such records are the greatest single advance in the right direction. In order to minimize the errors due to the personal equation,

some objective record of the employee's activities is necessary. Such a record sets a limit to the imagination of the foreman, and also provides the employment manager or committee with a concrete and reliable basis upon which to rest an opinion. The present chapter is devoted largely to the development and application of such a record.

In order to standardize the basis of retention and in order to put this basis into record form, it is necessary, first of all, to make a comprehensive estimate of the factors that *should* determine retention; in other words, to ascertain the relative importance of the various elements entering into the relationship of the employee to the company or to the company's officers.

In making an analysis of this relationship the first question which must be answered is: What is the chief purpose of the organization as a whole?

The chief function of an industrial organization, aside from all sentimental considerations, is production. It matters not whether that production is in the form of manufactured goods or in the form of service, such as street-car service; it is still production.

If it is granted that the chief object of an industry is to produce, then the foremost and most important factor about any member of that industry is his comparative productiveness. In estimating the value of the worker to the organization the first question should be: How does his productiveness compare with that of his co-workers? Obviously, an assembler who can assemble half again as many parts in a day as another man is the more valuable of the two, other things being equal.

Productiveness has two aspects, quantity and quality, which naturally supplement each other. In most manu-

facturing establishments all defective work is rejected or sent back to the responsible worker for repairs. In this way, the quantity of a man's work is made directly dependent on its quality. By comparative productiveness we mean both the quantity and quality of work produced by an individual in comparison with other workers.

Another factor which enters into the productiveness of an individual is attendance. A worker may be a very fast and careful operator or mechanic, but if he is out for a day or two days at frequent intervals, his work stands idle and his productiveness may fall below that of another worker not quite so fast but more regular in attendance. Attendance is also a very good index of many other qualities essential to a good worker such as loyalty, health, industry, habits, and so forth. Indeed, the matter of attendance is now generally recognized as one of the most serious of all personnel and production problems.

The question will undoubtedly be raised at this point: But what of honesty, patience, dependability, cleanliness, good moral habits, term of service, religious convictions, loyalty, and a host of other qualities just as important if not more so than mere ability to produce? We often find these qualities mentioned on interview and personal-record cards, and attempts are frequently made to describe workers in such terms. However, closer analysis will demonstrate that all of these factors enter into the productiveness of an individual. The worker who is loyal, industrious, and steady, will show it by producing more work than the one who is not. The employee who is neat, conscientious, and honest, will produce better work than the man who does not possess these qualities. Indeed, it is very difficult if not impossible to attribute such qualities to a worker except on the basis of comparative

productiveness. There are several reasons why this should be so. In the first place, there is the reason which has already been frequently given; namely, the unreliability of human judgments. A foreman's or superintendent's opinion of a worker's moral qualities is very easily influenced by many facts which are quite incidental, such as manner of speech or personal appearance. A man may be a very excellent worker and rank very high in the quantity and quality of his work and yet create an unfavorable impression because of such characteristics.

A second reason which makes it unwise to estimate an individual's moral qualities otherwise than in terms of production is the fact that these qualities are themselves relative rather than absolute. As has been pointed out, the moral qualities depend largely on the work to which an individual is assigned. Therefore, they should be judged with reference to this work rather than in an absolute fashion. If the work is suited to the capacities and preferences of the worker, he is quite likely to reveal the desirable moral qualities; whereas, if he is not properly situated, he is likely to give signs of traits which are undesirable. In either case, these would be exhibited in the quantity and quality of his work. If a worker fails to measure up to a certain standard of production, he should not be credited with a variety of undesirable moral traits. Rather he should be described as below the desired level of production and tried out on work of a different nature. No foreman or superior has the right to label his workers as morally unfit except in the most obvious cases. As a matter of fact, very few foremen have the courage to do so. One of the greatest drawbacks in the keeping of individual records hitherto, particularly in the matter of obtaining from the foreman a written statement of the

reasons for laying off a worker, has been this difficulty. Neither the foreman nor the worker considers this a just or an accurate procedure, for the very reason that the judgment expressed is too dependent on the personal equation and other unreliable variables. On the other hand, the record of a man's actual work, his comparative productiveness, is an impersonal criterion which is fair from both points of view, that of employee and employer, and does not excite the animosity so likely to be aroused by a personal opinion.

A third reason for judging moral qualities in terms of production rather than in terms of the descriptive adjectives usually applied is the fact that the former is usually much the more sensitive indicator. For instance, if a worker has been out late the night before or has taken part in some strenuous celebration, it may not be apparent to the foreman on the following morning, but the effects will hardly escape the impartial record of the man's production for that day or ensuing days. Continuous irregularities in the worker's manner of living may be kept from the foreman for a long time, but they are bound to affect the worker's ability to turn out work. The same principle applies to most moral traits. Impatience, lack of concentration, carelessness, dissipation, laziness, dishonesty—all of these traits will express themselves in the amount of work done by the individual with mathematical certainty. Therefore, for the sake of this increased certainty and decreased ambiguity, the description of a worker's moral qualities should be limited to his production record.

There are instances, to be sure, in which the moral qualities must be considered in themselves. Honesty, for example, is not always or entirely expressed in a man's productiveness. Therefore it is difficult to compare men

on the basis of their degree of honesty. We usually think of a man as either honest or dishonest. And we generally assume that a man is honest until evidence to the contrary appears. Therefore, it is unnecessary and even wasteful to include on a worker's record the virtue of honesty. It is only the occasional exception who must be recorded.

Before discussing the methods of recording comparative productiveness, we may briefly summarize the discussion preceding. The chief purpose of an industrial organization is to produce. Therefore the chief factor in the relation between the individual worker and the organization is comparative productiveness. Productiveness and attendance can be mathematically measured on an impersonal and uniform basis. A periodic record of these factors, practically independent of all personal opinions, can be kept.

The moral qualities as described by the terms patience, reliability, industry, carefulness, neatness, determination, etc., can not be measured mathematically or impersonally. The attributing of these qualities depends largely on the personal likes and dislikes of the foreman or other personal factors. The moral qualities are relative, rather than absolute, depending for their character and intensity upon the degree to which the tasks of the worker are suited to his abilities and preferences. Therefore, it is more just to praise or find fault with a worker's productiveness than with his moral characteristics. Finally, most moral traits work themselves out in productiveness even before they become apparent in a general way. It is best from every point of view to make the production record an index to a worker's characteristics. Such a method will, to a great extent, remove the unpleasant necessity of

obtaining a workman's *character* from his superior and will at the same time remove the ground for mutual suspicion and distrust which exists between the worker and his employers.

Granting that relative productiveness is the one most important factor about an employee, how can this factor be accurately measured? And how can the method of measuring it be standardized so as to permit comparing one worker with another? Frankly, there are many human pursuits in which productiveness can not and probably never will be mathematically measured. This will be taken up more fully in the following chapter. But there is a vast and ever growing field of industry in which such a measurement is possible. It has been made possible by the tremendous development of the division of labor and by the application of the principle of piece-work earnings. These are conditions which already exist and which provide the broad basis upon which the productiveness of individuals can be measured and compared. The actual application of this measure, however, must be guided by certain practical principles.

In the first place, the productiveness of one man can be compared with that of another if both men are engaged in the same kind of work, but not otherwise. For example, if Jones assembles eight motors a day and Brown repairs eleven, it would be obviously unfair to say that Brown is more productive than Jones. If both men are doing the same work and Jones assembles eight motors while Brown assembles six, then Jones may be called the more productive *in that kind of work*. However, it would be false to infer that because Jones is the more productive of the two men in assembling, that he would be the more productive in repairing. Such an inference would violate

one of the fundamental laws of psychology; namely, the law of the transfer of practice. This law states that practice in one kind of work does not necessarily mean ability in another kind. We can sum up the results of these observations in the form of a principle or law, as follows:

Two or more individuals can be compared with each other on the ground of productiveness only if they are both producing the same thing.

This leads us to another consideration. If employees are to be compared on the basis of productiveness they must not only be doing work of the same kind but they must be doing it under exactly the same conditions. For example, if a hundred girls are inspecting parts and fifty of them are working in a close, poorly lighted room with an unhandy lay-out for their work, it would not be fair to compare their output with that of fifty girls in a large, well-lighted room with an improved lay-out. Or, to use another example, it would not be fair to compare two tool makers on the basis of output if one of them were using the latest kind of machinery while the other had to work at machines that were almost obsolete. This may be formulated in the following law:

Two or more employees producing the same article can be compared on the basis of productiveness only when they are working under uniform conditions.

A third consideration enters into the determination of comparative productiveness; namely, the time-study factor. It is impossible to call one man more productive than another unless both men are working on a piece-work or task basis. As long as men are paid a straight salary or day rate, they all tend to produce about the same quantity

of work. As soon as they are paid a bonus or piece-work rate, individual differences begin to increase and it becomes possible to compare employees on the basis of production. There are numerous conditions which arise to defeat the purposes of the piece-work rate and to hinder the free development of the individual. These conditions are known to most managers and we may therefore include them by suggestion in the following law:

Two or more employees can be compared on the basis of productiveness only when they are allowed to produce under conditions which will encourage them to develop to their fullest capacity.

It may be objected that the three conditions outlined here as essential to a comparison of individuals are too idealistic, too theoretical, too far in the future for immediate application. As a matter of fact, they have already been realized. They are not theories but actualities. The great industrial development of the age has been the division and standardization of productive processes. All operations are being broken down into their elements, and instead of one man performing a hundred different operations on a single product, as in time past, we now have one hundred men performing exactly the same operation on a single part of the product. In this phenomenon, we have the fulfillment of the conditions indicated in the first two laws. The third condition is fulfilled in the generally accepted piece-work principle. These three conditions, namely, the standardization of operations, tools, and rates—already carried out to an enormous extent—are likely to be realized still more extensively. There is no prophesying what their scope will be in the coming industrial period.

Although many companies have approximated these three conditions, and are to-day paying their employees on the basis of comparative productiveness, it has not occurred to them that the same basis may be utilized in estimating the employee's relative value to the company or that the same standard may be applied to the process of promoting, laying off, and demoting. It seems almost unbelievable that one of the most fundamental principles in the science of management, namely, the recognition of individual aptitudes and differences by means of a piece-work rate, should be so largely neglected in its application to the retention and re-selection of employees.

As a result of this analysis, the following form and procedure were devised:

Name———————————Shop———————————

Week Ending	Class of Work	EARNINGS					Foreman's Rating	Attendance %	Total Hrs. Worked	Total Earned	Remarks
		Day Work Rate	PIECE-WORK AND BONUS								
			Amt.	Hrs.	Hrly Aver.	Group Aver.					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	

Reasons for leaving.....

.....

This form provides for a record of the individual worker's comparative productiveness. It provides also for certain other important items which affect the individual's standing and which must be considered in determining the correlation between selection and retention. The record of productiveness is provided for in columns three, four, five, and six. The record is to be made in terms of

money because money is the universal language into which all production is translated. The total piece-work or bonus earnings (column 3) divided by the number of hours worked (column 4) gives the average earnings per hour (column 5). Since these earnings stand for a certain amount of good work done, this hourly average is the index to the worker's productiveness. However, in order to compare his productiveness with that of others, it is necessary to obtain the hourly average or rate of production for the entire group. This is done by adding the hourly average of all individuals engaged in the same kind of work (see column 1, kind of work), and dividing it by the number of individuals at work. The group average (column 6) therefore represents the standard by which the comparative productiveness of individuals may be judged. When the hourly average of an individual is higher than the group average for a given week or series of weeks, it is obvious that the productiveness of that individual is high in comparison with that of the majority of the group.

This method of computing the group average and using it as a standard for comparison has certain very desirable features. In the first place, it is based upon the actual production of the workers engaged. Instead of bringing in a fixed and more or less theoretical standard of what all workers ought to do, it compares the individuals of a group with each other on the basis of what they are doing. Thus, it is just as effective in separating the sheep from the goats as the most rigid method imaginable, without having even a semblance of unfairness or pressure. Secondly, such a standard varies with the varying conditions of production. Every manager knows that production is not a smooth and orderly process at all times. There

are halts and inequalities in industrial programs which frequently delay or accelerate the productiveness of the individuals engaged. (See the third principle governing the record of comparative productiveness.) For this reason it would be unfair to compare an individual's productiveness with a fixed standard or rate. The group average as computed here must of necessity reflect all these conditions, by being low when the conditions are adverse and high when they are favorable. It is evident, therefore, that the group average combines the virtues of rigidity and flexibility. On the one hand, it serves as a fixed and impartial standard by which to estimate the comparative productiveness of each individual. On the other hand, it is a fair standard to go by, because it rests upon the work of the individuals actually concerned and varies with the conditions under which they are required to work.

The method of computing comparative productiveness described does not take into consideration the continuity of productiveness or attendance. For a variety of reasons, it is desirable to record attendance as a separate item. Every efficiency scheme or system of management has included elaborate charts and methods of keeping attendance records. Many of these have been distinguished by their artistic rather than their practical merits. The simplest and most flexible method of keeping an attendance record is the percentage method. In keeping such a record, absences should be divided into two kinds and only two kinds, those for which the organization is to be debited and those for which the individual worker is to be debited. Among the former must be included all time lost through lack of work, preventable industrial accidents, legal and company holidays, vacations and any

breakdown or hold-up in production processes. Among the latter is all time lost through tardiness, all time lost through illness or any other involuntary cause and all absences due to voluntary causes. To the second part of this provision many objections are sure to be raised. What if the cars are snowed in or a train wrecked? What if a relative dies or a friend is married? How can a worker be held responsible for time lost through illness? As a matter of fact, a certain allowance ought to be made to every worker for absences due to reasons similar to the above. Nevertheless, all absences, whether voluntary or involuntary, detract from a worker's productiveness and must therefore be charged to his account. Of two workers, one of whom lives near by and is always regular in attendance, and another who lives far away and is therefore frequently delayed by transportation tie-ups or is frequently out because of illness, the former should unquestionably have preference. Another advantage of charging all absences in class two to the worker is that it relieves the foreman or superior of the unpleasant and undesirable task of deciding which absences should be excused and which not.

The formula for computing attendance percentage on the basis outlined above is: Hours actually worked plus the number of hours lost through the company's fault, divided by the number of hours scheduled. For instance, if the working schedule is forty-eight hours a week and the worker is out a half day or four hours on account of illness or personal business, and loses in addition a half day or four hours through lack of materials, his attendance percentage for the week is: forty-four (that is, forty hours plus only the four hours lost by the individual on the company's responsibility) divided by forty-

eight (the scheduled number of hours) or ninety-one and six-tenths. This result is to be entered in column 8. The attendance record, taken in conjunction with the earnings record, makes it possible to establish a worker's comparative productiveness over any given period of time.

Column 2 provides for the straight hourly or weekly wage. There are many workers who are paid a straight rate for the hour or for the week. It is impossible to judge the comparative productiveness of these individuals on the basis of their earnings. Still, it is very desirable to keep the record as a basis on which to control the progress or promotions of any individual from one rate to another. The total weekly earnings and hours worked (columns 9 and 10) should be kept for a variety of reasons, one of which is accounting, another the necessity of a comprehensive record which will contain all the earnings of an individual, whether on piece-work or straight work.

Finally, a column is provided for the foreman's rating. In spite of what has been said about the disadvantages of personal ratings, the prejudices and accidents by which they are governed, it must be recognized that the personal factor is a potent one in every situation. If a foreman takes a violent dislike to a man, even for a superficial reason, a situation more or less harmful to the productiveness of the shop is created. Foremen or workers can not help forming certain likes and dislikes, because they are human beings rather than efficient machines. Now, instead of allowing the foreman's emotional judgments to have full sway, and permitting him to favor or fire his men until in course of time he has either proved himself to be a very good or a very bad judge of human nature,

or, on the other hand, depriving the foreman entirely of the right to exercise such judgments, a sane middle course may be adopted. The importance and effectiveness of personal and emotional estimates should be recognized from the outset by providing a column in which they shall be expressed. However, such estimates, instead of being entirely free, shall be controlled and guided. Now, it is evident from the form which has been provided that this can be done. On one side of the foreman's column is the worker's record of productiveness. If the foreman is inclined to rate a good man too low, a glance at his adjacent production record will automatically remind him of the worker's good points. If the foreman has, as sometimes happens, made it particularly easy or hard for a man to get out his work, a glance at the attendance record on the other side will remind him of the man's steadiness and reliability. Furthermore, if the opinion of a worker's value must be expressed in terms of A, B, C, and D, rather than more highly colored terms, the danger of emotional excess is still further reduced. Finally, by requiring a periodic expression of opinion rather than a sporadic one, another danger of excess is removed. In industrial situations the principle, count ten before you speak, can be applied with great profit. If there is something of special significance which must be said, space is provided under "*Remarks*"; although this place is intended also for the recording of many other factors which should affect an employee's retention; namely, "attends night school", "understands electrical work", "popular with the men", "would like a trial as a tool setter", and so forth. There are a thousand and one unpredictable facts or incidents which have a bearing upon the individual's record but for which no standard procedure can be devised. Under "Reason for

leaving" can be recorded the final summary of facts at the time of the individual's departure.

This record, therefore, embodies the fundamental elements in estimating the value of a shop employee. Other points such as age, family ties, physical condition, etc., should be recorded on application, and the record kept in the employment office. The activity record, however, should be kept in the shop as long as an employee remains there, and should serve as the basis of promotions, assignments, change in wages, and especially as a guide to the order in which men are to be laid off when that becomes necessary. After an employee has left the shop, the record should be kept in the employment office and used as a basis for rehiring a man should he apply for work in the future. Above all it should serve as a standard basis upon which to judge the degree of correlation which exists between the process of selection and retention, between the judgments of the employment interviewers and those of the various shop foremen and superintendents under whom the selected men are working.

DETERMINING CORRELATIONS

It remains, now, to show just how the correlation between selection and retention is to be determined. If we are to remain true to our analysis, the first step in determining correlations will be to compare the records obtained in the physical and mental tests with the production records kept on the activity cards. For example, let us suppose that there are ten men who have been selected for the same kind of work, and whose records in the tests, in production, and in attendance are approximately as follows:

Men	*Standing in Tests*	*Production in terms of ¢ earned per hr.*	*Attendance %*
A	98	70	97
B	96	69	95
C	95	68	80
D	92	66	99
E	87	64	93
F	81	63	90
G	76	61	92
H	69	59	99
I	62	55	84
J	53	53	87
10	809	628	916
	Av. 80.9	Group Av. 62.8	Av. 91.6

It is evident from the above figures that there is a satisfactory degree of correlation between the records in the tests and in production. The men who were highest in the tests were, on the whole, highest in production, and vice versa. If we apply the formula, familiar to statisticians, and explained in Chapter II, we would obtain *plus .60* as the index of correlation, and this is a rather high index. If there were no close correspondence between the test and production records, the correlation would be expressed in a much lower figure, for example, *plus .08* or even a minus quantity such as *minus .62.* Thus it becomes possible to determine with mathematical exactness just what degree of correspondence exists between these two factors, and to tell what the success of the selections has been.

If, now, it becomes necessary to lay men off for lack of work, unsuitability, or any other reason, the employment manager can determine, by referring to the employee's activity record, whether or not the right men are being laid off. For example, let us suppose that A, C and J on

the list given are to be laid off. If, as ought to be the case, the activity records of these men are sent into the employment office before the men are laid off, it will be seen that J is the least productive man in the group but that A and C are about the most productive. J's dismissal would therefore be accepted without question, but there would be a decided reason for investigating the reasons for the dismissal of the other two men. A further inspection of the activity records might show that, although C was the third most productive man in the group, his attendance was only 80%, which would put him pretty close to the bottom of the list in total production. And it might appear that A, although the most productive man, was marked "d" consistently by his foreman. This would indicate the existence of some strong reason for the discharge of that man, and this reason might be given under "Remarks". It might be given there as "insubordination", or "morally unfit". The employment office may consider it worth while investigating this charge, especially if it is made against the most productive man in the group, and may be able to correct what turns out to be a mere temporary difficulty between the foreman and his best man. Or it might be shown, upon investigation, that the machine at which this man happened to be working ran out of work, and therefore it became necessary to release the man. The employment manager, upon the strength of the activity records, could easily suggest the most intelligent way of meeting this situation by recommending that the least productive, rather than one of the most productive, men be released.

This account describes situations which occur daily in every company, and which are a source of everlasting perplexity. It also shows how the standardization

of the basis for selection and retention makes it possible to simplify these perplexities. In the instances given it appeared, when these men were recommended for discharge, that there was a lack of correlation between selection and retention in the case of A. However, a comparison between the two sets of records showed that this lack of correlation existed only at one point, and by investigating this point, the matter was rectified and the correlation maintained at a higher level.

Evidently, therefore, this method of finding the correlation between selection and retention has a double aspect. First, the strictly statistical, by which the degree of correlation may be numerically expressed. Second, the corrective, which reveals the exact points of difference between selection and retention and thereby makes it possible to apply the correct remedies.

There are, to be sure, many factors in the selection and retention of employees which have not been considered here, such as length of service, religious or political views, family status, etc. These, however, are ethical questions and must be settled on ethical rather than on scientific grounds. Psychology can offer only certain general principles to aid in their solution. However, as long as the chief object of an industry is to serve or to produce, all of these questions must be treated in the light of their effect upon the employees' productiveness. The industry or organization which does not attain a certain standard of productiveness or service can not survive; but the attainments of any organization depend upon the comparative productiveness of its units, the individuals who compose it. Comparative productiveness, therefore, is the "lead", the criterion, with reference to which all the factors of selection and retention must be determined.

XXIII

MEASURING BY LIMITED IMPRESSIONS

The method of determining correlations described can be applied, with slight adaptations, to many industries where large-scale production is carried on. The future will see an even greater division of labor and refinement in manufacturing methods; consequently, the method of comparative productiveness will be applicable to an ever increasing extent. Still there will always be instances where relative productiveness can not be computed mathematically, and where the process of production will not meet the three conditions outlined. The following instances may be given as representative of conditions under which the method of comparative productiveness is not applicable:

1. The small factory, in which the variety of work to be done is large in proportion to the number of workers employed. Each employee is likely to be engaged in several different operations each day, making it impossible to compare individuals on the basis of identical work done under identical conditions.

2. Offices, in which the variety of work is almost infinite, and in which it is practically impossible to compute the relative productiveness of individuals.

3. Service corporations such as railroads, street-car companies, etc., where the conditions of service vary greatly, and where, in consequence, it is difficult to compute exactly the relative usefulness of individuals.

4. Positions which require unusual ability or in which the work is specialized to such an extent as to preclude the possibility of comparing it with the work of others.

In general, it may be stated that the method of estimating comparative productiveness is not applicable where the principle of piece-work rates can not be applied, and is not practicable where only a few individuals are doing the same kind of work.

This fact, however, makes it all the more desirable to obtain an impersonal estimate of each employee's capabilities. The piece-work plan of compensation, or any other differential scheme, automatically tends to weed out the incapable employees. The very fact that the applicants selected for certain kinds of work fail to attain the level of productiveness required by the piece-work rates on that work, tends to show that the selections were unwise, and that those workers who fail to reach that level ought not to be retained on that particular operation. Where there is no plan of differential compensation this automatic weeding-out process does not occur. No supervisor can begin to approach in minuteness and concentration the supervision which the differential plan of compensation brings to bear. The employee's success, therefore, depends upon how well he can impress his superiors with his social connections, personal appearance, amiability, and a multitude of more or less incidental factors. The promotion and retention of such individuals, as every manager knows, depend very often upon momentary considerations and fleeting impressions. In fact, one of the mysteries of management is the way in which individuals progress through the various ranks of occupation and salary. Their comings and goings are as inexplicable as the traditional coming and going of the wind.

This difficulty does not remove the necessity of forming estimates of the capabilities of employees. On the contrary, it makes the necessity more urgent. If the work can not be standardized, and if the estimate of workers must depend upon personal opinions, the next best step must be taken. This step is to standardize the method in which personal opinions shall be expressed, and to pursue a course which shall reduce the chance elements in such expressions to a minimum.

But how can the formation and expression of personal opinions be standardized? As a matter of fact, they can not. Certain limits or guide posts can be established which will tend to produce a certain degree of uniformity. For this reason, the plan suggested here is called the method of *limited impressions*.

In the first place, the time at which these opinions are to be expressed can be specified. Too often the estimate of an employee is left until the critical minute when the employee asks for a promotion or a release. As long as an employee's work goes without serious hitches, the employee is regarded simply as a more or less useful fixture, and no attempt is made to study him or to gauge his capacities. When the emergency arises, an estimate must be made in a comparatively short time and frequently without an adequate basis of observation. If, now, at certain stated periods, it automatically becomes the duty of each head or manager to review carefully the work and value of each of the workers under him, and to record this review in a definite manner, this haphazard and fortuitous expression of personal opinions will be largely done away with. A formal record of such a periodic estimate would constitute a continuous appraisal of an employee, would tend to keep the employee's qualities

freshly in mind, would encourage a deliberate instead of a hasty expression, would serve as a check against emotional prejudices, and would overcome the serious lapses to which man's memory is subject. Too much can not be said about the unreliability of the faculty of memory and the great danger of depending for our opinions of people upon so uncertain a quantity.

A periodic written estimate would do much to reduce the sporadic character of so many of our impressions regarding people. However, the impressionistic method can be still further improved upon by arbitrarily limiting the range over which our impressions shall be spread. Without some arbitrary limitation, the qualities with which a worker may be credited or debited will be limited only by the descriptive vocabulary of the person making the estimate. The result will be a collection of biographies, too clumsy and involved to be of any value in comparing people. Therefore, although men may be capable of as many virtues as the human tongue can find names for, practical considerations make it necessary to concentrate upon a few of the more important qualities. Only by means of such a limitation will it become possible to find a uniform basis upon which to compare people.

The selection of the few most important qualities presents a most complex problem. To begin with, we have no concrete manifestation or summation of qualities such as is offered by the comparative productiveness of the piece-worker. Probably the only mathematical or concrete summation of qualities which we have is that signified by the attendance record. The factor of attendance, therefore, presents itself as the most definite and obvious one to be selected for this purpose. All other qualities must be selected after a more or less arbitrary method.

For example, we might follow the analogy of production and choose, as a leading quality, *industry*. Industry is the quality most closely corresponding to production, and although it is not subject to measurement, certain impressions as to an employee's industry can be gained by observation.

Numberless other qualities might be chosen, such as honesty, neatness, initiative, diplomacy, attention, personal appearance, temperament, intelligence, responsibility, etc., etc. Probably no two men will agree as to which are the most important qualities, and, as a matter of fact, it is not essential that they should. For practical purposes, it is much more important that a limited number of fairly well-recognized qualities be selected, and, above all, that the qualities selected be adequately defined. It avails little how many are chosen if those which are chosen are not carefully explained. As a tentative step, the following qualities are suggested and defined:

1. *Attendance:* To be estimated by the method described in the preceding chapter.

2. *Industry:* The degree of concentration and energy which the worker habitually brings to bear on his duties.

3. *Intelligence:* The quickness and thoroughness with which an employee grasps and executes tasks and directions.

4. *Reliability:* The accuracy and care with which an employee carries out his assignments.

5. *Speed:* The despatch with which the worker accomplishes his tasks.

6. *Initiative:* The degree of originality and inventiveness which the employee brings to bear upon new problems directly or indirectly connected with his work.

7. *Tact:* The success with which the employee is able to deal with his superiors and fellow workers.

8. *Executive Ability:* The success which the worker shows in handling problems which require the directing of others.

9. *Orderliness:* The system and neatness which the worker shows in the arrangement and execution of his work.

10. *Habits:* The traits manifested by the worker with reference to personal appearance, use of stimulants, language, etc.

These qualities are by no means exhaustive or unambiguous. However, it will be found that any attempt on the part of an individual or a committee to enumerate and outline a set of leading qualities will lead to an almost endless discussion, without producing any completely satisfying conclusions. As an example of the results of one such discussion, occupying a period of several weeks, the following chart is given:

INDIVIDUAL PROGRESS REPORT

Date_____

Name_____

Consider carefully each of the qualities given below and then place a check after each one which applies to the person under consideration.

I. Health
1. Poor
2. Fair
3. Good
4. Excellent

II. Quality of Workmanship
1. Poor
2. Fair
3. Good
4. Excellent

III. Speed
1. Slow
2. Fair
3. Fast
4. Very fast

IV. Habits
1. Bad
2. Fair
3. Good
4. Exemplary

V. Temperament
1. Enthusiastic
2. Indifferent
3. Conservative
4. Willing
5. Stubborn
6. Persistent
7. Quick-tempered
8. Even-tempered

VI. Mental Qualities
1. Dull
2. Alert
3. Medium

1. Poor memory
2. Good memory
3. Medium

1. Concentrative
2. Wandering
3. Medium

1. Constructive
2. Analytical
3. Neither
4. Both

1. Judicious
2. Injudicious
3. Medium

VII. Personal Appearance
1. Neat
2. Slovenly
3. Medium

1. Antagonistic
2. Coöperative
3. Medium

1. Irritating
2. Tactful
3. Medium

1. Weak
2. Forceful
3. Medium

VIII. Other Qualities
1. Plodding
2. Initiative
3. Routine

1. Honest
2. Dishonest

1. Unusual ability for leading and directing others
2. Moderate ability for leadership
3. Needs to be lead and directed.

What change in position, if any, do you recommend?
What additional facts are pertinent to this case?

Signed_____

It will be seen that this form provides for a very detailed analysis, involving a great variety of qualities and subtle distinctions. The mechanism of this form is as follows: Each quality has a given numerical value of which the subdivisions form a part. For example, *speed* may be valued at ten points. If, under this heading, the subdivision "*very fast*" is checked, the individual would be credited with ten or all of the points belonging to that quality. If *fast* is checked, eight of the ten points would be allowed. If fair, six points; if slow, four points. The same applies to every quality in various proportions. The highest possible number of points is 100. The person making the estimate would need only to check the qualities. A clerk in possession of the key would put down the values and total the results.

This method has certain advantages; but, on the whole, it is likely to be too detailed and laborious for very extensive use. Moreover, where personal opinions are the final standard, not much is gained by trying to draw distinctions which are very subtle and elusive. There is also the obvious difficulty of defining some of the qualities enumerated.

As a shorter and more simple method the following form, based upon the ten qualities defined, is suggested.

Name_____ Location _____

Opposite each quality enter either number 1, 2, 3, or 4, according as you consider the worker named in the 1st, 2nd, 3rd or 4th class in respect to that particular quality.

1. Attendance		
2. Industry		
3. Intelligence		
4. Speed		
5. Initiative		
6. Tact		
7. Executive Ability		
8. Orderliness		
9. Personal Habits		
10. Reliability		
Total		

Estimate made by

_____

Date_____

This method requires comparatively little work, is general enough to be inclusive, is not so subtle as to become ambiguous, and makes it possible to note the result at a glance. The above form provides for but a single estimate. However, this is a desirable feature, since all estimates ought to be made independently and the independent results recorded on another permanent record. The form on page 329 is a summary card upon which the estimates made by various appraisers can be entered. This form also provides for a running history of the worker's salary and of the positions which he has held. In this respect it is like the productivity record described in the preceding chapter.

SUMMARY OF INDIVIDUAL ESTIMATES

NAME				APPRAISER											
LOCATION															
DATE	POSITION	WAGE	QUALITIES	DATE											
			Attendance												
			Industry												
			Intelligence												
			Speed												
			Initiative												
			Tact												
			Executive Ab.												
			Orderliness												
			Personal Habits												
			Reliability												
			Total												

The next question to be considered is this: Who shall make these estimates? In the first place, they should never be made by equals, because, no matter how honest an individual may be, it is practically impossible for him to express a fair opinion of a fellow worker who is a possible rival. The estimates of each employee should be made by at least two superiors. The employee's immediate superior should always pass judgment because his interests are directly concerned and because he should have the most thorough knowledge of the workers under him. However, his opinions should be checked against those of some other superior who has at least an acquaintance with the employees being considered. In practice, there are usually several overseers or superintendents who are more or less directly concerned with the same group of workers. The very consciousness that one opinion is subject to check against another serves to create greater care on the

part of the judges. The judges themselves, in turn, should be subject to the appraisal of their superiors. The total result would then be a pyramid of appraisals with the general manager or the board of directors as the final appraiser. This is quite in accord with the present system, in which managers stand or fall according as they are able to gauge correctly the character of their subordinates. However, this method goes still further, by introducing a great refinement into the present more or less individualistic hit-or-miss process. One is inclined to wonder, in this connection, whether the time will ever come at which this method will also work backwards, so that the workers will similarly appraise their superiors.

In one of the best organized companies in Buffalo, it is the practice to rank all foremen and assistants in a fashion similar to that described here and to award them a semiannual bonus upon the basis of their standing. If any one fails to receive a bonus and asks the reason why, he is shown this record and his shortcomings are pointed out to him. The officials of this company assert that the results are highly beneficial.

Granting that the proposed method outlines certain limits and standards to which the impressionistic method must conform, the great question which still remains is this: Does this method eliminate that prolific source of trouble, prejudice? The unhesitating answer to this question must be: No. No method which rests in the final analysis upon personal impressions or opinions can be free from prejudice. However, it can be stated with equal emphasis that the method described will tend to minimize prejudices most decidedly.

In the first place, although prejudices can never be avoided, they can to a large extent be neutralized. A prej-

udice, as is well known, often rests upon only one quality in a person. Consequently, when the attention is called to qualities possessed by the worker other than the offensive one, the tendency is toward a more equitable and balanced opinion. For example, a supervisor may have conceived an intense dislike for one of his workers because of a strange and affected manner of speech. However, on glancing down the card, he may be compelled to admit that this worker is very industrious, intelligent, orderly, accurate, reliable, fast, and regular in attendance. At the end of this complete survey, he must admit, even though reluctantly, that, after all, the man has his good points. On the other hand, he may be compelled to admit that another subordinate for whom he has a distinct liking because of his amiable manner and ready wit, is lazy, slow, and unreliable, and not at all the man he had been impressed with.

Moreover, the fact that these opinions must be recorded and signed will do much to reduce the degree of prejudice expressed. The appraiser will be conscious of the fact that, in expressing his judgment, he is putting himself, as well as his subordinates, on record and that any mistake or exaggeration on his part may rebound to his own discomfiture. Again, the fact that the estimates are made at stated periods will also lessen the degree of prejudice expressed. One of the most fruitful sources of prejudice is ill-temper. Ill-temper may be induced by any number of causes, but its inevitable result is to produce a prejudice against anything or anybody it comes in contact with. In such moments, it is very easy to conceive an opinion of a person which is quite likely to result in an extremely unfavorable estimate. However, a comparison with estimates of that person made in previous, calmer

moments, may do much to counteract this hastiness and to promote a more just result. The same check will operate on opinions that are suddenly inclined to become too favorable.

On the whole, then, it may be accepted that the impressionistic method as outlined, while not free from the errors of the personal equation, is nevertheless free from these errors in their extremer forms. To recapitulate briefly, the liability of error is lessened for the following reasons:

1. Because a periodic rather than a sporadic expression of opinion is required. 2. Because opinions are limited to a fixed number of qualities. 3. Because those qualities are defined in the same way for all. 4. Because it becomes necessary for the appraiser to check off the various qualities against each other, thus producing a balanced result. 5. Because the judgment goes on record for or against the man who makes it. 6. Because the judgment of one appraiser will serve as a check against that of another.

Like the method of comparative productiveness, the method described has two general applications, the statistical and the corrective. In the first place, it offers a basis upon which to compute the degree of correlation between selection and retention. Unless such a record is kept, it can not be ascertained with any degree of certainty how successful the selections of the employment manager are. As has been repeatedly pointed out, the dismissal, resignation, or transfer of an employee is by no means a proof that he was poorly selected. Unless some other criterion of success exists, these incidents may be attributed to a hundred different reasons. The record illustrated will furnish at least an approximate means for judging the success of selections,—or, it may be, for judging the success of the supervisor in handling his subordinates.

In the second place, it will serve as a basis for corrective measures. In general, all promotions, changes in salary, demotions, dismissals, transfers, etc., ought to be made with reference to this record. As in the case of the record of productiveness, this record will serve as a guide to the employment manager, enabling him to exercise greater intelligence and wisdom in the conduct of his employment work. It will also furnish him with a definite check against the supervisors and foremen who wish to release old workers and secure new ones.

In making changes in an employee's status, these records will be very useful. Different positions require different qualifications, and although, as has been pointed out, there is the utmost confusion and overlapping in formulating these qualities, still they may, in a rough way, be determined and made use of. The work of a planning supervisor requires a high degree of originality and initiative; that of a preparation supervisor a high degree of industry, etc. If these qualities are definitely recorded, changes in the status of employees will be made much more intelligent.

After this chapter had been written, a striking coincidence was discovered in the form given on page 334. This form has been in use in one of the larger educational institutions of the East for many years and has proved of great value. It will be seen that the qualities enumerated have a remarkable correspondence with those outlined. However, instead of four grades there are five. Moreover, this form provides for ratings at only two periods; namely, a "first impression" and a "second impression". The first impression is recorded when the student enters, the second when he is about to leave. Provision is made for separate ratings by different in-

PERSONALITY RECORD

FIRST IMPRESSIONS							ATTRIBUTES	SECOND IMPRESSIONS						
a	*b*	*c*	*d*	*e*	*f*	TOTAL		*a*	*b*	*c*	*d*	*e*	*f*	TOTAL
							Mental Calibre Intelligence, "Head"							
							Maturity, Common Sense, Judgment, Tact							
							Earnestness, Industry, Seriousness of Purpose							
							Reliability, Dependability, Deportment, Co-operation							
							Alertness, Resourcefulness, Initiative, "On the Job"							
							"Push", Energy, Vigor, Vim, "Pep"							
							Leadership, Executive Ability, Efficiency							
							Accuracy, Neatness, Skill, Dexterity							
							Address, Manner, Appearance							
							General Education, Culture, Refinement							
							Capacity for Growth							
							Fitness for Line of Work Chosen							

PICTURE

MEANING OF GRADES
1 Exceptionally Poor
2 Noticeably Below Average
3 Average Fair, Satisfactory
4 Noticeably Above Average
5 Exceptionally Good

KEY TO INSTRUCTORS
a Major Class Room Subject
b Laboratory Work
c Drawing or Design
d Mathematics
e Shop Work
f Minor Class Room Subject

structors. Each instructor makes his rating independently, and the results are then entered under *a*, *b*, *c*, *d*, *e*, *f*, and totaled. This record and the student's marks in his class-room work, which may be called his record of comparative productiveness, are combined in a single record to which is added the history of the progress of that individual after he leaves college.

There are many similar methods in use to-day in all kinds of industrial, educational, and other social institutions. Wherever the progress of individuals is a matter of serious concern, some similar record is essential. No absolute uniformity for this procedure can be prescribed other than that contained in the general rules laid down here. In fact, one of the chief virtues of this method is its elasticity.

In justice to the methods of psychology, it must be stated that the above analysis can hardly be classed as technical psychology. The psychological method, it is apparent by now, tries to substitute for the crude and biased judgments of the human mind an exact and im-

personal system of measures. The method of limited impressions described, although it uses figures, can not by any stretch of imagination be called impersonal or scientific. It is still largely subject to the variables in the human equation. Nevertheless, it is a practical, common-sense device by which these probable errors will be radically decreased.

PART IV

CONCLUSIONS

PART IV

CONCLUSIONS

The inevitable conclusion to the material which has been presented in the preceding chapters is a summary which will present briefly, and without theory, the manner in which this material can be put into actual practice. Therefore, under the heading: "A Practical Combination of Employment Methods", the results of this study have been compressed into a concrete plan of procedure which can serve as a guide to the employment manager who wishes to apply them.

It has also been deemed necessary to discuss in a special chapter the applicant's point of view. The machinery of selection and retention would be crude and clumsy indeed if it were not devised with this point of view before it.

In conclusion, it is sought to give employment psychology its proper perspective through a consideration of its relation to the general interests of industry and labor. And so the definition of employment psychology with which we set out will once more be presented, this time in the more comprehensive terms which the body of the book has made possible.

XXIV

A PRACTICAL COMBINATION OF EMPLOYMENT METHODS

The various phases of employment have now been discussed separately. None of these phases, taken in itself, constitutes a solution of the problem of employment. Nor can any one of these aspects be properly understood until it is related to the employment process as a whole. The question which is undoubtedly uppermost in the mind of practical employment experts at this point is: How can the various phases of employment which have here been discussed be combined into a single and complete process which shall be practicable for the ordinary employment office? The answer to this question will be based largely upon the actual experience of the writer and his associates in applying the expedients and methods which have here been described. With one or two exceptions, all of the methods discussed have been applied in the selection of applicants and the exact procedure governing their application has been carefully worked out.

In every employment process, beginning with an applicant's appearance, one step follows another in a fairly definite order, until, finally, the applicant is either engaged or rejected. Therefore, in order to present the combination of employment methods as clearly and as practically as possible, it is desirable to consider each

step in chronological order, in the exact manner in which it would occur in actual practice. When an applicant appears for an interview, observation is inevitably the first step. It matters little whether the candidate makes his first appearance before the door attendant, the employment interviewer, or the employment manager. In each case the first act is to glance at the individual, make a general estimate of his appearance, and then make a mental reservation as to the general kind of work for which he will apply. In large organizations it is frequently desirable to make a rough classification of applicants as they enter, largely for convenience in handling the various types of applicants. Obviously, the preliminary classification will depend entirely upon the nature and size of an organization, the variety of its workers, and other local factors. The initial division, which is frequently made by a door attendant or high-class clerk, greatly facilitates the subsequent task of taking applications and holding interviews. A large manufacturing concern, for instance, may wish to divide its applicants into four groups, those applying for office or sales work, unskilled laborers, semi-skilled workers, and, finally, highly skilled workers such as tool makers, electricians, carpenters, and all such as have a distinct craft or trade. Laborers and semi-skilled workers are often unable to talk English fluently, or indeed at all, and it is therefore desirable to have an interviewer who can understand several languages and also a clerk who can make out application blanks for those who can not write; whereas, office workers and the more highly skilled workers will naturally be able to make out their own application blanks and will have to be interviewed much more carefully than those in the other two classes.

When the applicant has been admitted into the waiting room reserved for that particular purpose, the next step is to take his name and address, and to look up his previous record with the concern. Whether the applicant admits having worked with the company or not, it is still advisable to take this step. If the applicant is a former employee, and if the industry has kept a faithful and systematic record of all its employees, this one step will greatly simplify all subsequent steps in the employment procedure. If such a record as the individual activity record described in Chapters XXII and XXIII has been maintained, it will be possible to tell at a glance when and where the applicant has previously worked, the kind of work he was engaged in, his earnings at that work, how these earnings compared with the earnings of his fellow workers, his average attendance, the reasons for his leaving, his special qualifications or shortcomings, and finally, the foreman's opinion of him. Any one of these items may be sufficient to decide whether or not the applicant shall be rehired. The opinion of the foreman is a particularly potent factor, for no matter how desirable a man may be in certain other respects, if the foreman or supervisor has a distinct antipathy or dislike for a worker, it may be inexpedient to place that worker under him. To be sure, a foreman who manifests such an antipathy too frequently in the face of an objective record to the contrary will soon draw suspicion upon himself and upon the validity of his judgments of human nature. A record of this kind works both ways. For the moment, however, while the applicant is applying for the return of his old job, this record would apply only to him. In addition to a record of this kind, it is also possible to make use of the records of the physical examination, the psychological examina-

tion, the previous interview, and, in fact, of any action or correspondence which may have taken place at some previous time regarding the present applicant. In mentioning all these factors at this point, we presuppose, of course, that the various phases of the employment process which are to be discussed here shall already have been in use, and that therefore the resulting records are available whenever a former employee returns to seek reëmployment. The value of such records can not be overemphasized.

If the applicant has no previous record with the company in which he is applying for work, the next step is to have him make out an application blank which will provide some of the information necessary as a basis for the subsequent interview. The writer is not so bold as to offer the ideal application blank. There is no one application form which will answer all purposes. Every industry or commercial organization has its own particular needs and peculiarities and will design its application blank accordingly. Nevertheless, certain items can be enumerated as being almost indispensable on any application form. Among these are: name, address, age, family circumstances, nationality, general education, special education, history of employment in the past, special experience, references, kind of work desired, special qualifications for such work, and so forth.

When the application blank has been filled out it should be passed over to the person who is to conduct the interview. Or, if the applicant is a former employee, his record as an employee and his original application should be placed in the hands of the interviewer in order to make the best possible use of this information. To obtain a cue from which to start the interview, the interviewer's

first step will probably be to find out, either by looking at the application blank or by asking the applicant, what kind of work he is seeking. If the applicant is seeking reëmployment in the same capacity in which he served at some previous time, the interviewer's next step will be to find out by referring to the candidate's record what his success in that capacity has been. If the candidate's record is one of success, it will be logical to infer that he can succeed at the same job again. If his record is one of failure, it will be necessary to carry the interview further in order to discover the reasons for the failure and whether these reasons have been overcome. For instance, a former employee, working in the capacity of a draftsman, may have failed because his training had not been sufficiently thorough to fit him for that work. After leaving his position, he may have taken a correspondence or night-school course in drafting which would now fit him to follow such work with increased possibilities of success, and it may therefore be advisable to reëmploy him in the capacity in which he originally failed. On the other hand, if his experience in the intervening time has not been such as to contribute to his development, it would be unwise to hire him for the same kind of work unless it be in the capacity of a learner or an apprentice. The possible variations of this situation are infinite and must all be settled largely upon the basis of the candidate's record. However, where this record is lacking, or where it is ambiguous and unreliable, or where the immediate circumstances are such as to raise any question, the following rule may be laid down as the safest guide: Whenever any doubt arises about the status of an applicant formerly employed, always examine the applicant in the same thorough fashion in which an applicant about whose

previous record nothing whatsoever is known would be examined.

Coming now to the consideration of new applicants, the first step once more is to ascertain what kind of work the applicant desires. This single factor is the one most important item about any application, whether of a new or former employee. It may be accepted as almost a psychological axiom that the likes and dislikes of every applicant should be given the most serious attention. Obviously, however, the employment office can not be governed entirely by the applicant's preferences and it will therefore always be necessary to examine the nature of this preference with a view of determining its validity and significance. All preferences may, for this purpose, be divided into three or four kinds: First, there is the preference which may be described as fixed by training. This is the preference of the skilled workman for the trade in which he has been trained. The carpenter, for instance, prefers to work at the carpenter's trade and at no other. This is a natural and well-founded preference, and one which it would be unwise from every viewpoint to disregard. Secondly, there is the preference fixed by chance; that is, the preference of an untrained worker for some particular kind of work for which he has in some way or other conceived a strong liking. There may be no logical ground whatsoever for this preference, and the applicant may be neither trained nor naturally fitted for the work he prefers. Nevertheless, if the preference is strong enough to withstand all arguments, it is inadvisable to force the applicant into work of another kind. Thirdly, there is what may be called the *derived* preference. When an applicant prefers a certain kind of work because he has heard pleasant things about it, or because it pays

well, or because it promises to allow him to be near his friends, his preference for that work may be called a derived preference. Such a preference may usually be modified during the course of an employment interview. If not, it belongs in the group of fixed preferences. Finally, there are many applicants who have very little choice or none at all. These applicants are willing to take almost any job, at a reasonable rate, which the employment office can give them.

The first step in every interview should be to ascertain the nature of the applicant's preference and to which of these classes it belongs. When this has been done, the subsequent steps can be guided accordingly. We shall take up each one of these possibilities separately, since in each case the plan of procedure involves fundamental variations. In a case of the first kind, where the applicant's preference has been fixed by previous training, the procedure is a straightforward one of discovering how much the applicant knows about his trade and how well he is fitted for the work which the employment office has at its disposal. In discovering these facts, the interviewer will, unless he is very familiar with the work in question, first look up the description which has been furnished by the job analysis. He will then compare the candidate's application blank with the job description to discover whether the applicant has the requisite experience, age, education, and so forth, required by the particular job. If the information on the application blank is satisfactory, the next step is to conduct tests which shall reveal how thorough and extensive the education, experience, and ability of the applicant really are. Obviously, it is one thing to claim certain things on an application blank or in an interview and another to be in possession

of the ability which these claims signify. The application blank and the ordinary series of questions may reveal what the education and experience of an individual have been, but they do not show how well the individual has made use of his opportunities or what are his actual abilities at the time of the interview. A machinist, for instance, may state to the interviewer that he has had three years of experience at one place and four years at another, and has worked on all kinds of machine tools, from drawings and without supervision. These claims are good so far as they go, but still they do not enable the interviewer to conclude that the applicant is a first-rate mechanic worth so many cents per hour. Even if the candidate holds a certificate from a reputable apprentice school, his ability is still largely a matter of doubt; for few apprentice schools are able to guarantee that all their graduates are experts. The next step, therefore, in determining the ability of the applicant is to ask him the test questions prepared, together with the possible answers, for this very purpose. Questions of this kind, applying to the work of machinists, gunsmiths, designers of jigs and fixtures, accountants, etc., are given in other chapters and in the Appendix. These question series can be given by the ordinary interviewer who can determine approximately, by means of an accompanying key, whether or not the applicant is giving the proper answers. If the answers given are entirely wrong or very crude, it may be assumed that the applicant does not know as much as he has claimed to know and he may therefore be rejected. If his answers are good or even fairly good, he will be interviewed further.

Up to this point it is possible for the ordinary employment clerk to conduct the interview, but thereafter the

psychologist or the trained interviewer must continue the process. When, by a series of test questions, it has been discovered that the applicant has a general knowledge of the work in question, the psychologist will give him a series of standard tests, such as is given to all other applicants for that work, in order to discover more closely what the applicant's ability really is. These tests will be based upon the actual work of the position in question. In the case of the mechanical trades, applicants are first shown an assortment of odd tools, and asked to point out those which are used in their trade. Then, as a more refined test, they are given a series of hypothetical tasks and asked to point out the tools which would be used in the performance of each task. As a still further test, a set of typical drawings is displayed, and the applicant asked to point out the work which each drawing calls for. A tool maker or machinist, for instance, may be shown a series of blueprints representing operations of the various machine tools, and he may be asked to state, in each case, which of the machines would be involved in performing the work called for by each of the drawings. This is a very simple test but one which reveals a great deal about a man's ability. Finally, the applicant may be requested to give a demonstration of his knowledge by performing some actual work on tasks assigned by the interviewer. The draftsman may be asked to do some lettering, to make a sketch, to design a fixture, or to work out a gauge. The machinist may be given a task on a machine which will involve certain essential operations. The stenographer is tried out on some actual dictation and typing. The accountant will be given some entries to make, etc., etc.

Several objections are likely to be raised at this point.

First, it may be asserted that the tests mentioned are not psychological tests at all and need not be given by a psychologist. In so far as psychology is considered as something apart from actual work, the tests are not psychological. However, if they have been worked out by means of the careful technique and experimentation peculiar to the psychological method, they are very distinctly psychological, and unless they have been worked out in this careful fashion, they will represent only another wrinkle of the human equation. It is also true that tests need not be given by the psychologist, but may be given by a technical expert. However, before the technical expert can give these tests with any degree of uniformity and accuracy, they must be properly formulated and standardized, and this is exactly the work which only the psychologist is able to do. In fact, one of the great virtues of the psychological method, as has already been stated, is its ability to work out standard tests and standard directions for giving them in such a way that the actual giving of the tests and recording the results can be done by others who are less expert. The procedure of giving tests described in the Appendix is such that, under proper supervision, a high-school graduate of little more than ordinary intelligence can learn in about two weeks how to give and correct the tests. There were frequent changes in the staff of examiners giving these tests, but the uniformity of the tests themselves, the directions, and the method of computing the results preserved the process of selection against all changes in personnel.

It may also be objected that the interview described is entirely too long and too intricate for ordinary practice. The ordinary practice, however, is something which most employers wish to get rid of, because qualified

and unqualified workers slip through it as easily and indiscriminately as water through a sieve. In order to make a more careful selection and grading of applicants than is now being made, the addition of half an hour or more to the interview of supposedly skilled workers will be fully justified, particularly when it is remembered how much time misfits cost once they have been hired and lost sight of. Moreover, now that so many unskilled workers and semi-skilled workers are being given a slight training in some one of the skilled operations, all the more care will have to be exercised to discriminate between those who are really skilled and those who, on the basis of a superficial training, claim that they are skilled.

We now come to those applicants who, possessing neither training nor experience, still prefer a definite job which requires these qualifications to a greater or lesser degree. There is an amazing number of workers who fall under this class; for it includes not only those who have not yet learned a trade but also those who do not *intend* to learn a trade and who will be content to shift from place to place or job to job as circumstances dictate. We have divided this large group into two classes, those who have a fixed preference for a certain kind of work and those who have an accidental or derived preference which is subject to modification. In each case, the wishes of the applicants should be given every consideration, and they should be tested for the work which they desire. The nature of the tests, however, must be quite different; for these applicants do not claim to have the particular skill or training which is required by the work for which they are applying. The tests must therefore be such as to discover the applicant's *potential skill*, his innate ability, and his general experience and general intelligence.

Examples of such tests and the situations in which they may be given have already been discussed in the chapter on the vocational value of tests. When, for instance, a man applies for the work of assembling, work which may be learned by a man or woman who has had no experience at assembling whatsoever, it is nevertheless desirable to know whether the applicant possesses the necessary manual dexterity, and that degree of mechanical ingenuity which goes far in enabling a novice to become an expert. The same thing applies to the work of clerks of many kinds, inspectors, automatic-machine operators, machine-tool specialists, salesmen and saleswomen, packers, and the unlimited number of workers who, without previous training, can acquire the necessary skill and experience in a comparatively short time. Even the untrained worker who applies for a position as helper or apprentice in which he will have to serve years as a learner, can be selected more intelligently by the application of the appropriate tests, as has been shown in the chapter on tests for apprentices. When an applicant's preference is fixed so that he will take only the one kind of work, there is no course left but to reject him if his record in the tests is decisively below the standard. However, if his record is quite close to standard, it is advisable, provided there are no other hindrances, that the applicant be recommended for a trial; for it frequently happens that genuine determination on the part of a worker will enable him to overcome very substantial initial handicaps. On the other hand, when the preferences of a worker are not absolutely fixed and he fails in the tests for a certain kind of work, it is well to give him some further tests in order to discover, if possible, another kind of work for which he is suited. It frequently happens that appli-

cants of this sort ask for a certain kind of work only because they have heard good things about it, because they expect to make high wages at it, or because it is clean and light. Under present conditions in the industrial world, an extremely large proportion of applicants are of this very kind. However, when such applicants are refused the work for which they apply and it is explained to them that their qualifications are such as to make them less fitted for this kind of work than for some other kind, they can frequently be induced to accept the alternative which is offered them. Such a modification of their original preference is justified and indeed highly desirable because it will further not only the interests of the organization but the interests of the individual as well. And certainly a developed technique of selection which can not advise and direct applicants in their choice of work with more than average luck or certainty falls far short of its opportunities and obligations in this respect.

Finally, there is the large number of applicants who have no preference whatsoever, or at best, only the most vague and general desires. Their sole object is to get a job at anything which promises them a decent living. Such applicants are largely at the mercy of the employment office. There has been, in fact, too strong an inclination on the part of interviewers to take advantage of such applicants by using them as stop-gaps by pushing them into whatever kind of work is most in need of men at the particular moment. The interviewer or employment clerk, with a large number of orders for workers to fill, places willing applicants only too readily in those positions which are most in need, regardless of whether the applicants are particularly fitted for those positions or not. This is a situation which every employment

manager will recognize and at the same time deplore. Such applicants should be handled by interviewers as material of the utmost value, since their freedom from any original preference allows a wide range in deciding where they will fit best. After the application blanks of these candidates have been carefully examined to determine so far as possible their preliminary experience and training, some limitations can immediately be made regarding the general field of work for which each is fitted. It now behooves the psychologist to bring into play a series of leading tests which will enable him to tell still more definitely where the applicant will fit best. In one or two of these tests the applicant will undoubtedly be better than in the rest, and these, then, will furnish a clue as to what further direction the more specific tests shall take. For example, in the work upon which these chapters are based the undecided candidate was frequently given the leading tests for the work of inspecting, assembling, machine operating, and clerical work, and when it was apparent that the candidate excelled in one of these tests, the remaining tests for that specific work were given in order to determine more definitely still whether the applicant was fitted for this particular kind of work. Frequently, when newcomers applied for general clerical work they were given an arithmetical test, a filing test, a sorting test, and a posting or copying test in order to determine for what special kind of clerical work they should be further examined. This may seem like a long, expensive, and roundabout way to select applicants, but it is very much shorter and more direct than the ordinary, haphazard fashion of trying out an applicant for several days or even weeks at one kind of work after another until months elapse before the worker strikes his métier.

When, finally, the psychologist or the expert interviewer has concluded his examination, he must express his conclusions in concrete and intelligible terms. It has been found possible, by means of the pro-rating formulæ described in the Appendix, to express the results of certain series of tests in terms of percentage. This is a very desirable method for several reasons: First, it is easily understood. Secondly, it enables the employment manager or whoever has the final decision in the matter to make a very close comparison between several individuals who are all applying for the same work at the same time. Other things being equal, the candidate rated ninety-four would naturally be given preference over the one rated eighty-two. Thirdly, it provides a standard basis upon which to set the initial salary at which the individual shall be employed. This point in itself is of vast importance to the employer. There are, to be sure, maximum and minimum wages for certain classes of work, but it is extremely desirable to have some means by which the setting of these wage rates can be guided within these limits. At the present time, this matter is handled in much the same individualistic and haphazard manner in which selection is handled, with the result that all kinds of discrepancies and inconsistencies occur. The presence of a definite rating such as that mentioned and described in connection with the tests outlined in the Appendix furnishes exactly the concrete and impersonal basis needed to make an intelligent and fair decision regarding the salary or rate at which the applicant should be started. A candidate who stands high will naturally be started at a salary approaching the maximum starting wage for that work, while one rated very low will be started near the minimum. The point in the scale of one

hundred which is to be considered the passing mark in the tests will be determined beforehand by means which have already been described in Part I. However, in addition to stating merely the numerical results of a series of tests, it may be desirable to state explicitly whether or not the candidate is recommended for a certain job. Before the significance of the tests given in connection with this work was as well understood as became the case later on, it was the practice of the psychological examiners to express the results of an examination on the applicant's card in the following broad terms: Recommended for————————, or, not recommended for————————, or, recommended for a trial as————————. This, to be sure, is a somewhat crude expression of results, but where employment methods are also crude it has a corresponding advantage.

After the results of the examination have made it apparent that an applicant is to be hired, the next step is the physical examination. The importance and significance of this step have already been dwelt upon. The number of men who must be rejected on merely physical grounds is comparatively small, and for this reason, it is more economical to place this part of the employment procedure near the end of the process.

When, finally, it has been decided to engage an applicant for a certain kind of work, the work of employment is by no means over. The introduction of the new employee into his place of work and the process of seeing that he is made to feel at home in that place in the shortest possible time, is a very important part of the employment process. Some organizations do this by means of a little folder which describes the customs and rules of the organization and the privileges which an employee

enjoys. Others take each individual employee as he comes in and introduce him to his future supervisor, and make him feel generally welcome. These methods are desirable and helpful. However, by far the most fundamental means of introduction is the vestibule or introductory training school. Wherever possible, new workers should be introduced to their work through the mediation of experts and under conditions conducive to proper instruction. The nature of the vestibule school as a means of preparing new workers for the tasks to which they have been assigned has already been thoroughly discussed. Wherever there is a good-sized body of salesmen or saleswomen, office workers, machine operators, assemblers, textile workers, or workers of almost any kind engaged in similar work, a training school is practicable and advisable and new employees should be put through a period of conditioning. The modern industrial situation has demonstrated the importance of this item in employment work, and the lesson will never be forgotten.

All employment work is governed by a set of forms or blanks, the *paper* basis for all procedures. Such forms are quite essential for recording and controlling in a uniform way each step in the employment process. It may seem desirable to give such a set of forms here as illustrations of the steps which have been described; namely, the card for recording the results of the psychological tests (see Appendix); and the individual activity records (see Chapters XXII and XXIII). Besides these forms there will be necessary the application blank, the medical-examination record, the introduction slip, and the comprehensive record which is kept permanently in the employment files. The exact character of these records

depends upon such a wide range of factors that it is absurd to offer ideal forms at this point. Every industry has its peculiarities and its differences, and the details of its forms must be worked out with reference to them. The use of the individual-activity record has already been described. No employment process is complete unless it includes a thoroughgoing and systematic follow up of its results; and no such follow up is of more than incidental value if it is not based upon a uniform and well-defined set of facts properly recorded on a standard form. Very few employment offices at the present time follow up the results of their selections. Once a man has been selected, their work is ended. Even if they desired to institute a follow up, it would be of little avail because the systematic record of those facts upon which a follow up must be based is lacking. Such a record must become the very foundation of all employment work, and the basis upon which the relative merits of the various phases of employment shall be determined.

The conduct of two additional phases of employment rests directly upon such a record; namely, the transfer of employees and the attempt to prevent old employees from leaving. To prevent old employees from leaving is distinctly an employment activity, even though it does seem to take place at the wrong end of the process. Enterprising concerns are finding it much more profitable and satisfactory to expend energy on the retention of old employees than on the selection of new. In at least one company this activity has been carried so far that every foreman rushes to the employment manager as soon as a good man gives in his notice and the employment manager is compelled to make an attempt to stave off the employee's leaving. Although obviously a very sensible

procedure, it is evident that in order to carry it out intelligently, a past history of each employee must be kept so that the employment manager can, when the emergency arises, quickly and reliably learn about an employee's average earnings, attendance, general ability, and so forth.

The problem of transfers is a comparatively recent and troublesome employment problem. Practically every transfer from one kind of work to another is a turnover, and is economically equivalent to the hiring of a new worker. Transfers are due to many causes beyond and within the scope of the employment function. However, transfers can not be made intelligently unless they are based upon a worker's past performance. In addition to this, every transfer should be regarded as a case of rehiring, and the individual should be as carefully examined for his new work as he originally was. This will to a large extent reduce the number of transfers and will help solve a problem which has been reaching alarming proportions.

In summarizing thus the various phases of employment which have been previously taken up in detail, it has naturally been necessary to be somewhat sketchy. However, the individual who has had any experience whatsoever in employment work will recognize the significance of the procedure here outlined. Very little emphasis has been placed upon the observational method, because that method is so limited in its scope. Frequently, indeed, it fails even to enable the employment interviewer to distinguish between the unskilled laborer and the skilled operative; and as a basis for making the fine distinctions which are required by the division of labor to-day, it is entirely inadequate. As has been already pointed out, observation may tell us whether an applicant looks *good*

or *bad*, but it can hardly tell us what he looks good or bad *for*. On the other hand, strong emphasis has been placed upon the value of questions in the employment procedure—not the ordinary stereotyped questions such as: Are you a steady worker? Why did you quit your last job? Did you like your last employer? etc., but *relevant* questions which will actually engage a man's knowledge and his ability, and, above all, questions which have been carefully worked out and formulated in accordance with the psychological procedure. Still greater emphasis has been placed upon the value of psychological tests where such tests have themselves been first tested by the thoroughgoing procedure which has been again and again described in the course of the foregoing chapters. The method by which such tests are developed and applied makes them the most accurate and unambiguous criterion for selecting applicants which has yet been devised. Finally, the verdict of the physical examination and the use of the individual-activity record as a basis of following up the results of selection have been enumerated in their due place and with due emphasis.

All of these phases have been presented in such a manner as to suggest the division of functions which they necessitate. The medical examination, it is self-evident, requires the physician. The preliminary work of taking the applicant's application, inquiring as to the applicant's preference, and roughly comparing the applicant's superficial and observable characteristics with the requirements of a certain job either as he knows those requirements or finds them by reference to the job-analysis card, can be done by the ordinary employment clerk. The psychological examination requires the psychologist and, when the scope of the work makes it necessary, a staff of

trained examiners working under his supervision. When the examination includes an actual demonstration of the work in question, a technical expert who has been familiarized with the psychological technique should be present.

The ever ready cry that the combination of employment methods here described is a process entirely too long and too costly can be met only by calling attention once more to the fact that it is far more economical and effective to spend time in selection at the very beginning, by means of a method developed for that very purpose, than it is to allow the actual selection to take place in the slow grinding wheels of an organization which is fitted primarily for production and not selection. Natural selection is a sure and an inexorable process, but it is far more drawn out and much more expensive than artificial selection.

XXV

THE APPLICANT'S POINT OF VIEW

No study of employment psychology would be complete without a discussion of the applicant's point of view. The consideration of this topic will be particularly apt at this time if, in the minds of some readers, the foregoing chapters have dealt with the applicant in a somewhat artificial manner. It is very easy to talk about an applicant as though he were a mere bit of mechanism, an inanimate pawn in the game of industry. In order to counteract this tendency, let us imagine ourselves for the time being in the position of an applicant entering an employment office. Let us attempt to adopt the actual feelings and mental processes of the individual in search of a job. The question which now suggests itself is: What kind of applicant shall we be? Shall we apply as expert mechanics, draftsmen, or accountants, or shall we apply for the work of ordinary laborers, work which requires neither skill nor education? Shall we apply as Americans, fluent in the English language and at home in American customs and manners, or shall we be Italian or Russian applicants, unable to speak any but the most broken English and still more helpless in writing the language? Shall we apply as men or as women? Shall we be applicants for factory jobs or office positions? These questions could be continued indefinitely; but the few characters which we have suggested will indicate at once the com-

plexity of this problem, the hundreds of possible varieties of men and women, races and creeds, skill and awkwardness, education and ignorance, trades and professions, represented at one time or another among the seekers for work in an employment office. To place ourselves, therefore, in the position of the typical applicant, and to acquire his point of view, is a most complicated problem. For instead of one applicant with one point of view, we find a heterogeneous mass of applicants with a heterogeneous mixture of *points* of view. In short, there is no typical applicant.

However, it may be possible for us to overlook, for the time being, these innumerable divergencies, and think only of those fundamental characteristics which are common to all applicants. No doubt, there are such constant factors. We admit it in our use of the phrase *human nature;* for what is human nature but certain basic emotions, desires, or instincts which are present in all individuals? Now, if we attempt to arrive at these fundamental forces, in so far as they are characteristic of the human individual in search of work, we may not discover them all or be infallible in those which we do find. Nevertheless, such an attempt will contribute something to our success in adopting the applicant's point of view, and modifying the process of employment accordingly.

One of the most obvious qualities of human nature inherent in the applicant is the desire for a square deal. The opportunities which the employment office has of exercising or ignoring fair play are innumerable. For instance, when a number of applicants enter an employment office, it usually takes some time to interview them all and, unless particular care is exercised, some who arrive first will be interviewed last and some who arrive

last will be interviewed first. This may seem like a very trival matter, but it is really one of the utmost importance to the applicant; for a late comer who gets ahead of him may receive the very job which he himself might have received. To be compelled to lose an opportunity for work in this way can not but strike him as being essentially unfair. Even when a candidate who has suffered such an incident does receive a job, he does not forget the bit of unfairness which accompanied it. In fact, the degree of impartiality and fairness which an employment office exercises in the selection of its workers may be symbolical to the applicant of the character of the entire organization, and may color all his subsequent ideas of that organization. It therefore behooves the employment office to be impartial in its dealings even in a matter apparently so trivial as taking care to interview applicants in their proper order. In some places applicants are given numbered slips as they enter the employment office so that their sequence may be more carefully observed. A simple measure like this, particularly in places where the daily number of applicants is large, is a very genuine recognition and acknowledgment of the applicant's point of view.

A second fundamental characteristic of all applicants is their self-esteem. Any attempt to adopt the applicant's point of view must reckon with this force. From the most superior to the most ordinary candidate, self-esteem is a pivot point around which many actions and attitudes revolve. To show how this force may come into play during the course of employment interviews, we may take, as an illustration, the adequacy of the service. Some employment offices are almost always empty and all newcomers are disposed of with the utmost dispatch. Other offices are always crowded with applicants, and it fre-

quently happens that the individual must wait hours and sometimes even days, before his turn comes. Now the length of time which an applicant is willing to spend in the waiting room of an employment office is roughly proportionate to his degree of self-esteem. A man who places a high estimate on his value will not spend as much time in waiting as a man who does not. An expert electrician, for instance, is not likely to spend three hours or half a day simply waiting for an interview. He is too well aware of the fact that in the same amount of time he can probably find a position elsewhere. And even when the labor situation is such as to enable employers to enforce long waits upon applicants the injury done their self-esteem will rebound sooner or later to the disadvantage of the employer.

Another way in which the quality of self-esteem manifests itself is in respect to courtesy. Courtesy may be defined as the active acknowledgment of the other man's point of view. To treat an applicant discourteously is to ignore his point of view and to administer a violent blow to his self-esteem. There are myriad ways in which courtesy may manifest itself during the course of the employment process. From the very arrival of the candidate at the doors of the employment office to the time when his application is rejected or accepted, there is opportunity after opportunity for the exercise of considerateness. The fact that the applicant is, for the time being, more or less at the mercy of the employment interviewers sometimes promotes in the latter a tendency to be sharp in their questions and abrupt in their replies. This has a decidedly bad effect upon applicants, making them either very nervous or indignant.

Finally, it must be recognized that the most funda-

mental of all factors which go to make up the applicant's point of view is his self-interest. The very fact that he is applying for a position is an indication of this fact. The prospective employee is anxious to improve his condition, either economically or socially. In order to deal successfully with him, the employer must recognize this fact. It is altogether too easy to overlook it, for the employer has his own interests to conserve, and sometimes these interests conflict with those of the applicant. However, it may be stated as almost axiomatic that the employer who can ascertain the interests of applicants and identify those interests with his own program is making the most profitable arrangement from every conceivable point of view. As a concrete example of the application of this attitude the following incident will serve. A young musician of great promise was introduced to the employment manager of a big corporation. This young man was anxious to obtain work and was willing to begin at almost any kind of work. At the time the greatest demand was for automatic-machine work, and the obvious course of the employment manager was to hire this applicant for such work, particularly since he was capable of doing it and had himself expressed a willingness to do machine work. However, the employment manager had, in the course of the interview, discovered that the young man was a musician who already depended in part for his livelihood upon the use of his hands, and as a result he flatly refused to give the applicant such work. "It is part of my business," he remarked, "to protect the interests of our employees even when they do not recognize those interests themselves. Sooner or later they will recognize them, and we shall either be blamed or praised. Now, if you were to lose a hand, or a finger,

or even one flange of one finger, it would ruin your possibilities as a musician and undo the work of years spent in training." Instead of allowing the young man to take a chance, therefore, he exerted himself to find a position in which this danger was absent. Now, in a less obvious way, every case of employment involves a determination of the applicant's self-interest. The whole aim of selection is to select the right man for the right place, and naturally, no man is in the right place until his own interests as well as the interests of his employer are being furthered.

These elements of an applicant's point of view are fundamental and are common to all normal applicants. It does not require a psychologist to see them or to acknowledge their truth, any more than it requires a mathematician to see that things equal to the same thing are equal to each other, or that 2 plus 2 equals 4. However, though any man may recognize self-esteem and self-interest as fundamental factors in the human equation it by no means follows that this knowledge enables him to understand the particular individual or to achieve the individual's point of view. Just as the knowledge of the axioms is only the first step in becoming a mathematician, so the knowledge of these fundamental facts of human nature is only a beginner's step in becoming a master of the human equation. In order to approximate the viewpoint of the particular applicant it is essential to make a much more thorough and painstaking study of human nature. It is necessary to study human equations as systematically and scientifically as the mathematician studies the many kinds of mathematical equations. For there is an endless number and variety of human equations or viewpoints, as we saw when we tried to imagine ourselves in the position of an applicant and could not

decide which applicant he should be. On the basis of such a study a technique must be built up which will thereafter serve as a guide in obtaining the viewpoint of particular individuals, and which will reduce the effects of the prejudices and notions to which every human being naturally yields when he tries to put himself in the place of another.

This problem can once more be resolved into the terms of our introductory chapter; namely, the difference between *home remedies* and the scientific method. The various acts of imagination and guesswork by which we believe that we can adopt the viewpoint of another may be classed as home remedies. They may answer up to a certain point or as long as the consequences are not important. They are, however, much too full of the beliefs, traditions, and prejudices which beset every human being. They put the individual whose viewpoint is being sought entirely too much at the mercy of the individual who is trying to obtain that viewpoint. The scientific method, on the other hand, makes a much more fundamental survey of the human mind, and develops certain impersonal guides and standards by which to arrive at individual viewpoints. And although it begins with the psychological axioms that self-esteem and self-interest are common elements in the viewpoint of every individual, it is concerned more largely with the means by which to understand the great variety of ways in which these fundamental elements express themselves in different individuals.

Employment psychology in its entirety, therefore, is a scientific attempt to attain the applicant's viewpoint and to understand and satisfy his self-esteem and self-interest. The reason for devoting a single chapter to the subject is only to call attention more vividly to the manner in

which all phases of employment psychology contribute to the establishment of this fact. The first task of the psychologist, it has been seen, is to devise means which will enable him to assign the applicant to the work at which he can be most successful. Instead of relying upon the customary crude and unscientific assumptions about various types of people and various kinds of work, he makes a separate study of each kind of work together with the people who have failed or succeeded at that work. He engages in the work himself in order that some of its less obvious features may not escape him. When he has selected a group of tests which seem to apply to a particular kind of work he does not assume their value but first tries them out on workers whose success or failure are established facts. Indeed the process of finding and applying tests is based upon the closest and most continuous study of *actual people actually at work*. Experiment must follow experiment in order to obtain the means by which the applicant's abilities can best be determined.

This applies not only to the use of the more strictly psychological tests but to other methods of interviewing an applicant as well. The ordinary and usual manner of observing and questioning a candidate reveals a decided inability to penetrate his particular mental state. Instead of random observations it has been shown that observations based on a carefully mapped out plan and on actions relevant to the work in question will reveal much more of the candidate's state of mind. And it has also been seen that questions are not likely to discover the real interests and feelings of individuals, much less their knowledge, unless they are carefully worked out by means of the same experimental process as that which is applied to the development of significant tests. It has

also been found that a physical examination, tactfully conducted, will convince an applicant that he is dealing with a company which will protect his physical well-being. The period of training described and recommended for new workers is a deliberate attempt to obtain the individual's viewpoint; for it provides a mechanism which makes it possible to observe the new worker under varying conditions over a comparatively long period of time.

One of the most interesting examples of the psychological method and its appreciation of the individual's viewpoint is its technique of giving tests. It is generally recognized that candidates for employment are likely to be nervous and therefore unable to do themselves justice, either in the tests or in the oral interview. The psychologist not only admits this difficulty but he attempts to overcome it. In the first place, he leads the applicant into the fields of relevant activity; that is, he centers his questions and tests upon those activities in which the applicant is most at home and therefore likely to be least nervous. When this is impracticable, *shock absorbers* are first given, tests which are particularly calculated, by their interest and simplicity, to absorb the excitement of the subject. This is but one of innumerable ways in which the technique of psychology shows its concrete appreciation of the subtleties of the human mind. To give but another instance, let us refer once more to the development of a set of directions for giving tests. In order to give a test so that it will be understood correctly it is essential to grasp something of the viewpoint of the applicant. The average individual would probably try to imagine himself in the position of the person taking the test and then give his directions accordingly. He might write his directions down or he might even trust

to memory to help him remember them for the next occasion. The psychologist, as we have seen, may begin in the same way, by imagining a situation or a number of possible situations and then working out a set of directions for the test accordingly. However, once the work of his imagination is complete he may give these directions twenty or fifty different times and in the course of this work he may change the structure of a sentence at one time, the turn of a phrase at another, the position of a word, of a comma, or of an accent. He may make innumerable changes before he arrives at a set of directions which meet, with a reasonable degree of success, the varying viewpoints and ideas of a large number of individuals. In other words, he is not satisfied to obtain another's viewpoint by imagination or guesswork alone, but must try out his assumptions by means of careful experiments in order to find out how they work in actual practice.

The recognition of self-esteem and self-interest and their corollaries, courtesy and fair play, is still further developed in the individual-activity record. The fundamental qualities of the individual can not be properly gauged or recognized as long as the task is left to the uncertain and capricious judgment of ordinary human beings, whether they be gang bosses or general managers. The individual-activity record is largely an impersonal and objective record of the history of a worker. The items in this history are various, but they all contribute to the estimate of the total value of that individual both in the eyes of his employer and in his own eyes. Where such a record is kept the worker who esteems himself and is confident in his abilities need not fear that some caprice on the part of his superior will be able to oust him from his position.

He can be sure that no matter what difficulties arise, there is one source which is comparatively stable and free from the prejudices and excited judgments of a particular moment.

The attempt to consider the work of individuals from the vocational standpoint may be regarded as a tremendous stride in the direction of realizing the applicant's point of view. A technique which promises to help the struggling candidate understand his own needs, limitations, and capacities will go far toward achieving the viewpoint of the applicant in a full measure. And in so far as the technique of psychology enables the worker who does not care to acquire a vocation to obtain work which will bring him the largest returns of which he is capable, the important factor, self-interest, will be largely met.

Finally, and probably most important, is the fact that the entire process of employment outlined here is built up on an appreciation of the fundamental likes and dislikes of the applicant. The individual's freedom of choice is the central fact in the structure. Any attempt to limit or to thwart this choice is a failure to credit the applicant's viewpoint. There are, to be sure, limitations to any applicant's choice, but they are the limitations imposed by the scope of a particular industry and not by the psychological method. An industry can not be expected to honor the choice of an applicant for a kind of work which it does not have. Moreover, there are times when the applicant's choice is only an impulse, not a deep-rooted desire, and in such cases the psychological examiner is at liberty to modify that choice as long as he does not do so contrary to the interests and abilities of the applicant. In developing the mechanism to select applicants, the individual's

viewpoint, his desires and aversions, has been the central and dynamic factor; and therefore, the superstructure of employment psychology, like that of mathematics, rests upon a broad and substantial basis.

Several objections are likely to be raised to what has here been described as a scientific and thoroughgoing method of obtaining the applicant's point of view in contrast with the superficial individualistic and imaginative method. In the first place, it may be objected that the scientific method tends to reduce every variety of human being to a class or a type, and that, in doing this, it loses that very power of penetration and fine insight which belong naturally to the unfettered imagination. There is a certain degree of truth in this statement. The scientist does tend to classify individuals and reduce them to the level of types, and in doing this he loses sight of some of their finer individual differences. But the ordinary judge of human nature, the man who judges by intuition or insight or imagination, usually has just as strong a tendency to classify individuals and reduce them to types. The real difference is that he does not make his classifications consistently or systematically. His intuition or "hunch" may lead him to make one classification at one time and another at some other time. Consequently though he can always classify individuals somewhere, it is quite difficult to predict where he will classify them next. As a result of this indefiniteness *he escapes the appearance of making any classification whatsoever.* This method or rather lack of method has at least the merit of spontaneity, but it is somewhat unsatisfactory for practical purposes—especially in view of the fact that the classifications of two individuals are seldom likely to agree. The scientist differs from the individual who classifies by intuition

or imagination not in the fact that he lacks these fine qualities, but in that he confines them to certain orderly channels. The scientist may exercise just as fine an insight and imagination in his dealings with people as the man who is not scientific, and yet he achieves results which are systematic and which lend themselves to a practical and relatively stable classification. The scientist is sometimes considered unimaginative simply because imagination has come to be identified with a kind of glorified disorder. If to classify individuals is to forfeit insight into their nature, then the imaginative but unscientific mind is probably much the less penetrating of the two. For the chances are that the classifications of the scientist are far more subtle than the crude categories of the undisciplined imagination.

Moreover, the attempt to get at the viewpoint of an individual by an act of the imagination has certain very serious limitations. Such an attempt results very often in a somewhat distorted view of oneself or in a fantastic mixture of oneself and the other individual. The belief that one can, at will, imagine oneself in the position of another and at the point of view of another is one of the most dangerous and fallacious beliefs in existence. The very first teachings of psychology are diametrically antithetical to such an assumption; for the uncertainties and quirks to which the human mind is subject are such as to make it difficult enough for it to maintain a consistent viewpoint of itself. Most of the faults of the old methods of employment rest upon this fallacy; for hitherto the task of interviewing and "sizing up" applicants has been left largely to the unchecked and unguided imagination or judgment of isolated individuals. The entire aim of employment psychology is to substitute for this individ-

ualistic and haphazard method of ascertaining points of view a more reliable and scientific method.

Finally, it may be protested that the methods here described are altogether too disinterested and mechanical. It may be claimed that they work upon an individual as a machine works upon raw material, without sympathy and without the *human touch*. To be sure, it does seem to be the tendency of all scientific methods to reduce things to a perfect mechanism. The ideal employment method is undoubtedly an immense machine which would receive applicants of all kinds at one end, automatically sort, interview, and record them, and finally turn them out at the other end nicely labeled with the job to which they are to go. Those who are horrified at such a prospect have little to fear; for it will be many a day before this consummation is reached. Instead of comparing scientific selection with a machine it is much more reasonable to compare it with the practice of medicine. No doubt the modern practice of medicine may seem like butchery compared with the gentle home remedies of our imaginative forefathers. The appliances of the physician make a most threatening array and who does not quail at the mechanisms of the operating room? And yet, we do not generally think of medicine as disinterested and as mechanical. The surgeon may take our best friend and rearrange his entire anatomy without our accusing him of being cold-hearted; for medicine is a technique which is larger than the particular intentions of a particular physician. The entire aim of medicine is the welfare of the human being. Particular physicians may be mechanical and disinterested in their attitude toward their patients. However, the generous aim of their science far outshadows their own pettiness. With

its apparatus and technique, medicine has come to stand in the eyes of all as a servant of the physical welfare of mankind. The same opinion will probably be ultimately entertained toward the science of psychology. The objection that psychology is too mechanical and disinterested is the objection brought by the backward ones of every age against the advance of science. It will undoubtedly be commonly recognized in time that the entire aim of employment psychology is to attain the viewpoint of the applicant, and to further his interests by selecting him for the work which he is best able to do and at which he will be of greatest value to society and to himself.

XXVI

EMPLOYMENT PSYCHOLOGY, LABOR, AND INDUSTRY

It is a regrettable but undeniable fact that there is a tendency in labor circles to look with suspicion upon anything which contributes to the efficiency of management. Unfortunately, the fashion in which the various programs of scientific management have been carried out by some manufacturers has provided grounds for this suspicion. Many labor leaders have affirmed that the piece-work principle, which, under one name or another, is probably the most fundamental principle in all schemes of scientific management, is merely a clever but selfish device by which manufacturers attempt to stimulate their workers to greater and greater efforts. The large number of bonus and premium plans of remuneration inaugurated under these programs have tended to confirm this suspicion. In fact, the entire range of schemes and devices for the promotion of efficiency included under the name of scientific management has contributed to the belief on the part of labor that the science of management is a cold-blooded and heartless method which treats human beings as just so many machines from which the last pound of energy is to be extracted. Since this belief exists, any other method which offers to make management still more scientific is likely to incur a similar suspicion. It may be held that the psychological method also treats

human nature in a manner altogether too mechanical, and the human being too much as if it were a mere automaton, to be adjusted and shifted accordingly.

Now, strange as it may seem, even the manufacturer sometimes adopts a hostile attitude and resents the method of employment psychology on the ground that it is too scientific and too formal for application to human beings. Although entirely convinced of the necessity of applying scientific methods to the inspection, classification, and treatment of his material equipment, he is quite satisfied with the application of crude clerical methods to the treatment of his human equipment. And even if convinced of the value of applying the scientific method to the study of people, he considers it too involved and costly for application to his particular problems. The possibility of supplementing the physical, chemical, and medical laboratories with a psychological laboratory has thus far occurred to only the most farsighted of industrial leaders.

As a partial answer to this possible view the following quotation from an article in "The Harvester World", by Cyrus McCormick, Jr., is given: "Automatic machinery has come to stay. Progressive machining and progressive assembly are known sciences. The time has come when we must ask ourselves frankly if we are making the same good use of man power that we are of machine power. Speaking economically, an employer should take not only the same, but better, care of his men than he does of his machines. No factory superintendent would consent to the operation of any gear cutter, for instance, which was so dulled as to cause its rate of production to drop below the point of efficiency. Do we take the same care to keep our men from being dulled? I mean just this, if we spend

time and money to keep our machinery in the best order, how much more should we be willing to spend time and money to keep our men in good health.

"Good health does not mean simply that the man is free from colds and fevers. It means that he is happy in his home and his work, and it means further that he is surrounded with conditions of labor which make it possible for him to produce at all times up to the point of maximum efficiency. Good health means happiness, for the two are inseparable. We must, therefore, ask ourselves if we have provided the means to keep our men healthy and happy with the same care that we have taken to keep our machines properly and efficiently running.

"Looked at from the standpoint of dollars and cents, it costs money to keep a man, or a machine, working who is not doing his job properly, and yet, the man may be failing through no fault of his own. He may not be properly placed. He may, for instance, be working in an automatic department whereas he should be on the floor. Have we studied carefully enough the human side of manufacture? Have we developed a system whereby we may know without the possibility of doubt that a man is in the right place?"

This quotation, which is characteristic of the trend of some of the finest business talent of the country to-day, indicates the radical change which is taking place in the attitude of industrial leaders toward their employees. The one outstanding fact which has made it possible for industry to exploit labor has been ignorance. The failure on the part of industries to comprehend or try to comprehend the needs, desires, and capabilities of their workers has allowed them to treat their workers as if these factors

were nonexistent. Therefore, if failure to comprehend the nature of workers has in the past rebounded to their harm, anything which tends to remove this ignorance must be to their advantage. When manufacturers begin to devote the same careful thought to their human equipment that they have hitherto vouchsafed their mechanical equipment, it is an unmistakable sign that the interests and welfare of the workers will receive a more sympathetic consideration than has heretofore been the case. The fact that this attention may take the form of applying scientific methods to employment problems and treating human beings as if they were machines must therefore be recorded as a tribute rather than as an insult. It is the surest possible sign of the increased value which has been attributed to the workmen. Even if the increased interest of the industrial leader in the nature of his human material is actuated by the most selfish motives, the results can not help being to the advantage of the worker.

In order to understand correctly the place of employment psychology in this program, and its respective relations to industry and labor, it is necessary to consider the conditions to which employment psychology owes its importance. Employment psychology is obviously a response to the all important question of labor turnover. The amount of labor turnover in the last few years has been such as to entail a staggering loss, a loss which has affected every individual and every enterprise in a measurable degree. Labor and industry alike have suffered by the excessive labor turnover. This condition is an unhealthy one. In fact, the unemployment or the improper employment indicated by the labor turnover may be considered as essentially a disease. Steady employment is or should be the normal and healthy state of

affairs. Unemployment or a constant change of employment is the unhealthy or abnormal state of affairs. As such, it requires special treatment, just as physical illness requires special treatment. Now, whether the cases of unemployment or changing employment are due to the individual or to industry, it is the task of employment psychology to apply the necessary corrective treatment, just as it is the task of medicine to restore to health the individual who is ill. In so far as employment psychology duplicates in the field of employment what medicine does in the field of health, it contributes to the welfare both of the individual and of industry.

In order, however, to achieve a still truer perspective of the place of employment psychology with reference to labor and industry, it is necessary to go still deeper into the problem of labor turnover. To begin with, employment psychology is not the only road to steady employment, any more than medicine is the only road to health. Just as good health is dependent upon healthful recreation, health-giving food, proper exercise, and an absorbing trade or profession, so steady employment is dependent upon other factors, more fundamental than a temporary correction. Steady employment is essentially dependent upon the conditions of industry. It is dependent upon the degree and quality of physical health, recreation, family life, social standing, and the advancement which the worker is able to achieve. But above all, it is dependent upon education. The one most universal and powerful factor in reducing labor turnover and in maintaining a healthy state of employment is education. Education is the most stabilizing influence known to man. This is true not only in so far as it affects labor turnover, but in its effects upon the turnover of social institutions, indus-

tries, and governments as well. "The higher the fewer" is a phrase the significance of which is now becoming axiomatic. With regard to labor turnover, it may be interpreted as meaning *the higher the education the lower the turnover.* If statistics were available they would undoubtedly show that the turnover among college graduates is lower than among any less educated group. The same principle applies to every trade and profession which requires a thorough training and preparation. The expert tool maker and mechanic is one of the steadiest of all workers. Wherever he is, he holds a dignified and respected position. The same may be said of every other craft or occupation which requires educated talent. Education, health, and employment go hand in hand.

As a corollary of this fact, it may be stated that the fundamental cause of unemployment and instability is the lack of education. For the past fifty years the education of boys and men for industrial work has been neglected. The large number of expert mechanics, chemists, opticians, wood and iron workers, decorators, etc., etc., were drawn from European countries, notably France, Germany, Switzerland, Sweden, Austria, and England. As a consequence, the education of the youth of this country was neglected, and they were compelled to be satisfied with places requiring less expert ability. In addition to this cause was the development of automatic machines and the breaking down of all manufacturing operations into a series of comparatively simple elements. How far the simplification and division of labor have been due to the lack of experts and educated workers who were able to carry out an entire process, and how much of it is due to the inventive genius of a small number of exceptional individuals, is a question which can never be

answered. Undoubtedly, both were contributing factors. The lack of experts made it necessary to divide the work, while, in turn, the division of labor made expert workers unnecessary. The grand result, however, has been the breaking down of operations and simplifying of processes until less and less skill is required to perform any one of them, and until more and more workers are eligible for the task. This trend was still more accentuated by the exigencies of the war. And now it is possible for almost any man or woman to go into a factory and in a day or a week become an acceptable operator, and earn a desirable week's pay. In fact, the entire tendency in industry has been to place a premium upon the uneducated worker.

The high labor turnover, the unhealthy state of employment, which prevailed even in the face of a most dire need for labor, was the logical and inevitable result of this great development. An operation which can be learned in an hour, a day, or a week, possesses none of the elements which make for stability. The simpler the operation and the less time required to learn it, the less interest and mental effort it demands. Once such an operation or task is acquired, nothing more remains for the worker to do except to watch his fellow men, to brood probably upon his own hopeless condition, the more favorable condition of some of his neighbors, the inadequacy of the wage he receives, the pettiness of his bosses, and an infinite number of other details which may come into his mind. The unhealthy results arising from an unoccupied mind are proverbial. The worker whose work is so highly standardized as to allow him to become a mere automaton with a mind which may be anywhere but at work, is a fruitful field for all kinds of unrest. He is bound to be assailed by the desire for a change, the desire for larger

and larger wages, and sometimes even the desire for a bit of violence and excitement to make up for the otherwise undisturbed monotony of his days. The operation which is so simple that it requires no particular training or education commands a dignity and respect which is correspondingly meager. The good wages which piece-workers usually receive partly compensate for this lack. However, piece-work wages have had the effect of increasing rather than diminishing the restlessness of the workers. The unexpectedly high wages which one class was able to earn upset the entire labor market and added enormously to the labor turnover. This unforeseen increase in the earnings of piece-workers, and consequent unrest among all other workers, made it necessary for industries to readjust wages from the very bottom to the very top of the scale. Laborers, clerks, journeymen, and even salaried officers had to be included in this general readjustment.

No one realizes better than the leaders of industry who have lived through the rapid progress in the division of labor, how much painful truth the above assertions contain, and probably no group of men is more anxious to meet this problem in a fundamental way. The condition is present. Labor has been divided into minute and highly volatile parts. No amount of coercion, either upon the part of industrial leaders as a group or laborers as a union, can bring about the cure. No amount of preaching or doctrine as to the relative duties of capital toward labor and labor toward capital can make employment conditions healthy. Among the many lessons which the war has brought home is the fact that labor is capital and capital is labor. The practical solution of this problem can not be attained by steering a nice middle course

between two antagonistic forces. It can be achieved only by the combined effort of an entire community, and that effort must be concentrated upon *education*. Just as the neglect of education has made the present situation possible, so the development and increase of education must make it impossible. Industrial stability and a healthy state of employment can be achieved only when labor parties, industries, educational institutions, and in fact, the entire national community, coöperate. And this cooperation must concentrate on educating the youth of the land for work which commands their interest and their ingenuity.

The objections which will be immediately voiced to such a proposal are: first, that it will result in a superabundance of educated and expert workers, and will thereby deprive society of the ignorant and uncouth workers who will always be required to do the *dirty work;* secondly, it will tend to retard the development of the many labor-saving mechanical devices which have to so large an extent brought about the minute division of labor. In answer to the first of these contentions, it may be said that never, in the history of civilization, has there been, so far as we know, a superfluity of educated men or trained artisans. Never was the need for trained experts and skilled workers more painfully felt than during the course of the war. Moreover, it is safe to prophesy that no possible program of education can ever raise all men to exactly the same level of ability and knowledge. There will always be the two extremes of highly educated and poorly educated workers, and the large middle class of workers with only a fair education. This, however, does not mean that there must always be men and women to do the dirty work as it is being done now. The reason

for the recent dearth of labor is that labor has been so cheap in the past that we have come to depend on it as wholly as the South, at one time, depended on slavery. *Dirty work* is no more necessary now than slavery was then. To make dirty work less dirty requires only a little thought and ingenuity. It is not an inescapable evil. The same may be said about arduous physical labor. To eliminate or ameliorate the objectionable conditions, when in the course of progress they become objectionable, is only another little problem for man's inventive and mechanical ingenuity to meet. And, queerly enough, education, at the same time at which it develops men and women who find dirty and monotonous work objectionable, also develops the skill and knowledge by which these objectionable features can be removed. So far as industry goes, there can never be a superabundance of educated people, even though managers are sometimes put to it to make use of intelligent workers in an intelligent way.

The other contention, that education will make workers dissatisfied with the highly specialized and monotonous types of work brought about by the invention of machinery and thereby retard industrial progress, may be answered in much the same way. Education can never hope to solve the problem of labor turnover by attempting to create artisans and craftsmen of the old type. This is one of the pretty dreams of retrospective utopians, and runs counter to the entire trend of productive civilization. Not by the abolition of machinery but by a further and an even undreamed-of development of mechanical devices will education help solve the problem of labor turnover. Machines must more and more be made to do the work for which labor is becoming scarce or which labor is unwilling to do. But instead of workers being mated to a

single machine in an endless monotony of stereotyped and simple motions, one individual will supervise the work of a chain of machines, automatically fed and regulated, requiring, instead of a brainless and emotionless automaton, a well-trained mind and a knowing touch. Education, instead of dampening the fire of inventive genius, will encourage it to accomplish its utmost in emancipating mankind from enslavement to work that is merely automatic and from which all creative elements have been systematically abstracted.

What has been said of education and industry applies also to education and labor unions, though in a slightly different manner. Probably no factor does more to destroy the cohesion and intelligent coöperation of labor parties than ignorance or the lack of education. The very lack which contributed so much to the rise of unions is now the lack which acts as a bar to their intelligent and concerted action. But as the workers become better educated their power of cohesion will become stronger. At the same time, a cohesion made stronger through education will become less threatening because of its intelligence. Industry has much less to fear from an educated party than from an ignorant mob. And on the other hand, a union of educated members will be able to achieve more, in a constructive and coöperative manner, than can an ignorant mob by force.

We are now in a position to regard employment psychology in a truer perspective and with a clearer sense of its relation to industry and labor. If psychology is not a panacea for all employment ills and labor turnover, neither is education, fundamental though it is. No matter how extensively and intensively the work of education is carried on, there will always be an appreciable turnover,

yet received little attention but which is becoming daily more important; that is, the classification of workers into trades and grades. One of the greatest hindrances to the amicable settlement of wage disputes has been the lack of such classifications. When, for instance, a group of tool makers ask for a certain minimum wage for all first-rate tool makers and another minimum for all second-rate tool makers, the rock on which negotiations often split is the question: How do you distinguish between what constitutes a first-rate and a second-rate tool maker? The workers fear that the manufacturer will make the classification to his advantage if he is allowed the final word; the manufacturer fears that unless he makes the classification himself it will result to his disadvantage. Consequently, because neither party to the discussion possesses an impartial or impersonal criterion upon which to base a classification, the misunderstanding between both parties grows. This is a situation which has arisen very frequently in recent years and which is bound to arise with increasing frequency as the organization of labor continues to develop. Now, situations of this kind furnish a perfect illustration of the value and impartiality of the psychological method. It will be remembered that the introductory chapter described employment psychology as the application of exact and standard measures to the problems of employment, in contrast with the crude and prejudiced estimates of the human mind. In situations of this kind, just such scientific measures are needed. The manufacturer does not rely upon the judgment of the workers, and the workers are not willing to rely on his. Both judgments are naturally biased, and therefore subject to error. In order to solve this problem, it is necessary to appeal to an unbiased and impersonal criterion. Arbi-

tration boards do not furnish such a criterion. The ordinary arbitration board is even less able to classify workers than the ordinary employment office. The very fact which hinders such boards in their attempts to render a fair and just decision is the absence of any impersonal standard which will enable them to insure that the classification of workers upon which their decision must be based is an exact one. The psychological method, however, by means of the same technique which has been applied to the classification of individuals in the employment office, will make it possible to classify doubtful individuals in the case of labor disputes. By the application of standard measures, in the form of tests, questions, or demonstrations, it will become possible for the psychologist to furnish both labor and industry, or the arbitration board which sits for them, a scientific and impersonal basis for making the classification which they desire.

The relation of employment psychology to labor and industry, then, is an impersonal relation. Like all other sciences, it is impartial. It does not aim to help any cause or any party. It is merely an instrument, a method, which will serve without favor whoever makes use of it. If industry wishes to obtain the best possible kind of human material, if it wishes to make the best possible use of its workers, if it wishes to maintain a reliable check on its classification of workers, employment psychology is at its disposal. On the other hand, if organized labor wishes to carry out collective bargaining, if it wishes to base its claims for individuals on the sound basis of ability and training, employment psychology provides it with a technique which will enable it to classify properly its collection of workers for that purpose.

As for the individual out of work—to be without a job

is essentially to be ill. Now, just as the individual who is physically ill goes finally to a physician for an examination and prescription, so it will probably be, in time, that the worker who becomes dissatisfied with his work or has lost his job will come to the psychologist for an examination and prescription. The physician, by virtue of an impersonal and scientific technique, has become the acknowledged friend of every man. It may be that the psychologist, by virtue of a similar technique, may win a position as enviable.

This is looking somewhat into the future. But the future of psychology is so promising that ambitious promoters have already begun to capitalize it. There exists even now a large body of pseudo-psychological doctrine and literature which bears the same relation to psychology that nostrums bear to medicine. Advertisements and articles extolling "get rich quick mentally" schemes are as common in periodicals of high repute to-day as nostrums were a generation ago. The chief signs by which these quack psychological remedies may be recognized is that they uniformly promise a remedy which is *speedy*, *infallible*, and ready for *instantaneous application*. The industrial world and individuals generally will do well to beware investing heavily in any project, masquerading under the name *psychology*, which claims any of these characteristics.

While not purely scientific in every detail, it will be evident to the reader that the entire trend of the work described here is toward the development of an employment psychology based on scientific technique. The employment psychology which will prevail, and which will increasingly contribute to the unravelling of employment problems, is the psychology which rests on contin-

uous research and experimentation in the field of employment itself. And this research must in turn be conducted by psychologists trained in the best practices of the university laboratory. The coöperation between university and industry in this respect will not be the least fruitful result in the development of a basic and comprehensive technique for solving employment problems.

APPENDIX

As far as practicable, the tests used in the experiments described in this book are given here, together with the instructions governing their use. Mechanical tests and other non-paper tests can be represented only by a verbal description. Many of these are described in the body of the book and these descriptions will be referred to.

It must be borne in mind that minor improvements in the character and use of these tests are constantly being made. Consequently, in compiling this Appendix for publication, there will be points at which it will be slightly at variance with the procedure described in the body of the book.

The arrangement of this material is based on manuals actually used in giving tests to incoming applicants. It is therefore as practical as constant use and experience have been able to make it. Tests are listed in numerical order. (No classification of tests according to mental *faculties* is given, because it has been found that such a classification has little practical value, besides being theoretically unsound.) Numbers are given to the tests in order to do away with the clumsy practice of recording each test by its full name. Tests are therefore usually referred to by number.

The system used in the application of these tests is the *unit* system. That is, instead of printing a set of tests in a single folder for a single purpose—for example, a clerical series or an inspectors' series—each test has been preserved as a unit. Each unit can then be combined with other units in any series and for any purpose. This method has been found necessary from an economical point of view as well as for the sake of greater flexibility and accuracy in meeting the highly specialized demands of employment.

The tests themselves and the directions accompanying their use are arranged as far as practical in numerical order. Interlarded are comments which are called for by points not made clear elsewhere. Where tests have been combined in series it is indicated by the directions governing the entire series. Explanations and test series are designated by letter and are arranged alphabetically.

The tests borrowed from other sources are acknowledged either in the body of the book or in the Appendix near the test itself. Revisions and adaptations have become so numerous, however, that it is difficult to be absolutely accurate in this respect.

Numerical List of Tests

1. Eyesight test.
2. Card sorting (simple).
3. Accuracy (see Chapter II).
4. Steadiness (see Chapter II).
6. Cancellation.
8. Number group checking
9. Tachistoscope.
10. Arithmetic (simple).
12. Card sorting (complex).
13. Hard directions.
13b. Oral directions (easy)
13c. Context reading.
15. Substitution, letters.
15m. Substitution, mixed letters and numbers.
16. Spelling.
17. Handwriting.
18. Three-hole test (see Chapter X).
19. Filing, alphabetical.
19c. Filing, alphabetical (cards).
20T1. Dictation and typing.
21. Grammar.
25. Substitution (numbers).

26. Comptometer adding.
27. Comptometer extending.
30. Filing, topical (easy).
31. Hand dynanometer (Chapters IV and VI).
33. Manual dexterity form-board (large triangles).
34. Manual dexterity form-board (small triangles).
38. Cube construction (Chapter XI).
39. Stenquist mechanical test (Chapters VI and XI).
42. Tool maker's vocabulary (Chapter XIII).
43. Tool maker's part-whole relation test (Chapter XIII).
44. Tool maker's context test (Chapter XIII).
45. Trade questions for gunsmiths (Chapter XX).
46. Trade questions for jig and fixtures designers.
47. Arithmetical test for tool makers and apprentices.
48. Trade questions for machinists.
49. Association test for machinists.
50. Pictorial completion.
51. Spatial preception (Chapters IV, VI, and XI).
91. Machine operators.

Test Series and Explanations

A. Correlations.
B. General procedure of giving tests.
C. Rating single tests.
D. Inspecting series.
E. Pro-rating a series of tests.
F. Clerical series (general).
G. Typist series.
H. Stenographer series.
I. Comptometer Series.
J. Trade tests (42–50).

A. CORRELATIONS

Working out correlations can be made very difficult or very simple. The correlation sheets prepared by J. L. Stenquist, of

Teachers' College, are a great convenience for the beginner. A comprehensive treatment may be found in E. L. Thorndike's "Mental and Social Measurements" and a very concise presentation in Guy M. Whipple's "Manual of Mental and Physical Tests", Vol. I. The practical psychologist will find that the slightly greater accuracy of the Pearson formula is more than compensated for by the greater flexibility and simplicity of the Spearman formula. It takes about six times longer to work out the Pearson formula than the Spearman formula (differences squared). In the treatment of employment tests it is much more important to obtain a large number of correlations than to spend time trying to increase the refinement of a few. Two indices in which there is an inaccuracy of even 5 points have a greater practical significance than one correlation which is absolutely accurate.

Where groups of more than 20 rankings are to be compared, the Spearman "footrule" is sufficiently accurate, and extremely convenient. Extensive use of this formula was made in the course of the experiments described here. Where "n" was less than 20, the longer Spearman formula was used.

Probable errors are not given in connection with the indices of correlation in the body of the book for two reasons: first, because they would confuse the ordinary reader; secondly, the practical psychologist can tell almost at a glance what the probable error is. Knowing the number of individuals and the size of the correlation, the P. E. can easily be deduced.

B. GENERAL PROCEDURE

When an individual applies for work, his application is taken in the employment office and the information placed on a permanent employment record card. This card is then taken into the psychological examination room where it serves as an announcement of the applicant's readiness to be examined. It also tells the examiner the kind of work for which the applicant is asking and gives him certain other essential information.

When the examiner is ready, he goes to the waiting room with this card and calls for the individual to be examined.

The results of the psychological examination are entered on the psychological examination record card shown below:

.....Date.....No.....

Last name, first name, middle name

.....

Applied for.....Age.....	Left.....
Recommended for.....	Reason.....
Remarks.....	.....
.....Nationality.....	Lapsed.....
Hired for.....	Attend.....
Previous job.....Date.....	Foreman's opinion
Education: P. S.....H. S.....B. S.....N. S.....C.....	of worker.....
Follow up: 1 mo.....2 mo.....	.....
3 mo.....6 mo.....1 yr.....	Remarks.....

This card was devised not only for the purpose of recording these facts but also as a means for recording the history of each person examined, especially with reference to the success or failure of those hired. It will be noticed that spaces are provided in which to enter the results of a periodic follow-up. The records in the tests are entered in the blank upper portion of the card. This space has been left blank so as to accommodate more readily the various kinds and combinations of test records.

When the examination has been completed, the applicant is allowed to return to the waiting room. The results are then computed and entered on both the employment card and the examination record card. The former is returned to the employment office where the transaction of hiring or rejecting the applicant is then completed. The latter remains as a permanent record in the files of the psychological division.

The method of computing results described here may seem intricate at first reading. As a matter of fact, several clerks

have mastered it in one week and in no case has any clerk required more than ten days to learn it. Many of these tests are now given by clerks, a thing which is possible only because of the care with which this technique has been worked out. The arithmetical work has been still further simplified by means of tables. In fact, by the time a subject finishes the test, the examiner has almost finished computing the results.

1. Eyesight Test

Description: The Lowell chart and the Jaeger reading card are used.

Instructions: The eyesight test should be given by the medical examiner as a part of the physical examination. Where this is impracticable, the subject may simply be asked to read or to spell the lines on the Jaeger card and the Lowell chart according to standard practice, and the results recorded.

Standards: The sharpness of sight required will necessarily depend on the kind of work to be done. No exact correlations between eyesight and production have yet been established. The decision must therefore rest largely on expert judgment. For inspectors, 20/15 or 20/20 is desirable. Clerks can easily get along with vision ranging anywhere between 20/15 and 20/40.

Suggestions: The importance of an eyesight test for work requiring good eyesight seems so obvious as not to need emphasis. However, the number of industries paying attention to this fact is absurdly small.

2. Card Sorting (simple)

Description:

See Chapter II.

Instructions:

"I am going to give you a pack of cards like this (showing face of card in sample pack of six) which you are to sepa-

rate into two packs. On this side of the board where you see the 'O' (pointing to left side of a 12" x 12" cardboard with an 'O' in the upper left hand corner) put all cards which have an 'O' on them. On the other side, put those that do not have an 'O'. Try it with this pack (handing subject the sample pack of six cards, three with and three without an 'O'). Now do it with this whole pack quickly and carefully. Ready? Start." (Press stop-watch at the word 'start' and again when subject is finished.)

Record:

Turn cards face down and sort back into original order according to numbers on the back of each card, counting mistakes in the process. Record as follows: number of test, seconds taken, number of mistakes made. For example, 2; 35 secs., 2 E.

Rating:

Read following section on rating. All tests are rated according to one of two formulæ. In this one we apply formula II. The point of reference is sorting the 50 cards in 25 seconds. RU, or the total number of units in the test is 50 (cards). Ru, or the reference time per unit is .7, i. e., 35 (seconds) ÷ 50 (units).

E, the number of errors, to be counted double. T, the time. Applying formula II to the above sample record,

$$\frac{(\mathrm{Ru} \times \mathrm{RU} - 2\,\mathrm{E})}{\mathrm{T}} = \text{rating}, \quad \frac{.7 \times (50 - 4)}{35} = .92$$

C. RATING

Because of the multiplicity of varieties of tests and ways of giving them, much confusion has arisen over the methods of rating. Some tests are rated according to the amount done in a given time; others, according to the time taken to complete the entire test others, according to the number of correct and false moves; etc., etc. Because of this variety and subsequent

confusion, a method of rating which applies equally well to all tests was devised.

This method starts by taking the perfect completion of a certain number of units in a certain time as *a point of reference.* For instance, in test number 2, sorting the 50 cards perfectly in 35 seconds is taken as the point of reference. Then, 35 seconds divided by whatever time the individual takes will be the rating for the individual. For instance, an individual who does the test in 35 seconds will be rated 35 ÷ 35 or 1.00. One who does it in 40 seconds will have 35 ÷ 40 or .87. If anybody does it in 30 seconds the rating will be 35 ÷ 30 or 1.20. This is higher than 1.00. However, by selecting as our reference time a record in the test which only the very best individuals can reach, the subsequent ratings will approach, but seldom pass 1.00.

In many tests, however, every subject is allowed only a certain length of time. Therefore, since the time is always the same, it becomes necessary to divide the number of units completed by the number of units called for by the point of reference (RU). E. g., test 8, 120 seconds is the time. The point of reference is the completion of 70 numbers in that time. If only 60 are completed, the rating in the test is 60 ÷ 70 or .86. If the 70 are completed, the rating is $\frac{70}{70}$ or 1.00.

The next step is to compensate for mistakes. In tests like 8, where the time is always the same, it is only necessary to subtract the number of mistakes from the amount completed before dividing. E. g., $\frac{60 - 2}{70} = .83$. Therefore, whenever the time limit for a test is uniform, the rating formula is:

Rating Formula I

$$\frac{N - E}{RU} = r, \text{ in which}$$

N = number of units covered
E = errors
RU = the number of units called for by the point of reference.
r = rating

For application, see rating of tests 6 and 8. When no fixed time is set, but each individual is allowed to complete the test in his own time, the equation becomes:

Rating Formula II

$$\frac{Ru \times RU - E}{T} = r, \text{ in which}$$

RU = the number of units called for by the point of reference, in this case, the entire test.
Ru = reference time per unit, obtained by dividing the reference time by the reference units (RU). In test 2 this would be 35 (reference time) ÷ 50
T = time actually taken by individual (number of cards) or .7.

For application, see rating of test 2.

Frequently, accuracy is at a premium, and special emphasis is to be placed upon mistakes. This can be done by multiplying E or the number of errors by 2, 3, 4, or whatever value the situation calls for. The general practice here is to count each error as one unit and each omission as one unit.

The two equations formulated above can be applied to all tests in which time, quantity, and quality are the factors. Moreover, each equation can be easily converted from a time basis to a quantity basis, and vice versa. This is a great advantage in handling data obtained under varying circumstances. This method of rating may appear complex at the outset but a little practice will show it to be extremely simple and easy of application. It can be still further simplified by the use of tables.

5 1 6 8 4 9 2 3 7 0 1 2 7 5 0 4 8 6 9 3 4 1 8 9 0 2 5 6 3 7 1 7 5 6 0 8 9 2 4 3 7 8 6 9 0 4 3 1 2 5
7 8 0 5 1 3 4 2 6 9 2 4 0 9 7 6 1 5 3 8 3 2 0 4 1 5 7 9 6 8 4 8 1 2 6 7 3 9 0 5 3 7 9 0 8 6 5 2 1 4
3 5 9 7 8 4 6 1 0 2 5 1 8 2 3 7 4 9 6 0 8 5 9 3 2 4 1 0 7 6 9 3 4 5 2 0 8 6 1 7 9 3 1 6 7 5 8 4 0 2
2 7 3 9 6 5 0 8 1 4 9 7 3 6 1 5 0 2 8 4 0 4 7 8 5 9 6 2 1 3 0 9 3 1 5 6 4 8 7 2 4 2 3 5 6 7 9 0 8 1
4 2 5 3 0 1 7 9 8 6 3 8 6 0 9 1 5 4 7 2 9 3 6 7 4 8 0 1 2 5 6 4 9 3 1 2 0 7 5 8 6 1 2 7 4 9 0 5 3 8
9 4 7 0 3 8 5 6 2 1 6 0 9 3 8 2 7 1 4 5 7 8 1 0 9 6 4 3 5 2 5 2 7 9 4 1 6 3 8 0 1 0 4 8 2 3 7 9 5 6
0 9 8 2 5 6 1 7 4 3 8 3 5 4 6 9 2 0 1 7 6 0 2 1 3 7 9 5 8 4 2 1 8 4 9 5 7 0 3 6 0 9 5 2 1 8 6 7 4 3
1 0 4 6 2 7 9 5 3 8 0 6 2 8 4 3 9 7 5 1 2 7 4 5 6 0 3 8 9 1 3 5 0 7 8 4 2 1 6 9 5 6 8 1 9 2 4 3 7 0
8 6 1 4 9 2 3 0 5 7 4 5 1 7 2 8 6 3 0 9 1 9 5 6 8 3 2 7 4 0 8 6 2 0 7 3 5 4 9 1 2 4 7 3 5 0 1 8 6 9
6 3 2 1 7 0 8 4 9 5 7 9 4 1 5 0 3 8 2 6 5 6 3 2 7 1 8 4 0 9 7 0 6 8 3 9 1 5 2 4 8 5 0 4 3 1 2 6 9 7
7 9 6 2 1 3 4 0 5 8 4 2 5 1 9 3 8 6 0 7 9 0 4 8 1 7 2 3 6 5 6 2 8 3 0 5 1 4 9 7 5 9 4 8 0 7 1 2 3 6
9 6 8 1 0 5 3 7 4 2 1 9 4 5 3 7 0 2 6 8 0 4 7 2 3 8 6 5 9 1 9 0 3 6 8 2 7 1 5 4 7 5 0 3 2 9 4 1 6 8
0 7 3 4 2 9 1 8 6 5 9 6 1 2 4 8 7 0 5 3 1 9 8 3 0 6 5 4 7 2 1 5 7 9 3 4 8 2 6 0 8 3 5 9 7 2 6 4 0 1
3 4 7 6 8 1 2 5 9 0 6 3 0 7 5 9 4 8 1 2 4 8 5 9 7 3 1 2 0 6 7 1 0 2 9 6 4 5 3 8 3 4 7 1 6 5 2 8 9 0
6 5 9 7 3 2 8 4 0 1 0 8 3 6 1 4 9 7 2 5 2 5 3 4 6 9 0 1 8 7 5 4 1 7 2 8 3 9 0 6 1 2 6 5 8 3 0 7 4 9
8 3 5 0 9 4 7 2 1 6 8 5 7 0 2 1 3 9 4 6 5 2 1 0 8 4 7 6 3 9 2 7 4 5 1 9 0 6 8 3 6 8 9 7 1 0 3 5 2 4
1 8 0 9 7 6 5 3 2 4 2 7 8 4 6 5 1 3 9 0 3 1 2 6 9 5 8 7 4 0 4 8 2 0 5 1 6 3 7 9 4 1 8 0 5 6 9 3 7 2
2 0 4 8 5 7 6 1 3 9 7 1 6 8 0 2 5 4 3 9 6 7 0 1 4 2 3 9 5 8 0 6 9 4 7 3 2 8 1 5 2 0 1 6 4 8 7 9 5 3
4 1 2 5 6 8 0 9 7 3 5 0 9 3 7 6 2 1 8 4 8 6 9 7 5 1 4 0 2 3 8 3 5 1 6 7 9 0 4 2 9 6 2 4 3 1 5 0 8 7
5 2 1 3 4 0 9 6 8 7 3 4 2 9 8 0 6 5 7 1 7 3 6 5 2 0 9 8 1 4 3 9 6 8 4 0 5 7 2 1 0 7 3 2 9 4 8 6 1 5

6. Number Cancellation

Description: Woodworth-Wells. See accompanying sample.

Instructions: Show applicant a sample slip containing the following line and nothing else.

5213689687341880657273652098443968425721073264814

"I want you to cross out every '7' on this slip with a quick dash like this." (Examiner makes a short dash, "—", through the first "7" and lets subject finish the line.) "Now do the same thing on this entire sheet (showing the test sheet). Begin at the top line and go across each one, crossing out every '7'. Do this quickly and carefully. All right? Start" (allow 100 seconds). "Stop now, please."

Record: Record number of test, the time (in this case always 100 seconds), the number of "7's" covered (there are 100 on the sheet), and the number skipped. E. g., 6; 100 secs., 80 — 2.

Rating: Reference points, 100 "7's" crossed off in 100 seconds; RU, or reference units, 100; N, number of units or "7's" covered by subject; E, errors, to be counted double; r, rating. Applying formula I, $\frac{N - E}{RU} = r$, to the sample record given above, we have $\frac{80 - 4}{100} = .76$.

8. Number Group Checking

983642	168379	694517	253914	745682	158923	729648
426357	372159	754936	297835	627519	786531	731469
654173	947386	589761	134852	146237	194526	936425
837162	691324	814536	326175	368792	549826	572194
458671	971648	479612	495683	784295	817243	916328
275148	318495	635728	596873	982563	431289	381647
513978	182765	615832	851279	498136	356719	412789
197584	563792	748315	861395	421856	973124	125437
918654	846975	453867	281463	213956	651274	526987
397841	961872	248691	574389	532416	723964	473519
872351	327984	437528	864712	825916	682543	534169
923871	632791	765429	235849	672834	295481	349257
867314	462758	486592	198537	871596	164985	247153
963458	981374	156843	259671	762491	983567	579361
345962	941258	182653	561487	435781	179428	731825
672389	346521	427163	281937	672539	985273	956142
312876	853926	587436	296851	784623	875126	513647
934612	739548	843216	215367	916483	294378	768914
954178	371629	529817	436978	123874	957641	682917
719325	294736	639187	286415	593182	297568	145389
594231	389254	196235	825749	461289	378652	672841
349716	427395	138962	268794	524617	358472	319546
714932	759431	382145	853624	714529	635819	237465
649752	718254	596743	862934	851763	329418	495867

8. Number Group Checking

Description: Woodworth-Wells. See sample test.

Instructions: Show applicant a sample slip containing nothing but the following line:

954178 168379 814536 864712 358472 762491 936425

"I want you to put a quick dash like this (examiner illustrates by putting a quick dash about an eighth of an inch long after the first group on slip) *after* every group in which there is *both* a '1' and a '7'. It makes no difference in what order they come or whether they are together or not, as long as they are in the same group." Subject puts a short line after each group on the slip that contains both a "1" and a "7". "Do the same thing on this paper" (examiner

shows test sheet). "Start at the top and go across every line, marking every group that contains both '1' and '7'. Do this quickly and carefully. All right? Start." Allow 120 seconds.

Record: There are 70 numbers which can be marked. Each number skipped or marked wrongly is an error. Record number of test, time allowed, numbers checked, errors made. E. g., 8; 120 secs., 60 − 3.

Rating: Apply formula I. The reference point is 70 numbers checked in 120 seconds; RU, or reference units, 70; N, number of units the subject covers; E, errors, which should count double. Then $\frac{N - 2E}{RU} = r$, applied to above sample gives: $\frac{60 - 6}{70} = .77$

Suggestions: A correction key which can be placed alongside the test sheet will materially help the examiner in correcting the test.

9. Tachistoscope

Description: The small Harvard type piece was used to test inspectors. No correlations whatsoever were found. This fact may be attributed in part to the inaccuracy and unreliability of this type of apparatus. A portable tachistoscope of an entirely different type has been devised and is being tried out. It is as yet too early to publish the results.

C. INSPECTION SERIES

1. *Order of Procedure:*
   - *a.* Shock absorber, 33.
   - *b.* Eye test, 1.
   - *c.* Cancellation test, 6.
   - *d.* Number group checking test, 8.
   - *e.* Card sorting (simple), 2.

Each of these tests is to be given in turn according to the directions accompanying it. While the applicant is performing the first test, the examiner transfers from the employment record card to his own record, the name, education, etc., of the person being examined.

2. *Pro-rating:* The applicant's fitness for inspection is determined by pro-rating the results of the tests. The meaning of pro-rating and the manner in which the pro-rating formula is determined are described in the following section. The formula in this case is: $.3 \times r2 + .3 \times r6 + .4 \times r8 = R$, in which r stands for the rating in the test whose number it accompanies, and R the final pro-rated score. E. g., $.3 \times .75 + .3 \times .80 + .4 \times .60 = .71$, the pro-rated result.
3. *Record:* The results of the examination are recorded in two ways:
   (1) the numerical result of applying the pro-rating formula.
   (2) whether or not the person is recommended, not recommended, or recommended for a trial. The examiner's card naturally has all this information in detail.
4. *Standards:* For the kind of inspection described in Chapters II and III, the passing standard was .65. Anybody above .55 was recommended for a trial under close supervision.
5. *Suggestions:* It is of little use to give these tests to persons who fail to understand English because they would have great difficulty in the tests as well as in understanding the instructions given to inspectors in the shop. Applicants below the sixth grade in education cannot be accurately judged by these tests. When more than one applicant is being tested at the same time each one should be asked to write his initials on the back of each sheet before beginning.
6. *Shock absorber:* Test 34 is used as a shock absorber. The test is extremely simple and easily understood.

E. PRO-RATING

After a group of tests has been given and each test has been rated, the result is a collection of ratings which is often very confusing. It is quite necessary, from every point of view, to be able to express all these ratings in terms of a single rating for the entire group. This is sometimes done by adding together the results in each test, a procedure which is obviously fallacious, because each test may have a different value.

The value of each test is determined by its index of correlation. The tests for inspectors, for instance, were found to have correlations of plus .56 for 2, plus .63 for 6, and plus .72 for 8. Therefore, test 8 should be given more weight in the final result than 6, etc. The proportional value of each test may be approximately found by dividing each correlation by the sum of all the correlations. In the above instance this gives .30 for 2, .32 for 6, and .38 for 8. That is, test 2 is to count 30% of the total, test 6, 32%, and test 8, 38%, no matter what the record in each test is.

Pro-rating is the process of applying a formula by which the rating in a group of tests can be combined in such a way as to give each rating its proportional value in the final result. If we use the results of the above analysis, and apply it to the inspectors' test, we shall have the following formula:

$.30 \times 2r + .32 \times 6r + .38 \times 8r = R$, in which R is the final group rating, and 2r, 6r, and 8r the rating in each of the three tests. If our deduction has been correct, R should be 1.00 when each test has been done in reference time. E. g., $.30 \times 1.00 + .32 \times 1.00 + .38 \times 1.00 = 1.00$.

It is impossible to apply this formula to any ratings which are not computed on a standard basis similar to that described under the section on rating.

It is also desirable to pro-rate tests in accordance with changing and special conditions. For instance, in the case of clerical tests, it may be necessary to place considerable emphasis on the arithmetical test, especially for ledger, statistical, and ac-

counting clerks. In the case of tests for comptometrists, actual comptometry tests count 50% of the final rating. This proportion must to a large extent be determined arbitrarily. The proportion will naturally depend on the varying needs of particular kinds of work. However, once determined, it follows that every applicant will be rated in exactly the same way.

10. Simple Arithmetic

I. *Add*	II. *Subtract*	III. *Multiply*	IV. *Divide*
23	290	(1) 5321	(1) 21 | 252
46	121	.62	
17	48		
23	36		
151	152	(2) 2.456	(2) .62 | 3.038
18	38	54	
479	111		
45	99		
384	678	(3) 5081	(3) 12.3 | 418.2
215	184	.206	
789	794		
476	697		
1895	980	(4) 26.62	(4) 462 | 4.3890
432	871	4.18	
7586	1294		
1904	358		

Description: See sample test.

Instructions: "On the other side of this sheet (pointing to test sheet) you will find some simple arithmetic examples in addition, subtraction, multiplication, and division. Be sure to notice all decimal points. Go down each column doing each example quickly and accurately. All right? Start." Allow 300 seconds as a maximum time.

Corrections: A key with the correct answers should be in readiness. Examples have the following values: addition, 1 each; subtraction, 1; decimal point wrong or omitted, 1; multiplication and division, 5 if the decimal point is right, 6 if it is wrong. Total value of test, 64 units.

Record: Number of seconds taken, number of possible points (64), minus number of points lost. E. g., 10; 250 secs., 64 − 8.

Rating: Apply formula II. Point of reference, the perfect completion of 64 units in 240 seconds. RU, 64, total number of reference units in test; Ru, reference time per unit which is 240 ÷ 64 or 3.75; E, errors or omissions; T, time taken. Applying formula $\frac{\text{Ru} \times \text{RU} - \text{E}}{\text{T}} = \text{r}$ to sample record above we have, $\frac{3.75 \times (64 - 8)}{250} = .84$

12. Card Sorting (complex)

Description: (1) 50 cards, 2″ × 3″ × .03″, stiff cardboard, with seven black letters posted promiscuously on each one. The cards are numbered and marked on the back so that the examiner can sort them after every trial into their exact original order and at the same time count all mistakes. (2) A sample set of eight cards, for preliminary trial. (3) A plain square cardboard, 12″ × 12″, with X − K printed in one corner, X − Y in another, 5 − 6 in the third, and *others* in the fourth.

Instructions: Place the cardboard in front of subject. "I wish

you to arrange these cards (holding out sample set) like this: those that have X and Y on them go here (pointing to appropriate corner of large cardboard and laying down the card) where it says X — Y; those that have X and K on them go here, where it says X — K (laying down the cards which contain X — K); those that have 5 and 6 on them go here; and those that have none of these combinations here, where it says OTHER. Now (picking up the sample set and handing it to subject) try it with these cards."

"Now do the same thing with these cards (handing subject the large pack). Do it carefully and quickly but do not rush. All right? Start." Allow subject to finish.

Record: Sort back cards, counting all mistakes. Record number of test, number of seconds taken, number of mistakes made. E. g., 12; 84 — 2.

Rating: Apply formula II. Point of reference is 50 cards correctly sorted in 80 seconds; RU, 50, the total number of units in the test; Ru or reference time per unit is 80 ÷ 50 or 1.6; E, errors, to be counted double; T, time taken. Applying this formula to the sample record above,

$$\frac{1.6 \times 50 - 4}{84} = .84$$

13b. ORAL DIRECTIONS (EASY)

Description: This test, because of its nature, is given under instructions.

Instructions: "I am going to give you a number of directions so listen very carefully and do exactly what I tell you to. For instance, I might ask you to fold this sheet of paper twice and then write your name near the top, like this, (examiner demonstrates). Be sure to listen carefully each time and as soon as I stop talking do exactly what I say. Are you ready?" The examiner then proceeds to give the following series of directions which he has carefully

memorized beforehand. Each direction is to be given once only.

1. Draw a line three times as long as this one (showing a line 1 in. long).

2. Find the telephone number of —— in the telephone directory and show it to me.

3. What time will it be in 20 minutes?

4. Find the address of —— in the telephone directory and write it on this envelope.

5. Count the cards in this pile and write the number at the top of this paper.

6. Put a cross in the lower right hand corner of this paper and fold it so the cross will be inside.

7. Get a book on the second shelf of the cupboard and open to page 98.

8. Separate these clips so that there will be ten in one box, three in another, seven in the third and fourteen in the fourth.

9. Write the date at the top of this paper, your father's name in the center and your address at the bottom of the other side.

10. (Examiner places a 25 cent piece and a 5 cent piece before the subject and a 25 and 10 cent piece before himself.) Out of the money in front of you, pay me 20 cents, using my money for change.

Record: Number of test, time taken, number of directions given, number of mistakes made. E. g., 13b; 300, 10 − 2.

Rating: Apply formula II. Point of reference is completion of 10 units in 250 seconds; RU is 10; Ru, 25. Applied to sample record above $\frac{25 \times 10 - 2}{300} = .67$.

13c. Context Test

1. The kind lady.....the poor man a dollar.
2. The.....plays.....her dolls all day.

3. Boys and.....soon become.....and women.

4. The poor baby.....as if it were.....sick.

5. The.....rises.....the morning and.....at night.

6. The poor little.....has.....nothing to.....; he is hungry.

7. The boy who.....hard.....do well.

8. Men.....more.....to do heavy work..... women.

9. It is a.....task to be kind to every beggar..... .....for money.

10. It is very.....to become.....acquainted..... persons who.....timid.

11. To.....many things.....ever finishing any of them.....a.....habit.

12. One's real.....appears.....often in his..... than in his speech.

13. The knowledge of..... .....use fire is..... of.....important things known by.....but unknown ..... animals.

14. .....that are.....to one by an.....friend should be pardoned.....readily than injuries done by one .....is not angry.

15. To.....friends is always.....the.....it takes.

13c. Context Test

Description: See accompanying test. This principle has been adapted to a variety of uses as for e. g., the context test for tool makers given in Chapter XIII, and test number 50.

Instructions: "On each dotted line write the word which makes the best meaning. For instance (reading first sentence and pointing out the blank with a pencil) 'The kind lady *gave* the poor man a dollar.' Put only one word in every blank. Do this quickly and carefully. All right? Start." Allow subject 240 seconds.

Record: Number of test, number of seconds taken, number of blanks attempted, number of mistakes made. E. g., 13c; 240 secs., 30 — 2.

Rating: Apply formula I. Point of reference is perfect completion of 31 blanks in 240 seconds; RU, 31; errors, wrong word in blank counts double and each word omitted counts one. Applying formula to sample record, $\frac{30 - 4}{31} = .84$.

Suggestions: Guard against subject's spending too much time over any one space.

15. Letter Substitution

t	g	u	p	m	k
c	v	e	j	z	d

g	t	u	p	m	k	t	g	u	m	p	k
m	p	t	k	m	p	g	t	m	k	u	g
t	g	u	k	t	u	p	m	k	g	p	t
p	k	u	t	u	p	u	t	k	u	g	m
u	t	p	m	t	m	g	k	t	m	k	u
p	g	m	k	t	g	k	u	t	m	p	g
k	m	p	g	u	t	p	g	u	m	k	p
g	m	p	u	k	p	m	g	t	m	u	k
u	p	g	m	t	k	m	t	g	p	u	g
m	g	k	t	p	u	g	k	u	t	m	u
k	m	t	g	u	p	t	g	k	m	u	p
p	t	k	u	m	g	k	u	t	g	p	k

Description: See sample test.

Instructions: Show applicant a slip containing the following sample:

b l r d n y q (1)
f w h i s a x (2)

r q n l d b y l q y r b (3)

"I wish you to put under every letter in this line (pointing to third line) the letter that you see under it up here (pointing to first two key lines). Under every 'b' put 'f' and under every 'l' put 'w' etc. Now, what would you put under 'r' (pointing to the first letter in the third line)? Finish the line. Now take this sheet (giving subject test proper) and do the same thing, taking each number as it comes. Do this quickly and carefully. All right? Start." Allow 120 seconds.

Record: Count number of mistakes. Record number of test, number of seconds taken, number of letters covered, and number of mistakes. E. g., 15; 120 secs., 76 — 2.

Rating: Apply formula I. Point of reference, 90 in 120 seconds; RU, number of units called for by point of reference, i. e., 90; N, number of units completed; E, errors, which count double. Applying the formula to above sample,

$$\frac{76 - 4}{90} = .80$$

15m. Mixed Letter and Number Substitution

Description: This test is like 15 except that it is based on the following key:

m k 8 7 d 2 h
c 4 6 u y 9 t

F. Clerical Series (general)

1. *Order of Procedure:*
   - *a.* 8
   - *b.* 13b or 13c
   - *c.* 15
   - *d.* 10
   - *e.* 12
2. *Shock absorber:* Test 8 is simple enough to act as a shock absorber and is counted as only 10 per cent of the total performance.

3. *Pro-rating:* The applicant's final rating is secured by pro-rating the five tests as follows: test 8 counts 10%; 13c, 25%; 15, 25%; 10, 20%. The pro-rating formula then is: .10 × r8 + .25 × r13c + .25 × r15 + .20 × r10 + .20 × r12 = R. The pro-rating formula in this case is based on estimates placed upon the importance of each of the tests in relation to the kind of clerical work to be done. Various combinations of clerical tests are made to suit the particular specifications of various kinds of jobs, and in each case, the pro-rating formula varies accordingly. When, for instance, alphabetical or topical filing clerks are desired, these tests are given more weight than any others. It is impracticable to go into all the details of these combinations. The tests as units will however be given.
4. *Standards:* The standard in use is to recommend those who obtain 70 or over, and to recommend for a trial, those between 60 and 70, especially when help is scarce.

16. Spelling

advance	concieve	contrary
destribution	leaveing	appointment
payroll	various	instal
section	defenite	routene
beleive	numerous	confusion
posession	preform	proccess
parrallel	origon	adviseable
neccessary	function	comittee
allowence	effective	establish
information	duplicateing	discribe
revised	schedul	concise
temperary	maintenence	deferred
expence	fourty	alteration
required	recind	permenent
telephone	cansel	conveneince
clearence	accomedate	approved

discrepency	typwriter	knowlege
sufficient	issuing	assisstance
coordinate	application	apparently
emergency	envelop	beureau
proceed	compencation	admirable
proceedure	dissappoint	miscellaneous
devisions	inquire	superflus
production	ocassional	elimenate
voucher	accertain	desireable
saleable	dictate	appropriation
recieve	discoverable	campaigne
engineers	seperate	desposition

Description: See sample. This and other similar tests were based upon a study of typical correspondence.

Instructions: "On the other side of this sheet you will find a list of words. Some of the words are spelled correctly and some incorrectly. Place a check after every word that is spelled incorrectly. Do this quickly and carefully. All right? Start." Allow subject to finish. Examiner than corrects the test and at once continues: "Now write down these words as I dictate them to you." Examiner then dictates to subject those words which have been wrongly checked or overlooked.

Corrections: Record time taken, number of mistakes, and number of mistakes left after dictation. E. g., 16; 127 − 8 − 3.

Rating: Formula II. Point of reference, perfect completion of 84 words in 126 seconds. RU, 84; Ru, 1.5, i. e., 126 + 84; E, errors count one if made once, and two points if repeated. Then, applying the formula to the above sample:

$$\frac{1.5 \times (84 - 8 - 6)}{127} = .83.$$

Suggestions: This method takes much less time than the straight dictation method and is just as fair.

17. Handwriting

Description: The subject is given a short paragraph of easy English, or a short column of figures to copy. The Thorndike and other scales have been used to correct this test but none of them have been found satisfactory. The scales themselves may be good but no two people applying them can get the same result. It is sufficient in most cases to rate handwriting as large, small, medium; very legible, fairly legible, illegible.

19. Alphabetical Filing Test

Description: See sample given below.

Instructions: Show subject a slip containing the following:

chain	a	e	g	i	w
spend	ab	ef	ho	sa	st
mixture	a	f	k	r	x
eyes	b	d	m	p	v
candy	ar	ca	co	l	s

"Put a check to show between what letters you would file these words. For instance, *chain* begins with 'c' and would come between 'a' and 'e' so you place a check there; *spend* begins with 'sp' so it comes before 'st' but after 'sa.' Try it with the rest of these words." Applicant finishes placing the words on the sample slip. "Now do the same thing with this entire sheet (examiner shows test 19 which consists of 50 words arranged according to the above principle). All right? Start." Allow 150 seconds only.

Record: Time, number of words placed, number of errors. E. g., 19; 150 secs., 48 − 3.

Rating: Formula I. Point of reference, 50 words in 150 seconds; RU, 50; N, number of words covered; E, errors, which count double. Applying to above sample record, $\frac{48-6}{50} = .84$

19c. Alphabetical Card Filing

Description: An Acme 4″ × 5″ file box, with alphabetical filler; 25 cards each containing a name.

Instructions: "Read the name on each of these cards (showing subject three sample cards) and place it back of the letter with which the name begins. Try it with these cards. Now do it with this whole pack." Here the subject is given 25 cards to finish filing.

Record: Number of test, time, number of cards filed, number of errors. E. g., 19c; 140 secs., 25 − 1.

Rating: Apply formula II. Point of reference is 25 units in 100 seconds; Ru, 4 secs.; RU, 25; E, errors, count 2. Applying formula to above sample record, $\frac{4 \times (25 - 2)}{140} = .66$.

20T3, Typing and Dictation

Mr. Maurice Bennett,
465 Eighth St.,
Boston, Mass.

Dear Sir:

You wish to get your morning and evening papers promptly
1 2 3 4 5 6 7 8 9 10 11
and regularly every day.
12 13 14 15 16

It is extremely annoying not to be able to get your favorite
17 18 19 20 21 22 23 24 25 26 27 28
paper at the time when you are accustomed to read it. If it
29 30 31 32 33 34 35 36 37 38 39 40
is late, you haven't the time to look it over as carefully as you
41 42 43 44 45 46 47 48 49 50 51 53 53
would like. And you want to have it delivered in a manner
54 55 56 57 58 59 60 61 62 63 64 65
that will cause you no personal inconvenience.
66 67 68 69 70 71 72 73 74

We are the only news dealers having a stand in this locality,
75 76 77 78 79 80 81 82 83 84 85 86
and we give special attention to the delivery of newspapers at
87 88 89 90 91 92 93 94 95 96 97 98 99

residences. If you want careful and courteous service, if you
100 101 102 103 104 105 106 107 108 109 110 111
want your papers delivered promptly every day, then you want
112 113 114 115 116 117 118 119 120 121 122 123
what we are here to give.
124 125 126 127 128

We shall appreciate a trial of our service and shall make
129 130 131 132 133 134 135 136 137 138 139 140
every possible effort to please you.
141 142 143 144 145 146 147

Very truly yours,
148 149 150

20T3. Typing Test

Description: See accompanying sample. Besides this, a variety of typing tests, including forms and tabulations, are used. However, because of the fact that few beginning typists have had specialized instruction and also, because of the inevitable handicap of a new machine, it is advisable to give tests which are free from technicalities.

Instructions: Explain to subject anything which she fails to understand about the spacing, keys, etc., of the machine which she is to use. Use a machine of the kind she has been accustomed to using or one as near like it as possible. Allow subject to adjust sheet and type salutation by way of preparation. "Now I wish you to copy the rest of this letter quickly and carefully." Do not allow subject to exceed ten minutes.

Corrections: Mistakes are valued as follows: There are 150 five-space units in test 20T3. Each wrong word or word omitted counts 5; each mistake in punctuation or capitalization, 2; each smudge, 2; from 5 to 10 for poor margins and unsightly distribution.

Record: Number of test, time taken, number of units covered —it will be seen in the sample letter that every fifth space marks a unit—and number of mistakes made. E. g., 20T3; 160 secs., 150 — 20.

Rating: Apply formula I. Point of reference is 150 units in 150 seconds; RU, 150 units, Ru, 1 second. Applying formula to sample record above, $\frac{1 \times (150 - 20)}{160} = .81$

20T3. Stenographic Test

Description: See sample typing test and description. The same tests used for typing can be used for dictaphone and dictation.

Instructions: "Please take down the following letter:" Examiner hands subject a regulation notebook and a pencil (all pencils should be #2 hardness, without erasers, and kept always well sharpened). "If I go too slowly, say: 'faster.'" Examiner dictates letter trying to keep up to the applicant's capacity but being very careful not to press for speed. Periods and commas should not be called, but paragraphs, colons, semi-colons, dashes, etc., should. Time is taken. After the applicant has finished taking the dictation, she is placed before a machine and told to insert her paper, adjust her margins, and type the salutation of the letter she has just taken down. "Now copy the rest of the letter quickly and carefully. If you get stuck in any one place, skip it and go on with the next part. All right? Start." Subject should be allowed to complete the letter.

Record: Number of test, time taken for dictation, time taken for transcription, number of mistakes.

Rating: In rating this test, the time taken for dictation and transcription shall be added together since both belong essentially to the same test. Apply formula II. The point of reference is the perfect completion of the test in 6 minutes; RU in this particular test is 150; errors shall be deducted from this according to the scale of values given. Ru is 2.4 seconds, that is, 6 minutes (reference time) divided by RU (150). If the test is done in 7 minutes or 420 seconds

with errors valued at 20 points, formula II will give

$$\frac{2.4 \times 150 - 20}{420} = .74$$

21. Grammar Test

Correct any mistakes in the following sentences:

1. It was me who he sent for the doctor on winchester av.
2. Between you and I its a very good offer.
3. He said he would learn you unless you was to dumb.
4. If them houses was cheap, I might of been able to buy one.
5. The office boy said mr smith done the work easy.
6. Do you not enjoy reading Washington Irvings essays, especially since you seen the hudson river.
7. Harolds brother in law managed the business like he was used to such work.
8. The sound of voices were heard as she sung a beautiful french song.
9. You might of gone with Tom and I.
10. Neither you or me should boast said Jim but I know Im the strongest of us two.

Description: See sample test.

Instructions: "On the other side of this paper are some sentences with grammatical errors. I want you to read through each sentence carefully and correct each mistake you find, by crossing out the error and writing just above it the correct form. For instance, how would you correct this sentence? (Examiner gives subject a sample slip containing this sentence: 'John set on the steps because you was not to home.') Now correct the sentences on the other side of this paper just as carefully as you did that one. All right? Start." Allow 180 seconds maximum time.

Record: Number of test, number of seconds taken, number of units covered, number of mistakes made. E. g., 21; 100 secs., 40 — 10.

Rating: Apply formula II. Point of reference is perfect completion of 40 units in 160 seconds; RU, 40; Ru, 4 secs.; errors count 2. Apply to sample record above,

$$\frac{4 \times (40 - 20)}{100} = .80.$$

G. TYPIST TESTS

1. *Order of Procedure:* (a) Shock absorber
   (b) 15
   (c) 13c
   (d) 16
   (e) 20T3

2. *Shock Absorber:* As a shock absorber, give subject a typewritten letter with several glaring mistakes in spacing, punctuation, and capitalization. Ask subject to read this letter and check off the mistakes. This test should be very simple and easy.
3. *Pro-rating:* The applicant's desirability is determined by pro-rating the above tests according to the formula: $.10 \times r15 + .25 \times r13c + .25 \times r16 + .40 \times r20T3 = R$. From this it will be seen that the typing test counts much more than any other, viz., 40%, while the context and spelling tests count 25% each, and the letter substitution test 10%. However, in the case of a new typist, just out of school, who has not yet had time to develop speed on the machine, it is advisable to count the typing test only 25%, and tests 13c, 16, and 15, 30%, 30%, and 15% respectively. This is on the assumption that ability in these tests predicates a good basis for future ability as a typist. See Chapter VIII.
4. *Standards:* From .60 to 1.00 shall be recommended; between .50 and .60 shall be recommended for a trial under close supervision.

H. STENOGRAPHERS' SERIES

1. *Order of Procedure:* (a) Shock absorber (same as for typists)
   (b) 15m
   (c) 16
   (d) 13c
   (e) 21
   (f) 20T3

2. *Pro-rating*: These tests are to be pro-rated according to the following formula:
   .10 × r15m + .15 × r16 + .15 × r13c + .10 × r21 + .50 × r20T3 = R. In cases where it is desirable to engage an inexperienced stenographer on the basis of her future possibilities, this formula should be modified as follows:
   .20 × r15m + .20 × r16 + .20 × r13c + .10 × r21 + .30 × r20T3 = R.

3. *Standards:* Above .60 shall be recommended; between .50 and .60 shall be recommended for a trial under close supervision.

4. *Suggestions:* If the applicant is exceptionally poor, i. e., below .30 in any one test, it is advisable to give further tests in this direction. A stenographer whose work in spelling alone, or in grammar alone, is atrocious, can hardly be recommended no matter how high she is in all other tests.

25. Number Substitution

Description: This test is like 15 and 15m, except that it is made up entirely of numbers, and is based on the following key:

1 2 3 4 5
8 7 0 6 9

Instructions: See instructions for test 15.

Rating: Point of reference, 100 in 120 sec.; RU, 100; E counts double. Apply formula I.

26. Comptometer Addition

1	2	3
9.85	12.04	23.89
6.73	9.78	16.48
4.06	36.79	24.77
5.98	92.83	90.02
4.90	80.46	81.01
8.69	9.69	97.96
2.74	74.65	38.64
1.88	.27	45.26
9.78	3.92	98.32
5.69	64.38	52.13
4.37	7.21	69.95
9.99	.96	80.03
	12.38	29.06
	4.97	84.79
	92.83	32.90
	69.85	98.76
	34.79	20.48
	2.39	86.39
	10.50	92.68
		43.97
		60.40
		29.28
		13.40
		35.87

27. Comptometer Extending

1. 4291	3. 5.278	5. 812.5
33	5.4	57.4
2. 5321	4. 772	6. 4721
.62	3.15	.0076

7. 4206	9. 439	11. 26.62
1.45	.527	.418
8. 50.81	10. 5.321	12. 5073
.206	72.5	3.604

26. Comptometer Adding

Description: See sample. This is one of the several tests in use for operators on the comptometer, Burroughs adding machine, etc.

Instructions: "Add these columns on your machine. Add each column until you get the same answer *twice*. Do this quickly and carefully. All right? Start."

Record: The first column counts one unit, the second two, and the third three, making six units for the test. Record number of test, time, number of units, and number of units wrong. E. g., 26; 200 sec., 6 -- 1.

Rating: Point of reference, 6 units in 180 seconds; RU 6; RU 30 sec. Apply formula II. E. g., $\frac{30 \times (6 - 1)}{200} = .75$

27. Comptometer Extending

Description: See sample test.

Instructions: "Work out these multiplication or extending examples on your machine. Write each answer as you get it. Do each example once only. Work quickly but do not rush. All right? Start."

Record: Number of test, time, number of mistakes.

Rating: Point of reference, 12 units in 144 seconds; RU, 12; Ru, 12; E, errors which count double. Apply formula II.

I. COMPTOMETER OPERATORS' SERIES

1. *Order of Procedure:*
   a. 8 (shock absorber).
   b. 25.
   c. 13b.
   d. 10.
   e. 26.
   f. 27.

2. *Pro-rating:* The formula in use for operators who have had training in both adding and extending is:
   $.10 \times r8 + .10 \times r15 + .10 \times r13b + .20 \times r10 + .25 \times r26 + .25 \times r27 = R.$
   Division is comparatively little used. Where it is required, an appropriate test is included. Where operators with special experience in adding or in extending alone are required, the more important test is valued at 40% the less at 10%. Where operators who are just out of school and who have not yet acquired speed are desired, the proportional value given to the tests shall be .10, .15, .10, .30, .20, and .15 respectively.

3. *Standards:* Above .70 to be recommended; .60 to .70 to be recommended for a trial.

30. Topical Filing (easy)

A. Traffic
B. Education
C. Athletics
D. Politics
E. Music
F. Agriculture

1. The building of a new Commercial High School is now under consideration.
2. Now is the time for every good man to come to the aid of his party.

3. It has been necessary for the mayor to determine exact routes for jitneys in order to relieve congestion.
4. The baseball squad is having daily practice from three to five.
5. The program offered by the conservatory for the coming winter promises to be a very interesting one.
6. The farmers during the past year raised the biggest wheat crop in history.
7. Those who wish to learn to speak French should join the class which is being formed to meet every evening in the high school.
8. The Democratic party is sending speakers to all the doubtful states during the fall campaign.
9. The citizens of New Haven should support their public schools in every way possible.
10. It has been found necessary to clothe the policeman at the crossing of Chapel and Church Streets in a white coat at night, to prevent him from being run over.
11. Song leaders are being trained so that there may be patriotic singing when the band plays at noon.
12. The principal occupation in the southern states is the raising of cotton.
13. The English and French soldiers are enthusiastic over the American game of baseball.
14. Woolsey Hall was packed with people who came to hear Galli Curci give her famous song recital.
15. No automobiles are allowed to park on Chapel Street near the Green, on account of the narrowness of the street.
16. The best man finally won, although the election was very close.

Description: See sample test.

Instructions: Place before subject a sample slip containing the following:

A. Traffic
B. Education

C. Athletics
D. Politics
E. Music
F. Agriculture

1. A wrestling match will take place to-night at the Arena.
2. Three concerts were given by the Regiment band last week.

"Here are a number of topics. (Examiner reads off all the topics to the subject.) Read this sentence (number 1) and tell me which of these topics it speaks about. (Examiner waits for subject's answer.) Athletics is right. Now, write at the end of the sentence the letter in front of that topic. (Allows subject to write letter 'C' at end of sentence.) Now do the same thing with each sentence on this sheet (displaying complete test), taking each sentence as it comes. All right? Start."

Record: Number of test, number of seconds taken, number of sentences covered, number of mistakes. E. g., 30; 90 secs.; 16 — 1.

Rating: Apply formula II. Point of reference, perfect completion of 16 units in 80 seconds; RU, 16; Ru, 5; E, errors count 2. Applying to sample record above,

$$\frac{5 \times (16 - 2)}{90} = .78$$

33, 34. Manual Dexterity

Description: See Chapters IV, and VI.

Instructions: Empty the triangles into cover of form-board, and leave them in that position. Place empty form-board before subject, the largest triangle being at the left. "I wish you to put these triangles back in the holes where they belong. Start with the biggest one and do each in turn. Every triangle fits loosely, so do not try to force it. Do this quickly and carefully. All right? Start." Let

subject finish. "Now do the same thing with your left hand. All right? Start." Two trials with each hand are given.

Record: Number of test, hand, and time in each trial.

Suggestions: These tests have since been combined into a single board, and another board with still larger cut-outs is being designed. No definite standards have yet been established.

When 34 is used as a shock absorber, it need be given only once, and only with the right hand. To give it for the left hand might embarrass rather than quiet the subject. These tests have been found valuable in detecting at once people who are left handed. It is important not to assign left-handed people to machines or benches designed for right-handed use.

38. Cube Construction (see Ch. XI).
39. Stenquist Mechanical test (see Chs. VI and XI).

J. TRADE TESTS

42. Tool makers' vocabulary (see Ch. XIII).
43. Tool makers' part whole relation test (see Ch. XIII).
44. Tool makers' contest test (see Ch. XIII).
45. Trade questions for gunsmiths (see Ch. XX).

46. Jig and Fixtures (designing)

1 Q. What is the difference between a jig and a fixture? A. A jig holds the piece and at the same time provides guides for the tools. A fixture holds the work, provides no guides and must in turn be held securely to the machine on which it is used.

2 Q. What determines the length of a drill bushing? A. The bushing generally is twice as long as the diameter of the tool used in it.

3 Q. What must be allowed for when designing a fixture, if the piece has previously been worked upon? A. Allow for burrs.

4 Q. Which is better practice, to mill toward the solid or the movable jaw of a fixture? A. Toward the solid jaw.

5 Q. What must first be decided before a jig or fixture can be designed? A. The locating points must be known.

6 Q. What relation must the feet of a jig bear to the guide bushings? A. All bushings must be inside the geometrical figure formed by the feet.

7 Q. If the fixture is to be used on a machine which has "T" slots, what should be provided on the fixture? A. The base of the fixture should have keys or tongues to fit the slots and they should be square with the holding points.

8 Q. Where should clamps be provided to best resist springing? A. Opposite the bearing points.

9 Q. Which are better for fixture work, straight or taper pins? A. Taper pins.

10 Q. Which would be the better, a jig designed so as to admit the piece one way only, or one into which the piece could go several ways? A. Have opening so as to allow piece correct way only.

47. Apprentice Test

(1) Add 8297
4335
1759

(2) Subtract 59763
47857

(3) Divide $68256 \div 432$

(4) Multiply 79643
$\times$ 448

(5) Point off this number 7607548.

(6) Put in figures in decimal form this number:— Four thousand, five hundred and ninety-seven hundred thousandths.

(7) The answer of this $(427)^2 =$

(8) $\sqrt{20164}$ =
(9) Sketch each of these:—
  (a) Square
  (b) Rectangle
  (c) Hexagon
  (d) Pentagon
  (e) Semicircle
  (f) Ellipse
  (g) Right angle triangle
(10) Find the circumference of a wheel which is 5″ in diameter.
(11) Multiply $7 \times 3/16$: $3/4 \times 5/8$: $3\ 1/4 \times 2\ 1/2$:
(12) What would be the cost of eight $1/2'' \times 5''$ machine bolts at 1 5/8 cents each?
(13) Change 7/32 to a decimal.
(14) Change .3125 to a fraction.
(15) Give the area in square feet of a room $15' \times 25'$.

48. Trade Questions for Machinists

1. How many ways do you know for turning a taper?

2. Name five types of work which can be done on a universal miller.

3. What machines and tools would you use for surfacing a flat cast iron plate 16″ x 25″ x 2″?

4. What is the most important thing to look after before starting the feed on a cylindrical grinder?

5. What causes a drill to cut larger than its diameter?

6. How should a lathe tool for use on brass differ from one for use on steel?

7. What type of machine do you consider capable of the greatest variety of work?

8. Which would you run at the greater R. P. M., a slotting saw 5″ diameter or an end mill 1¾″ diameter?

9. What will be the result of leaving chalk on a steel or iron surface?

10. How much stock is usually left for reaming?

11. When would you use Prussian Blue?
12. In what respect does a shaper tool differ from a lathe tool?
13. What determines the size of key for a shaft?
14. Name some (3) good bearing metals.

49. Association Test for Machinists

Name the machine with which you associate the following words:

For example.....dog.....lathe.

1. Rack—
2. Platen—
3. Turret—
4. Compound Rest—
5. Collet—
6. Ram—
7. Mandrel—
8. Lead Screw—
9. Ways—
10. Hollow Mill—
11. Allundum—
12. "T" Bolt—
13. Rawhide—
14. Drift Pin—
15. Knee—
16. Parallel—
17. Magnetic Chuck—
18. Dresser—
19. Feed Rod—
20. Chasing dial—

50. Machinists' Context Test

Fill in the blank spaces with words making the best meaning.

There are.....size drills generally thought of when prepar-

ing to drill a tapped hole, namely, the.....size and the..... size. If a tap is broken off in the hole it can be removed by means of a..... Frequently.....the tap helps to prevent breakage. The pilot of a counterbore should be.....

To allow for adjustment when fitting bearings.....are sometimes inserted. All bearings must be made so as to permit ..... If a babbitt bearing.....it will.....thus preventing injury to the shaft.

It is a good plan to.....pieces of machinery so that they will go back in the same position if taken down for some purpose. A good way to.....such pieces is by means of.....

A.....is put on planners and shapers to prevent wear of the tool on the return stroke.

A worn gear should generally run in.....

A.....drive pulley to a.....follower gives a fast speed to the follower.

A pulley may be fastened to the shaft by means of a..... or a.....

When filing on a lathe the work should revolve..... The file should be fitted with a.....

A good cut for a file which is used for finishing work would be.....

When knocking a cutter out of a collet it is best to use a .....in the tang hole.

51. Spatial Perception

Description: See Chapters IV, VI, XI. This test has been enlarged (1) by the addition of new spaces (2) by using two form-boards instead of one. The use of two boards, each with a different arrangement, makes it possible to give the same test in two ways, but it also makes it possible to have the pieces arranged in exactly the same position for every subject (Ch. XI).

Instructions: These instructions are intended for the original test "Pick up each piece, size it up, and then put it

where it belongs. Each piece fits loosely, so don't try to force it. Do this quickly and carefully." After subject has finished, repeat the test.

Record: Each attempt to place a piece in the wrong space counts as an error. Mistrials of a piece in the right space are not counted, (1) because it is impossible to count them; (2) the total time compensates for them automatically. Record, for trial a and b, the time and number of mistakes.

Rating: Point of reference, completion of test in 56 seconds; RU, 14; RU, 4, E count 1. Apply formula II.

91. Machine Operator's Test

Description: See Chapter X.

Instructions: Examiner in preparation makes sure that the dial is revolving at a speed of 35 R. P. M. "I want you to drop a ball through the slot into the funnel like this: (Examiner drops five or six balls in succession.) Use this hand (demonstrating with the left hand) to pick up the balls and pass the balls to your other hand one at a time like this. (Examiner drops three more balls.) If the ball fails to go through the slot or falls on the floor, don't pay any attention to it but keep right on with the others. See how many balls you can drop through the funnel. Now, try it. All right? Start." Subject is allowed to go on for two minutes with occasional suggestions from examiner to correct bad practices. Then allow an interval of one minute during which the examiner makes his records and engages the subject in conversation. Another trial of two minutes is then given. After another minute interval, a third trial of two minutes is given, this time with the slot half closed. Each time the examiner makes a reading on the Veeder counters at the beginning and at the end of the trial in order to determine the R. P. M. and the number of successful attempts made by the subject.

Record: There are three trials, to be designated a, b, and c.

For each trial the exact time, number of balls successfully dropped, and the R. P. M. should be recorded.

Rating: Point of reference for trial a is 60 successful attempts; b, 70; c, 50. In each case, the time is 120 seconds. Sample record, 91: a — 50; b — 64; c — 47. Formula I is applied to each record separately. In this case, the formula would work out as follows: $\frac{50}{60} = .83$; $\frac{64}{70} = .91$; $\frac{47}{50} = .94$.

Standards: Only approximate standards for this test have been developed. For the type of work described in Chapter X a minimum of .80 for fast machine operators, and .60 for slow machine operators was required.

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