

EVALUATION OF INDUSTRIAL TESTING PROGRAMS

by

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INTRODUCTION

The use of tests in industry is a relatively new process. Even today, their use in American industry is limited primarily to the larger companies. The current trend, however, indicates a growing realization of the potential value of testing as a personnel device.

Changes in the social structure of our industrial economy have perhaps contributed most to this increased awareness of the benefits to be derived from testing. The caliber of the people on its payroll largely determines the degree of success of any company - large or small. Finding the best man for the jobs that are open, and finding the best jobs for the men available, is vital to a company's efficient operation.

It is difficult to measure in monetary terms the saving, which a sound testing program may provide, since there are many variables which do not easily lend themselves to measurement. The great majority of personnel men when asked, "How much does it cost to hire the wrong man or to place a man on the wrong job?" are unable to answer this question accurately. This does not imply that through the use of tests, all of the problems

of selection or placement will be solved, since tests, in and of themselves, are not the ultimate answer. Selecting and placing people properly is, in the final analysis, a matter of sound human judgment, supported by experience and training. There are no shortcuts, formulas, or panaceas which will guarantee that each and every employee selection will be satisfactory.

During recent visits to many companies in southwest Virginia, the author found that those companies using some means of scientific selection and placement agree as to the positive value of such techniques. They readily admit that they could not continue to operate efficiently without some means by which to measure differences among the many individuals with whom they must deal. That these individual differences do exist is a well-proven fact.¹ Part of the job of the effective personnel administrator is to be able to recognize these individual traits and to determine to what extent such traits will prove useful in helping to resolve the problems of selection and placement.

1. Joseph Tiffin and Ernest J. McCormick, "Industrial Psychology," Fourth Edition, Prentice-Hall, Inc., N. J. (1960), Chapter 2.

In its many applications throughout the field of personnel administration, testing places a particular emphasis on individual differences. The author does not imply that management is now or should in the future constantly seek the best individual in any one area for any particular job. It is quite evident that job characteristics vary widely from plant to plant as well as within an entire industry. Consequently, there are no stereotypes, as such, which can be used as patterns into which an individual can be fitted.

There are many tangential subjects to the field of industrial testing. A thorough study of these related subjects is beyond the scope of this investigation. For example, tests, to be of any aid to industry must be valid. To validate a series of test scores would require other reliable data so that the two could be correlated to determine whether or not the test reveals what it is supposed to reveal. A comparison of this nature could be made with the results of periodic merit rating, supervisor's job performance reports, or other data of this character. Merit rating is one of many entirely separate fields, and it will not be investigated in detail in this study.

This study is, however, directed to those companies who either have never used a scientific means of selection, or else have had unfortunate experience with such a program. Without exception in this study companies who do utilize valid employee testing techniques are agreed that the practice results in a better, that is, much more satisfactory selection of employees.

Personnel tests should be used only as supplementary tools. Certainly it is conceded that an applicant's experience, education, and personal appearance, among other factors, are of the utmost importance. The basic underlying premise of this study is that tests do provide further information and measures of human characteristics not obtainable in any other manner. Such characteristics, as revealed by tests are useful in arriving at sound decisions. Available evidence strongly indicates that tests are indispensable tools when used in their proper perspective.

CHAPTER I - HISTORICAL BACKGROUND

Early Concept

Ever since men have been formulating judgments of one another, there have existed tests of one form or another. The idea of testing is not something new and mysterious. Perhaps to some it is new and to others there may be an element of mystery which shrouds the principles of testing. But, those who use and understand the principles of personnel testing find it to be a helpful device in attempting to solve many of management's problems.

Testing today is used primarily as a means of measuring those abstract qualities of an individual which elude detection by other, and perhaps more subtle means. Modern management realizes the limitations of other means such as the interview, which, even when properly conducted falls far short of accurately measuring an individual's inherent native abilities. Successful personnel managers agree that in the final analysis, one must rely on valid, objective data such as that obtained by an accurate testing program. Accurate decisions must be made on the basis of a combination of reliable objective and subjective data.

This concept of industrial testing is a relatively new one. It first gained wide-spread acceptance with the development of formal personnel programs. Prior to 1920, the functions presently associated with the modern personnel department were spread out under many various departments, if, in fact, they did actually exist. When one department needed a new man, it simply went out and recruited one. It was as simple as that. Whether or not he was well suited for the particular job was left entirely to the discretion of the person doing the hiring. Such person may or may not have been able to make a wise decision.

Immediately following the first World War management began organizing all functions of a personnel nature into one single department. This department, charged with the responsibility for recruiting, selecting, and placing all employees to fill the various jobs in the plant, began to search for some tool to aid it in improving the caliber of the individuals it placed before the foremen.

During World War I, the U. S. Army was faced with the monumental task of classifying its recruits in order to obtain a high degree of efficiency. The Army Alpha and Beta tests were given to about two million soldiers with

such amazing success that industry felt there was a lesson here which it could well afford to learn. The success of these mental ability tests convinced industrial leaders of the importance of measuring this variable. Management then began to look upon employment tests as a useful and objective scientific device.

This era is not without its undesirable effects on the principles of industrial testing. As mentioned, the popularity of the tests grew tremendously within a short period of time. However, like anything else with a new appeal, it attracted many self-styled experts with very limited knowledge and usually no experience in this field. These pseudo-psychologists took advantage of the mounting enthusiasm that employers had for tests and attempted to establish testing programs. Unfortunately, in many cases top management was deceived by this "new" device. Since most top executives think in quantitative terms, they made unusually good targets for these so-called experts. Many of these employers were amazed at the apparent facility with which the best man for a job could be chosen from a list of numbers.

However, experience soon proved that the "best number" was not always the best individual and

management, in many cases, threw out the program bodily and returned to the old methods.

One can easily see how this situation could develop. In fact, this danger provided stimulation for this particular study. While the writer was employed as Assistant to the Personnel Manager in a medium-sized manufacturing plant, his superior came in one day and placed on his desk a large, loosely-bound notebook with the title Hiring Manual on the cover. "Here," he said, "the company has just purchased this testing program for the plant. Look it over and put it to work for us." With absolutely no experience in this field, the writer was charged with the responsibility of administering, scoring, and interpreting a series of psychological tests. After studying the manual for several days, the writer [feeling very much like a qualified industrial psychologist] decided that he was ready, and gave the first series of tests to a small group of employees.

Management had given the personnel department a list of present production employees who had been recommended by their immediate supervisors as having supervisory potential. It wanted the personnel department to determine by the use of its new packet of tests, those

employees who should be promoted and those who should not be promoted. In other words, management wanted the group ranked numerically from first to last so it could pick from the top. Many interesting obstacles were encountered before the program was completed, and some of these shall be investigated in later chapters. But, the point to be made here is that today, forty years after the broad introduction of tests to industry many people, even seemingly well informed personnel administrators, and members of top management have some very erroneous ideas about psychological testing and its proper place in modern industry.

Nature of Tests

"Basically a psychological test is an objective and standardized measure of a sample of behavior."¹ The results of tests when charted graphically from a random population should approach a normal distribution and take the shape of the familiar bell curve. This is one of the basic fundamentals underlying the use of tests. The bulk

1. Herbert J. Chruden and Arthur W. Sherman, Jr., "Personnel Management," South-western Publishing Co., Cincinnati, Ohio (1959), page 123.

of any group will be bunched in the center, and in each tail of the distribution will appear equal numbers of either extreme.

With this knowledge in mind, industry leaders must determine which segment of this distribution will yield the most desirable employee. The nature and characteristics of each particular job must be considered in order to arrive at an optimum score. In designing and selecting tests the administrator must insure that the test samples that aspect of human behavior which it is designed to measure.

Gradual Acceptance

Perhaps erratic would be a better word to describe the degree of acceptance of personnel testing. In field studies the writer noticed that a company usually jumps [head first and blindfolded] into a program of industrial testing, or else shys away from it completely. Replies received from inquiries made into this matter revealed that several relatively large companies in this area had not employed a testing program in the past, are not using one now, and do not contemplate using one in the future. When the writer mentioned this fact during

an interview with Mr. E. B. Petersen at the General Electric Plant in Salem, Virginia, Mr. Peterson expressed complete amazement that these companies could make accurate selections and placements. On the other hand, one small company had gone completely beyond all reasonable limits on their testing program. They were not well staffed to handle their program, and either were not interested in, or did not feel it worth their while to establish local norms. Thus, this company's test results were probably not valid nor reliable.

This evidence would indicate, immediately, a very erratic type of acceptance of the broad testing program. But, upon a closer and more extended analysis by many experts over the last forty years, it is concluded that the acceptance of industrial testing programs has been a slow, evolutionary process despite isolated cases in either extreme. Many companies still do not avail themselves of the use of a sound testing program. However, these companies are in a much more stable position than those companies which have gone blindly into a program. This is particularly true with respect to the package type, mail-order programs which lull management into accepting the test results unquestionably as true and accurate scientific data.

Increased Popularity

The fact that industrial testing programs are more widely used today than ever before does not preclude the fact that they are not always understood. Nor does it imply that the tests are always used with the taste and discretion which their very nature warrants.

When the writer discussed this matter of personnel testing with the Vice President of one of the largest companies in Virginia, the executive indicated that he would prefer to rely on his time-tested judgment rather than on any results obtained from a group of seemingly insignificant questions. In this particular instance, however, the writer, being the interviewee, told this person that for twenty minutes he could be almost anyone; and, that since he was deliberately trying to impress the executive, any entirely subjective means of evaluation was wholly inadequate.

This "hit or miss" method of pre World War I is still being used by many of our modern personnel administrators. But, it is the author's opinion that most of these executives would convince themselves of the advisability of employing a sound testing program if they were to weigh carefully all the facts.

The person just mentioned agreed that he probably erred in his judgment from time to time. However, when asked what he thought this mistake cost his company in monetary terms, he admitted that it may have been a very costly mistake. These costs are not easy to determine with any degree of accuracy. However, if the author was able to plant seeds of doubt in this company's evaluation of their selection techniques, this study will have more than served its purpose.

Even though this inquiry has revealed, to some degree, limited usage of industrial testing, it should not be considered a serious reflection upon the desirability and feasibility of industrial testing.

In most cases companies that accept tests for what they are find that they are able to increase the efficiency of the total personnel program. Test results should be used as indicators of a person's ability. In no case, should tests carry the full burden of selection and placement decisions. The test is not a panacea for any selection procedure, and no company should engage a testing program unless this is clearly understood.

Tests can do many things. They provide the employer with extremely valuable data which cannot be

obtained by any other method. However, they must be used within the framework just mentioned or else another unfortunate experience is likely to be the outcome.

The increased popularity of industrial testing programs is due in large measure to the serious efforts of well-informed personnel administrators who use them wisely, and in their proper perspective. Certainly their popularity will continue to grow as more and more companies realize the need for a scientific measuring device to supplement existing procedures.

CHAPTER II - TESTING AS A PERSONNEL DEVICE

Customarily, industrial testing is employed primarily by the personnel department. This department typically performs a multitude of tasks from employment to retirement. It must, in many instances, maintain accurate files and records, interview applicants, handle insurance programs, grievance procedures, merit rating and appraisal programs, public relations programs, and safety programs, to name only a few of the varied duties performed by the modern personnel department. Usually, any new program considered by management is placed in the hands of this department merely for want of a better place. This is particularly true with so many companies which are at that size where it is not feasible to staff a full-time Industrial Engineering Department. It is unfortunate that the personnel director is required to perform so many varied duties that he is unable to perfect any of them. However, this is exactly the situation in many medium and small size companies.

Thus, it is that the prevailing practice is to overburden the personnel department with many chores, all of which are vital functions necessary to the efficient

operation and functioning of the enterprise. The point to be emphasized is that any objective device which would lighten the personnel administrator's burden is well worth considering. An industrial testing program is such a device, and it is therefore alleged that such a program is of great value.

Used within the framework of an adequate employment system, psychological tests can be of considerable value in increasing the operational efficiency of any company, but it must be emphasized that they do not, by themselves, provide an adequate basis for hiring, placing, promoting, or any similar function. The purpose of testing is to provide the employer with additional information which will enable him to make a much wiser and more meaningful decision.

Tests may measure one or a group of factors. For the most part they indicate what a person is potentially able to do. Whether he will do it is another matter entirely. In personnel work, especially in selection and placement of individuals, one is always dealing with two important unknowns. First, there is the question of the person's ability to perform the work for which he is being considered. This is a basic and important issue.

Certainly it is not management's intention to place an individual on a job if he is inherently unable to perform that job. Second, even though management may be sure of a person's abilities, it does not know whether or not, after being placed on the job, the individual will possess the necessary incentive, initiative, or motivation required to perform the job satisfactorily. It is apparent that the more important of the two is the former. The interviewer, if he is skilled in his art, can usually tell on the basis of data from the application blank, interview, physical examination, references, and other relevant information, the relative stability of the individual and whether or not he actually desires to do a good job. However, the interview alone cannot be expected to reveal a person's innate abilities nor his basic intelligence. Only by using some objective, scientific device can one pinpoint with any degree of accuracy the inherent ability of an individual. An appropriate industrial testing program belongs in every efficiently run personnel department if the company is to remain competitive. Even in an extremely tight labor market when it appears necessary to hire almost everyone who is available, tests perform

the important job of helping to place this individual where he will make his greatest contribution to the company's success.

Tests help the personnel administrator and the entire organization in many ways. They perform valuable services and make many contributions; but, at the same time, it should be noted that they are not without their limitations.

Contributions

"The objective nature of tests make them especially valuable in the selection and placement of personnel. If the tests are sufficiently valid, in predicting whether or not an applicant will be successful, they can contribute to the selection of better qualified employees."¹ There are tangible benefits of testing such as reduced costs in industrial training, fewer accidents and reduced turnover. There are also intangible benefits such as improved morale, better worker adjustment, and increased job satisfaction. Such benefits may be very difficult to measure, but the advantage of their presence is certainly

1. Herbert J. Chruden and Arthur W. Sherman, Jr., Personnel Management, page 124.

not questioned. Companies that use tests as an integral part of their selection program tend to attract better applicants. Those applicants who feel that they could not measure up to the tests do not apply. Thus, there is here a hidden contribution to the cost conscious executive which may more than offset the cost of administering the tests. But, here again, management is concerned over the unavailability of adequate tools for measurement. Also, when tests are used, any invalid charges of unfair hiring practices that might be made against the company can be answered by providing objective information about the individual's performance on tests as compared to the required standards. It is not meant to imply in this last instance that the test scores should be used as a crutch, or as a shield behind which the company should stand. The tests do, however, provide concrete and objective evidence as a basis for decision making as compared with a mere subjective opinion or evaluation.

By selecting individuals who are most likely to succeed on the job, training costs are ordinarily reduced since training can often be condensed or, in rare cases, eliminated. Tests can be used to determine

areas where training is needed, and as training progresses, specially designed tests may be used to measure the trainee's progress. Tests are also helpful in the training program in determining just which employee is best qualified to take advantage of training. It would certainly be wasteful to attempt to train an individual for a particular field in which he had no aptitude or interest.

The use of tests in selecting employees to be advanced to higher positions is not only desirable from the standpoint of placing the best talent in these positions, but it is likely to have a salutary effect on employees who note that ability is recognized.

Limitations

Tests are precision instruments and they are designed for specific purposes. When they are employed properly they can be of great assistance to the personnel program by enabling a company to lay the foundations for a competent and cooperative work force whose morale and efficiency will increase productivity and reduce costs. If tests are improperly used, or abused, they may produce disastrous results.

Tests are not infallible. They are designed to supplement, not supplant human judgment. It is not claimed that tests will eliminate all job failures. Industrial testing programs are designed to reduce, rather than eliminate, errors in selection and in the other areas where they are employed.

In order to more fully understand the limitations and strengths of psychological testing in industry, it may be well to illustrate, in broad terms, how they supplement human judgment.

If an employer utilizes only a trade or performance test (which shall be covered in detail in a later chapter) it will not disclose other and equally important factors which are necessary in justly evaluating an applicant. Let it be assumed, for illustrative purposes, that Jones and Smith have both applied for a job vacancy.

Jones' personal factors actually are:

1. Intelligence above job level.
2. Natural talents in other lines.
3. Personality conflict with job.

He scored high on a performance test.

Smith's personal factors actually are:

1. Intelligence at job level.
2. Aptitudes in job line.
3. Personality harmonious with the job.

He scored low on a performance test because of nervousness while taking the test, as well as insufficient training and experience.

Therefore, if the company's selection is based solely on the performance test, Jones would be employed. But if all the factors are considered, the company might well decide to select and develop Smith as the best potential employee.

The employer may decide to determine on the basis of his own judgment to what extent an applicant has other occupational qualifications. But should his judgment prove to be faulty the tests, themselves, should not be blamed. Even with a battery of tests covering the most significant factors demanded by the job, it must be remembered that they are but tools supplementing human judgment. The final decision in any selection requires the putting together of a mosaic of information and qualifications in order to find the man with the integrated abilities and capacities best

fitting the demands of the job. If that man cannot be found, then the decision must be to employ the applicant whose favorable qualifications are the most promising.

While there are definite inherent limitations in psychological tests, the weakness of many company programs seems to arise not from these limitations but from confusion and misunderstanding as to the basic principles of employee selection and placement. This situation is unfortunate, since much of the unfavorable publicity about testing and the skepticism which at times surrounds it is due to a basic misunderstanding of its principles coupled with an expectation that it will produce infallible results.

Listed below are some of the major limitations of tests and some of the areas in which confusion has arisen:

A. Limitations of Psychological Tests:

1. They are not in themselves, adequate to measure potential success on the job. For instance, they cannot measure highly desirable human characteristics such as honesty, cooperation, ambition, loyalty, and the like.

2. Temporary personal problems may result in a low score which is not indicative of the man's real level of intelligence or his potential. He may be ill when he takes the test; he may be excessively nervous or he may have family or other personal problems. In addition, some applicants are opposed to tests in principle and may make no effort to reveal their true mental capacity.
3. In some jobs, factors other than intelligence are so important that there is very little correlation between job success and intelligence.
4. Psychological tests do not fully measure intelligence as against acquired knowledge. Thus, some men who have a great store of acquired knowledge in the trade and the ability to progress and develop in it, may be passed by.

B. Limitations of Ability Tests:

1. They may not be measuring the special abilities required in specific jobs. For example, if the job requires the

ability to do fine work with tools, a test of finger dexterity may not be the proper one. On the other hand, this same test might be properly used in selecting a typist.

2. Certain aptitude tests are thought to have more value in eliminating potential failures than in predicting job success. Thus, the findings of such tests should be considered tentative and corroborated by other tests or information from other sources.
3. Some trade tests tend to depart from strictly work-sample techniques and the measurement of trade knowledge toward a search for general work skills. As this deviation widens, the tests tend to become aptitude rather than trade in nature. The distinction between the two types of tests should be kept in mind: aptitude tests reveal potentiality; trade tests show how well the trade has been learned.

C. Limitations in Construction of Tests

It should be made clear that the writer does not feel adequately qualified to criticize the actual composition of any test. That is an entirely different field and shall be left to the students of psychometrics. There are, however, some basic limitations of this nature which are not outside the scope of this study.

1. Sometimes the test is not completely comprehensible to the people to whom it is directed. They may not know the language well, or the directions may be confusing because they are not expressed in simple terms, or the test may use words that do not have the same meaning to all social groups.
2. The test may stress one or more aspects of the job to a degree that it is out of proportion to their importance in the over-all job.
3. The test may be difficult to score.
4. The test may not be readily adapted to changes in job content.

5. The test may be constructed so that it is possible for the applicant to fake or cheat on the test. The following excerpt from Mr. Whyte's article illustrates this point.

"Are the people who don't score well necessarily the misfits? Almost by definition the dynamic person is an exception - and where aptitude tests reward, personality tests often punish him. Look at profiles and test scoring keys, and you will find that you will come closer to a high score if you observe two rules:

- (1) When asked for word associations or comments about the world, give the most conventional, run-of-the-mill pedestrian answer possible.

- (2) When in doubt about the most beneficial answer to any question, repeat to yourself:

I loved my father and my mother,
but my father a little bit more.
I was a happy, normal American
boy and everybody liked me.
I like things pretty much the way
they are.

I never worry about anything.
I love my wife and children.
I don't let them get in the way
of company work.

I don't care for books or music
much."¹

1. William H. Whyte, Jr., The Fallacies of Personality Testing, Fortune Magazine, Sept. 1954, Vol. No.

It appears that the most serious hazards to the effectiveness of an employee testing program arise not from the inherent limitations of the tests themselves, but from their indiscriminate use by unqualified persons and use where their application is not justified.¹ (See also, Limitations of Tests, Appendix A.)

Areas of Usage

Psychological tests, when used properly, perform many important functions for modern management. In American business and industrial organizations, personnel testing programs are used for a multitude of purposes. Among these uses are the following.

1. Selection of new workers from among available applicants.
2. Placement of workers on the basis of test scores helps insure a higher degree of worker satisfaction.
3. Training programs are more effective when participants are selected by the use of tests.
4. Transfer assignments can be made easier if test scores are available.

1. National Association of Manufacturers, Information Bulletin No. 21, 1954.

5. Promotional procedures should be supplemented with testing.

Selecting New Workers by means of tests prevents many potential troubles from coming into existence. Testing has had its widest application in this area. The highest degree of success has been in the selection of "shop and clerical jobs,"¹ but they are becoming increasingly more important in aiding in the selection of professional and executive talent. One of the country's largest retail chain stores² uses tests exclusively in determining their top executive talent. They have stereotyped their successful manager and only select those persons who fall into this pattern. It has been said that the most important day in the life of a young executive with this company is the day he takes the required battery of psychological tests. For, if he is not in the proper percentile, he may as well resign himself to mediocrity, at least so long as he remains with this company.

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1. Michael J. Jucius, Personnel Management, Richard D. Irwin, Inc., Homewood, Illinois (1959), page 231.
 2. Sears, Roebuck and Company.

Placement of Workers is made much easier if there are reliable test results available. There are, in every job, certain characteristics which demand a particular type of individual. For instance, if Jones has high mechanical interests and Smith's interests lie in the clerical field, it would be foolish to place Jones in accounting and Smith in the machine shop. Perhaps this is an overly-simplified hypothetical situation, but it does illustrate the basic point. In actual practice, individual differences are much more subtle and thus demand some objective, scientific device by which we can more readily recognize and take advantage of these individual differences.

Training of Workers demands some method by which management can recognize the individuals who can best take advantage of special training. Tests can also be used in determining where training should begin and whether or not the training has been adequate or effective. In one experiment,¹ it was found that the learning cost of employees who had scored lowest on a finger dexterity test, as measured by a simple peg

1. C. H. Lawshe and Joseph Tiffin, "How Tests Can Strengthen the Training Program." *Factory Maintenance and Management*, Vol. CII, No. 3, pp. 119-21.

board, averaged \$59.00 per employee before they earned the maximum hourly rate on a piecework basis. On the other hand, those with the highest finger dexterity incurred a learning cost of \$36.40 before achieving the expected level of efficiency. Obviously, savings in training costs would more than offset the cost of such selection tests. This report also showed that tests can reduce training costs by determining where training should begin and end. On a simple measurement question asked about an illustration showing some blocks adjacent to a scale, it was found that 70 per cent of the 650 applicants were unable to read to 1/32 inch. Obviously, training would be of little or no value in these cases unless the training were started at a level low enough to teach measuring fundamentals.

Transfer Assignments between departments which are often necessary can at times be greatly facilitated by the use of tests. Also, a person is more apt to accept a transfer if he has definite assurance that he is qualified.

Promotional Procedures can and should be supplemented through the use of tests. They should not, as in the case of one company previously mentioned, be the

final determinant in this decision. We have seen that tests are not infallible. They should not be called upon to make any final decisions, particularly when they are being used in determining the future destiny of a human being.

Does Testing Pay?

Certainly the writer will not argue with the philosophy that the best possible test of a man's ability to handle a particular job would be an actual trial of that man on the job. But, is this not an extremely costly method in itself? It is costly to both the employer and the potential employee, particularly when a large percentage of trials end in job failure. The resulting labor turnover causes financial loss to the employer through waste of time, idleness of equipment, and a lowered rate of production. Also, these job failures may lower the morale and reduce the future working capacity of the rejected employee. One big drawback in this type of selection procedure is that in many cases an applicant is put on a job for which he is not suited nor qualified. Some months later the company becomes aware of this fact. But, all too often, it is too late for management to correct its mistake. Especially where there are

operating unions, management must insure that the selection made is the right one. Otherwise, the company may soon find itself with much dead wood in its ranks. This is particularly true in those companies who have active union participation. The majority of current labor-management contracts contain a clause which describes the probationary period. This interval, which is typically 60 or 90 days, allows management the opportunity to observe the new employee and decide whether or not he will be able to perform the job satisfactorily. In other words, management has the prerogative during this probationary period, to release the individual without having to show cause. However, at the end of this interval the employee gains seniority rights under the contract and cannot be arbitrarily removed from his job.

Thus it is that in many cases management hires "for keeps"; and, the burden on its selection decisions is greatly increased. If tests can help to improve those decisions and thereby place better individuals on the job, how can the employer afford not to use them?

Industrial testing does not cost - it pays. Some businessmen "feel either that they cannot afford testing

or that it is just a lot of theoretical hokum anyway. This latter group looks upon every industrial psychologist as just another Wizard of Oz - who was, you may remember, a very poor wizard, but a very good humbug!"¹

The number of applicants who must be tested to fill each job is an important factor to consider in determining the monetary cost of a program of testing. The "ratio of the number hired to the number who apply has been called the selection ratio."² For instance, it may cost \$1.00 to test a single applicant, but the cost per employee hired will vary as the selection ratio varies. For example, if 100 men are to be hired and it costs \$1.00 to administer the test to each applicant, it will cost \$3.00 per employee hired if 300 applicants have to be tested to secure the number needed. And, if 600 applicants have to be tested to secure the 100 suitable employees, the cost of testing for each worker hired will rise to \$6.00.

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1. Arthur M. Whitehill, Jr., Personnel Relations, McGraw-Hill Book Co., Inc., New York (1955), page 165.
 2. John F. Mee, Personnel Handbook, The Ronald Press Co., New York (1958), page 413.

These figures may or may not appear large to the employer. There are many intangible costs which must be weighed in the balance to determine in each individual instance whether or not testing will pay. However, as mentioned, the majority of these costs are subjective in nature and do not lend themselves to very accurate measurement. It would appear, however, that the key question which must be answered is whether the use of tests and other scientific measurement techniques will improve, not make perfect, the personnel program. If selection and placement results are improved by using tests then the benefits derived may then be weighed against costs to determine in any particular case whether or not testing pays.

CHAPTER III - DEVELOPING AND OPERATING A
TESTING PROGRAM

A testing program is not a device which should be purchased as you would purchase a ream of bond paper. Much thought and study must precede the actual testing itself. A company must determine whether the addition of a trained industrial psychologist to the staff is justified. If the addition cannot be justified, the company may have to send one of its members to school for specialized training in test administration. The company must also decide what scale program to pursue. Management may wish to use the tests to maximum advantage in all areas of usage. Or, the company may wish to begin by using tests only in the selection procedure or some other limited area. Management must decide what type of tests to use. It must also determine whether to use a short, easily graded personnel test such as the "Wonderlic", or a very complex but comprehensive battery. All these questions and more should be answered thoroughly before initiating the program.

Factors Underlying Success in Testing Programs

Recent studies indicate that there are a number of factors which are basic in almost all successful testing

programs. This does not imply that to be successful a program must include all of the following. Nor does it mean that all of these factors are found in every successful program. They are offered here only as a guide to the personnel administrator contemplating a testing program.

1. There must be a full understanding of the principles involved in sound employee selection and placement both by those who are to administer the program and those to be subjected to it.
2. Top management must be completely convinced of the desirability of initiating such a program. So, also, should the supervisory group and the rank and file employees. This may be more difficult in the presence of union opposition which will be discussed in a later section.
3. The administrators of the tests must be fully trained or otherwise competent to carry out the program. If not, the time and money that go into testing is wasted, and actual harm may result.
4. The test must be validated before it is administered, and provision made for sufficient and continuing investigation of the relationship between test scores and success or failure on

specific jobs. The following are offered as standards by which to gauge the validity of a test.

- a) Quality of work (or spoilage)
- b) Speed or quantity of work
- c) Attendance record (absenteeism; tardiness)
- d) Accident record
- e) Length of service
- f) Periodic merit rating.

In other words, a company should have convincing evidence that a test permits a reliable judgment concerning applicants as employees. (See Appendix A.)

5. It must ensure that the groundwork for the program has been laid carefully and completely.
 - a) Jobs to which tests are applied must be carefully selected; generally, they are essential ones, and the number of persons involved is relatively large. Because of the all important cost factor, the selection of jobs to be tested should meet the above criteria.
 - b) The characteristics that make for success on the tested jobs must be carefully

determined by investigating groups of employees on the job. The characteristics must then be carefully validated by relating job performance of both successful and unsuccessful employees to the results of the tests under investigation. This original validation is necessary whether the company utilizes available standardized tests or decides to develop its own. Standardized tests are generally developed by independent organizations. Standardization merely means that the test is probably "reliable," that is, repeated administrations of the test will produce essentially the same results and that general or over-all "norms" have been established by administering the test to representative samples of groups of persons thought to have the same characteristics as the population at large.

6. In establishing the program, it must be recognized that the improper selection of tests, or setting passing scores too high on a battery

of tests, will result in the loss of many potentially acceptable employees. Obviously such a situation will defeat the over-all objective of the program, waste substantial sums of money, and may discredit the entire program.¹

Types of Tests

Before any company incorporates a testing program of its own, one of the most important things to be decided is the type or types of tests the company wishes to administer. Basically, this depends upon the trait which one seeks to measure, which, in turn, depends on the characteristics of the job which is to be filled.

There have been literally thousands of tests developed, and it is almost impossible to classify many of them because they may be designed to perform more than one function. For instance, a simple peg board test can tell us a great deal more about an individual besides his degree of finger dexterity. The way in which he goes about placing the pegs might give us an insight into his resourcefulness and reasoning ability.

1. National Association of Manufacturers, Industrial Relations Division, Information Bulletin No. 21, 1954.

However, for the convenience of this study the tests are broken down into five categories. A more detailed listing as to specific tests will be found in Appendix B.

1. Intelligence Tests

Intelligence tests are designed to measure the general mental aptitude of the individual and to determine whether he has the capacity to learn a new job, regardless of experience or training.

Jobs have appeal to individuals at different levels of intelligence. If an individual is placed in a job above or below his mental capacities, he will probably be frustrated. In one case, the job will fail to stimulate him since it does not challenge all his abilities. In other cases, the job will confront him with problems beyond his ability to solve effectively. In either event, the individual is likely to have a poor record, frequent tardiness and absenteeism, and a tendency to exhibit a general lack of responsibility. Thus, it is not wise to select only those with the highest score - rather an optimum hiring range should be developed for each job.

Intelligence tests are used to determine which applicants can learn quickly and have the potential for progress, as well as to indicate those people who are suitable only for the less complicated jobs.

2. Aptitude Tests

In general, aptitude tests are designed to disclose an individual's inclination to do certain types of work. They measure natural abilities such as speed and accuracy, perception, keenness of vision and hearing, accuracy of movement, sensitivity to change in bodily position, and sensitivity to color and tones.

They are reliable and useful in determining whether or not the applicant has the potential ability to handle a job that is new to him.

"One might have high capacity for a certain skill without having any of that skill at the time of testing. Thus, one might have exactly the combination of keen vision at close distances, finger dexterity, and mechanical ability necessary to become a watchmaker or repairer, but, if he has no training in watchmaking, he

might know nothing about the mechanism of a watch."¹

There are a number of types of these tests but each must be validated to assure that it is actually measuring the specific abilities required in a particular job. These tests measure potential or latent abilities and capacities but they cannot indicate the actual skill of the individual. This vital question may be answered through achievement or trade tests.

3. Trade Achievement or Performance Tests

Probably the tests which have the most practical value to management are these so-called trade tests. By using such a test, it is quite possible to determine, in a very few minutes, the degree of proficiency of a tradesman or other skilled worker. This is in sharp contrast to the month or more on the job normally required to assay a man's skill. It is true that better results may be obtained by extended

1. Joseph Tiffin and Ernest J. McCormick, Industrial Psychology, Fourth Edition, Prentice-Hall, Inc., N. J. (1960), page 81.

observation on the job, but this process is, as we have noted, a costly one especially where it is necessary to hire substantial numbers of employees in a relatively short time.

Tiffin and McCormick say that "achievement tests . . . are used to measure the level of proficiency of individuals in some work activity or subject matter (and are) used primarily for the following purposes: (1) the employment of people for jobs for which experienced workers are sought, (2) the transfer and/or promotion of present employees, and (3) in connection with training (as in identifying areas for which additional training is desirable and measuring the results of training that has been given)."¹

4. Personality and Temperament Tests

If skepticism could be said to group itself around any one particular type of tests, it would certainly be the personality test. Also, employers tend to think of tests in terms of more concrete variables such as aptitude or

1. Tiffin and McCormick, Industrial Psychology, Fourth Edition, page 185.

achievement. Yet, most of them realize the need for some device to determine an individual's personality traits.

Teamwork is essential in any enterprise, and a man's personality determines whether or not he can get along with, or even work with, his fellow employees. Without a temperament that enables him to fit appropriately into his working environment and to cooperate with the people with whom he comes in contact, an employee will be of little value to the company, or to himself, despite the fact that he may otherwise be superbly qualified for the job. It is a disservice to the employee to place him, or to permit him to remain in an environment for which he is temperamentally unsuited.

Personality tests may be summed up as a procedure for determining the pattern of behavior of an individual. Such tests are designed to reveal the possibility of abnormal behavior, permitting the elimination of applicants who give promise of becoming problem employees. It is not an unkindness to refuse to hire a man whose failure in job performance is

highly probable, or where his contact with other people is highly problematical.

5. Vocational Interest Tests

"Interest tests typically require the persons being tested to indicate the strength of his interests in such things as various jobs, hobbies, recreation, or leisure-time activities."¹ These tests measure an applicant's vocational interests and give the employer the opportunity to determine the applicant's preference for certain types of occupations. While being used increasingly in industry, their primary use continues to be in the field of vocational guidance.

In industry, they are sometimes used in screening applicants who have had no previous work experience, or to determine whether the individual should engage in the kinds of jobs the company has to offer. They are also widely used by companies in recruiting college graduates.

1. Tiffin and McCormick, Industrial Psychology, Fourth Edition, page 171.

Another occasional but important use of these tests which should not be overlooked is in the counseling of the employed individual who is a misfit on his present job. As a result of such tests the employee may be transferred to another job within the company for which he is better suited, or it may become evident that he should enter an entirely different field of work.

6. Test Battery

"Test battery is a combination of several tests, each measuring a different factor, skill, or characteristic."¹ No one single test of any of the types mentioned can be expected to measure all of the capacities or abilities required on any one job. Johnson² points out that the aptitude for any job consists of a "syndrome of abilities" and that one needs all of these to be successful. Test batteries range from the simple to the extremely complex. For instance, a company may

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1. John F. Mee, Personnel Handbook, The Ronald Press Co., New York, N. Y., 1958, page 398.
 2. H. M. Johnson, Some Neglected Principles of Aptitude Testing, American Journal of Psychology, Vol. XIV, 1935, 47, pages 159-165.

simply group several of its tests together, weight them properly, and arrive at an optimum score for the group. Or, it may use elaborate batteries such as those published by Industrial Psychology, Inc.¹ In the final analysis, any test battery must be individually tailored to the requirements of the job.

Testing Services Available to Management

There are many varied sources of tests from which management may choose. (See Appendix C.) Some companies may even wish to construct their own tests. This, however, is not recommended unless the company is staffed with a qualified psychometrist.

For the convenience of this inquiry testing sources may be divided into two sections, public and private.

Public industrial testing is conducted on a nationwide scale by the United States Employment Service in cooperation with the various state employment offices. There is some variation among the several states regarding the extent of services which are rendered but all the states participate in Pre-Employment Testing.

1. Industrial Psychology, Inc., 505 Madison Avenue, New York, N. Y.

In Virginia, each district office has the facilities to administer these tests for the companies in their area. Each office has a Catalog of Tests to be given in connection with each of some 500 jobs. This manual also gives the norms for each job and the number and type of sample used in the validation process. It also lists the standard error and the coefficient of correlation for each job field. Here management has at its fingertips a completely validated series of tests which are made by professionals, administered by specialists, and can even be tailor-made to all particular requirements. All this is available at no additional cost to the employer. This means that when applicants are referred to the company for employment, they will have already met the ability specifications determined through a comprehensive research program.

Any employer contemplating the installation of a testing program should not overlook this major source. The development of this service places a tailor-made, reliable, and validated testing program within the reach of every employer.

Private sources of industrial tests are much more elaborate and comprehensive. Tests can be purchased for

every conceivable need. For instance, whereas the public employment service does not use any personality tests, private companies have spent large sums of money in developing this type of test for use in industry.

The company may wish to purchase an inexpensive personnel test or it may wish to buy a complete package program in which the company only administers the tests and then returns them to the testing company for scoring and evaluation. Then, on the basis of the tests alone the testing company will return in a few days a complete story on the individual tested. The use of this method is seriously questioned by the writer primarily because of the lack of personal association with the program. A partial list of available tests and testing services is listed in Appendix C.

Requirements of Tests

Reliability and validity are the basic requirements for any test but there are also other considerations. Ghruden and Sherman¹ suggest that in order to properly measure differences between individuals, the test must be of proper difficulty. "A mathematics test designed

1. Ghruden and Sherman, Personnel Management, page 131.

for advanced physics students, for example, would be of little value in testing the mathematical ability of the typical lathe operator."¹ Tests also should be practical in that little or no special skill is required to administer or score them.

A test must be reliable. "The reliability of a test is the degree to which a test measures consistently whatever it does measure."² Probably the most typical method of determining the reliability of a test is to give the same test to a group of individuals twice with a time interval in between. The two sets of scores are then correlated. Of course, this method is only suitable with tests on which memory or practice effects are of limited consequence. In that case the "alternate forms"³ method would be used. This method involves the administration of two separate, but equivalent, forms of the same test. The scores of these two forms are then correlated to determine the degree of reliability.

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1. Ghruden and Sherman, Personnel Management, page 131.
 2. Tiffin and McCormick, Industrial Psychology, Fourth Edition, page 92.
 3. Ibid, page 93.

Before a test is given, it should be validated. In other words, a company should have convincing evidence that the test permits a reliable judgment concerning the applicants as employees. "Validity refers to the degree to which a test measures what it is supposed to measure"¹ (see Appendix A). Employment tests should be revalidated from time to time in the light of new or accumulated knowledge and experience. This simple precaution cannot be over-emphasized. A revalidation may serve to confirm a test or it may show a need for new methods. The following are suggested as means of validating or revalidating a test.

1. The easiest, though perhaps not the least expensive is to rely on the analysis of a consulting psychologist and to submit the test to him from time to time for reexamination and revision.
2. The test may be given to a group of employees, satisfactory as well as unsatisfactory, and the results correlated with the past work (or other measure) of employees in the group.

1. Ghruden and Sherman, Personnel Management, page 131.

3. Have all new employees take the tests, and then correlate their later work with the test results. This may prove effective but the actual process of validation may take several years.
4. The company may inquire concerning the experience of other companies with tests given to their employees who do comparable work.
5. The company may compare general experience or statistics before and after the installation of tests with respect to matters such as:
 - a) Productivity
 - b) Quality
 - c) Absenteeism
 - d) Accidents
 - e) Grievances
 - f) Labor turnover.

Steps in Laying the Foundation for an Effective Testing Program

Before a testing program can be effectively launched in any plant, all levels of management and rank and file must be convinced of its desirability. Top management must endorse the program without reservation. "Supervisors must understand that tests

are an addition to, rather than an encroachment upon their authority. Union representatives, by the same token must be convinced that a test program will make promotions, transfers, and other movements of personnel within the organization more acceptable and justifiable to their members."¹

If a company is organized, the labor union may accept the program and cooperate; or, it might actively resist the program. Labor does not seem to be much interested in the utilization of such practices and the attitudes of union officials, in general, range from passive acceptance to downright opposition. However, experience with other aspects of scientific management seems to indicate that this obstacle, if it exists, is not insurmountable. Management may be able to convince the union that testing is not a discriminatory device nor a speed-up, nor deserving of any of the other charges that labor is prone to level when management introduces a new scientific technique. It can readily be pointed out that such techniques represent effective devices for helping to increase industrial efficiency and to deal with the

1. C. H. Lawshe, Jr., Principles of Personnel Testing McGraw-Hill Book Co., Inc., New York, N. Y. (1948), page 193.

human problems that arise in plants. "The chances for gaining acceptance among union representatives in a specific company will depend largely upon the quality of past relationships, the willingness of management to bring the union in on developments right from the start, and the presence or absence of intelligence and responsibility in the make-up of the particular union leaders involved."¹

Having decided that a testing program would be desirable and feasible, the following steps are recommended:

1. Determine clear, satisfactory, and reasonable objectives. Too often, companies expect tests to solve all their problems.
2. An analysis or evaluation of the jobs should be available. This involves accurate job descriptions and specifications for the job or jobs to be tested. In other words, some criteria of job success is needed. Job descriptions are . . . "extremely helpful in selecting personnel tests that really test for

1. Whitehill, Arthur M., Personnel Relations, page 162.

those measurable factors associated with adequate performance in each type of work."¹

3. Select the tests on the basis of those human characteristics that appear to be essential for successful job performance. The company may choose to use either available standardized tests or develop its own.
4. The tests must be carefully validated specifically for the particular jobs for which they are to be employed. It must be noted that in this task there must be enough employees involved to make the validation statistically significant.
5. Institution and Operation of the Testing Program. "Those tests which are useful, practical, significant, valid, and reliable in the context of the particular situation are selected for the actual testing program."²

1. Whitehill, Arthur M., Personnel Relations, page 163.

2. Ibid, pages 163-164.

CHAPTER IV

CASE I - CELANESE CORPORATION OF AMERICA

Located in Narrows, Virginia, Celco is one of six plants of the Celanese Fibers Company, an operating division of the Celanese Corporation of America. Celco's primary products are: cellulose acetate flake, acetate filament yarn, acetate staple fiber, cigarette tow, and intercel fiber. It is the largest industry located at Narrows and currently employs about 2200 people.

Celco is at the present time, in the process of rebuilding its testing program. Several years ago the company abruptly decided that this plant should have a testing program. Consequently, a contract was entered into with one of the larger companies specializing in the industrial testing field. A considerable investment was made, with the result that the testing company did come in, study their jobs, and leave with them an elaborate report illustrating, step-by-step, the procedure to be followed in testing each group. The individual tests to be used were the standard forms which would be purchased from the testing company which had made the study and recommended the system.

This sounded very convincing to the purchaser who was having more than the normal amount of union discussions during this period. The testing company had assured Celco that these tests had been validated on the national population and that if the company would follow their instructions regarding tests, many of the existing problems would be solved. Instead of solving problems in the organization, additional problems were created. The company realized too late that the ready-made testing program was not a panacea for all of its problems.

In fact, the institution of the program by the outside company actually created some unfortunate situations which had not existed prior to this time. One reason was, of course, the tests themselves. They were not designed for the purposes for which they were being used. The consulting firm had arbitrarily assigned tests to perform random duties. Thus, it was not known with any degree of certainty whether the tests were effective or not. Secondly, and very important, the tests were not validated relative to local conditions. To say that a test is valid is very incomplete unless it is known what segment of the population was sampled. In the case of Celco, testing policy was established based upon a so-called national population. Here again, one could

run into difficulty unless it was known which geographical section of the nation was sampled.

Thus, whenever personnel decisions were made with the aid of these tests, Celco's employees were being compared with a national population about which little was known.

The third, and probably the most important reason for the failure of Celco's initial testing program was the failure of management to introduce the program properly. The tests were pressed into use by top management before the rank and file were convinced of their usefulness or even understood their purpose. Thus, it immediately became a union "football" and was used to level claims of unfair practices against management.

Within two years management weighed the dollars spent on the testing program against the achieved results, and consequently discontinued the entire program. For several years thereafter, no tests were used in any phase of the personnel program. Only recently has management felt the increased need for a revival of the tests.

Today, several years after the inception of an entirely new system of testing based on local standards management is pleased with the results and with the increased acceptance of it by the rank and file.

The the present time, top management support for testing is exceptionally strong in three areas:

1. To help develop potential or latent skills
2. Promotion
3. Counseling.

Selection testing is broken down into the following groups:

A. Factory Male and Female

1. Trades - millrights, machinists, and the like.
 - a) Wonderlic
 - b) Mechanical aptitude
 - 1) Spatial relations
 - c) Shop arithmetic
 - d) Mechanical ability.
2. How to read a working drawing.

B. Clerical

1. Shortt employment test
 - a) Verbal
 - b) Numerical
 - c) Clerical aptitude
2. Typing
3. Wonderlic
4. Steno proficiency.

- C. Laboratory - hourly rated job
 - 1. Wonderlic
 - 2. Numerical
 - 3. Special test devised by the Celco departmental supervisor
- D. Salary
 - 1. Hackerman (personality)
 - 2. Wonderlic
 - 3. Mechanical comprehension

Upgrading or promotional testing is divided into the following categories:

- A. Upgrading into the Helpers Class
 - 1. Wonderlic
 - 2. Mechanical comprehension
- B. Into Second Class
 - 1. Wonderlic
 - 2. Mechanical comprehension
 - 3. Blueprint reading
- C. Upgrading to Foreman Level
 - 1. Wonderlic
 - 2. Mechanical comprehension
 - 3. Numerical and verbal
 - 4. Gordon's personal profile.

It is the responsibility of the Industrial Relations Department, specifically the employment director, to provide line supervision with the most suitable and best qualified candidates when needed.

Each applicant must possess the following:

1. High school graduate or equivalent¹ thereof
(exceptions may be made in consideration of special skills)
2. Eighteen years of age or more
3. Hourly female production minimum height requirement of five feet, three inches.

Final selection is a result of a combination of the following:

1. General evaluation and appraisal (interview)
2. Past performance (reference checks)
3. Testing (selection by area).

All applicants are logged in a book alphabetically by name. Information contained on this log sheet will be:

1. Date filed
2. Name
3. Sex

1. This is a frequently found phrase used apparently for management's convenience. Its meaning, in context, is not fully clear to the author.

4. Area filed (production, clerical, etc.)
5. Height
6. Weight
7. Number years experience
8. Disposition
9. Rating.

The filing of applicants is broken down into two basic sections: Pre-Test and Post-Test.

1. Pre-Test applications are divided into two additional classifications: (1) Pending testing, and (2) Not to be tested (rejected). Within each of these classifications the applications are filed in one of four groups:
 - a) Production, male
 - b) Production, female
 - c) Trades
 - d) Clerical
2. Post-Test

After testing has been accomplished, all applications are filed in the Post-Test section numerically, as determined through the use of the point qualification system. Using test results plus established qualification factors, weighted according to importance, a numerical

total is obtained for each applicant. The applications are then filed numerically, highest first, within each of the four sections mentioned above. Then, as requests are made for new employees, the applications are pulled in numerical sequence and the final departmental screening is all that remains.

The basic preliminary screening is carried out by the employment clerk. Those applicants not possessing the minimum qualifying requirements are told there is no work available. Those who meet minimum qualifications are given the single sheet application to fill out. There is no interview at this time. The employment clerk fills out a small screening sheet to aid the employment manager in his initial decision as to whether or not the application warrants further consideration.

Applications are then screened by the employment manager to determine the area in which the application is to be filed and also whether or not the individual is to be tested.

Tests are scheduled for groups of 12 to 15 with sufficient frequency to keep a backlog of 40 to 50 applicants. Reference checks are made on individuals who are invited back for testing and interview. On the

day set up for testing, the employment manager will schedule an interview either before or after the administration of the tests in order that additional qualification factors might be considered. The first eight of these factors are objective and self explanatory in nature. The factor, The General Evaluation Interview, results from the usual "directive" personal interview conducted by the employment manager. Through observation and pointed questioning, the interviewer will be able to arrive at a decision as to now he feels the applicant will fit into the work of the plant, thus lending more objectivity to the total evaluation.

The next and final step is the numerical tabulation based on the following table.

	<u>Qualification Factors</u>	<u>Max. Pts.</u>
1.	Education	5
2.	Appearance	5
3.	Travel distance	8
4.	Means of transportation	8
5.	Job-related experience	7
6.	Communications	5
7.	Part-time and summer work	7
8.	Job stability	5
9.	General evaluation interview	25
10.	Tests	<u>25</u>
		100

Celco's experience with testing should stand as a symbol of caution to any company contemplating a program. Had company management made a proper investigation of the subject, it would possibly have been spared the unfortunate experience of adopting a testing program, and subsequently having to discontinue its use.

With competent administration and interpretation of test results, Celco's current program appears to be accomplishing the desired results. Unless there are some major and at present unforeseen changes in the program now in effect, the Celco plant should, within a few years, be able to review their testing program with considerable pride of accomplishment.

CHAPTER V

CASE II - GENERAL ELECTRIC COMPANY

The General Electric Company's Industry Control Department located between Roanoke and Salem, Virginia, employs approximately 2000 people. Their primary products consist of electrical control equipment for industry. Production is closely tied in with the future growth and expansion of automatic factories. Many of the jobs handled by this division are of an exceptional nature and require skilled labor of a highly specialized character. The General Electric Company is known throughout the industry as a leader in the field of personnel services as well as being a pioneer in industrial testing. Because of the technical nature of so many of their jobs and their continuing quest for the "best" from the labor market, this company early recognized the need for an objective measuring device. The answer appeared to be in psychological testing. By using these tests, the General Electric Company found that it could improve upon many of its personnel programs, particularly in areas of selection and placement.

Mr. E. B. Petersen, Director of Employment at the Salem plant, emphasized that the company's top

management people were becoming even more increasingly aware of the importance of a sound testing program in the over-all operations of the company. The employment manager has virtually a free hand in using funds budgeted to his department at his discretion for experimentation and improvement of his testing program. He decides which tests will be used and also how they will be used.

Mr. Petersen has one unique advantage in that his union contract has a "merit and ability clause." This means, in effect, that he can promote a man with proven ability even though he may not have the seniority or, indeed, may not even belong to the union. The employment manager related an instance where there occurred an opening for an inspector's job to be filled by one of ten eligibles. Nine of these were union members. By all measures of work standards, the best man for the job was the non-member but, of course, the union wanted one of their own to have the promotion. Mr. Petersen ordered an entirely new battery of tests from Dr. J. P. King¹ and called the ten men in and administered the tests. As anticipated, the non-union employee scored the highest

1. Dr. J. P. King, Industrial Psychology, Inc., N. Y.

and the employment director was able to demonstrate to the officials that the choice was simply one of promoting the best qualified man to the job. This plant of the General Electric Company has a decided advantage in that it is located in an area with an abundant labor supply. And, by virtue of the fact that its wage scale and working conditions are superior to those prevailing in the area, it has no problem in attracting applicants. There is practically a constant stream of prospects through the employment office daily. Mr. Petersen said that to take away his tests would be, "like cutting off an arm."

Applicant testing begins at the front gate of the plant. The guard notices the appearance and manners of each individual, and if anything is out of the ordinary, he calls the employment office and relays his observations. The applicant meets his second test when he approaches the employment secretary. She observes the applicant's dress, manners, personality, and any apparent physical defects, and notes this on a small form to be attached to his application. If the secretary thinks there might be an immediate interest in the applicant, she will carry the application to the employment manager who may wish to interview the individual before the applicant leaves. Usually, however, the applicant is thanked for his

interest but is given no encouragement regarding future job possibilities. Next, all applications are screened by the employment manager to determine which applicants should be called in for testing. Those applications which generate no apparent interest are placed in an "inactive file."

After an individual has been tested, his scores are posted to his record, but he is still given no encouragement regarding employment.

When the office receives a requisition for new employees, a number of these eligible candidates are called in for personal interviews. The interviewer selects the best of these and sends them to the particular department where the final choice will be made. This is a long and involved "weeding out" process but in the case of this company it appears to be necessary. Where there is an abundant labor supply the company feels they must make every effort to select only the best qualified in the group. Psychological tests play an important role in this endeavor.

For testing purposes, three groups are used:

A. Factory

- 1) Male
- 2) Female

B. Non-Exempt¹

1) Male

- a) Finance and marketing
- b) Engineering assistants

2) Female, clerical

C. Supervisory, Exempt

Factory Male applicants who pass initial screening tests are given the following battery:

1. General ability - non-verbal
2. Mechanical intelligence - verbal
3. Electrical ability
4. Blue print reading
5. Spatial relations
6. Micrometer and scale reading tests
7. Coordination test (if being considered for assembly-type work).

These tests are only given to those applicants being considered for jobs where this particular type of knowledge would be essential for satisfactory job performance.

1. This term applies to those employees not exempt from the provisions of the Fair Labor Standards Act.

Factory Female applicants are given the following battery:

1. General ability - non-verbal
2. Coordination
3. Identical forms
4. Finger and tweezer dexterity.

Non-Exempt Male applicants in the field of finance and marketing are given the following battery:

1. Wonderlic
2. Minnesota clerical
3. Mechanical comprehension
4. Vocabulary
5. Kuder interest test.

Those applicants considered for engineering assistants are given the following battery:

1. General ability
2. Mechanical comprehension
3. Mathematics
4. Spatial relations
5. Working drawings, blue print, tracing, drafting.

Non-Exempt Females are given the following:

1. Wonderlic
2. Minnesota clerical

3. Spelling
4. Typing
5. Shorthand
6. Vocabulary

The supervisory exempt classification is given the following:

1. Mental alertness
2. Temperament
3. Judgment and comprehensive
4. Expression - involves spontaneous writing
5. Vocabulary
6. Spelling
7. Spatial relations
8. Shop arithmetic
9. Algebra
10. Mechanical comprehension
11. Wonderlic.

Mr. Petersen assured the writer that before any of the above tests are used they are thoroughly validated on the premises. He also emphasized that a complete follow-up study is made each year by which all the tests are completely revalidated.

The one possible oversight in the otherwise seemingly flawless testing program at this plant stems from the fact that it has the first choice of all applicants from the labor pool. It appeared to this writer that all the company's programs were directed toward the single end of obtaining the best possible candidate available. It would seem that in, at least, some cases they were putting over-qualified workers on the job. When these jobs do not offer a constant challenge to the individual he may become a marginal or sub-marginal producer. Perhaps the company has become obsessed with its ability to attract the most well-qualified applicants, and has lost sight of the fact that the most intelligent employee is not necessarily the "best" employee for any one particular job.

Judged by all recognized standards of a sound industrial relations program, this particular plant would rate very high on any list. Employee turnover, absenteeism-tardiness, and grievances are very low and productivity is high. Thus, management might possibly be led into a false conclusion or evaluation regarding its testing program. Periodic revalidation carries even

further this semblance of an unusually high correlation between ability scores and job performance.

The writer cannot help but believe that underneath this outer surface there is something less than perfection in this plant's hiring and placement programs. There is no apparent evidence upon which to base this conjecture, but it would appear that the plant management is operating under an illusion.

Since, over the years, this company has continually placed "over-qualified" employees on all of its jobs, how does it know that those individuals on the jobs are performing at an optimum level? The plant, in this instance, does not know whether or not a less totally qualified person might perform more satisfactorily on some of the jobs.

Thus, it would appear that revalidation studies are practically useless, since the individuals used as standards of job performance are not necessarily the most desirable employees for the particular jobs being studied.

CHAPTER VI

CASE STUDY III - DAN RIVER MILLS

Dan River Mills, located in Danville, Virginia, is one of the south's leading textile producers. Its fabrics are recognized and used all over the world. Currently, the company employs about 10,000 persons, but to visit the plant, one would think that there are not more than several hundred. The greater portion of their labor force is in the non-skilled, or semi-skilled categories, but there seems to be a wide range of types of jobs which would, in turn, require varying levels of skill and ability.

This company is similar to Celco in that it has had an unfortunate experience with industrial testing and is now finding it difficult to accept test results in making personnel decisions. In 1943, the company's management was convinced of the desirability of installing a testing program by one of the nationally known firms. This testing company sent overly-ambitious psychologists into the plant to set up a complete program under which everyone was to be tested. They not only wanted to use the test results as a basis

for selecting the new, but also in evaluating the old employees. The extensive testing of old employees consisted of a comprehensive battery requiring eight hours to administer.

For several years, tests became the final measure of a person's potential. Other reliable subjective data was of no importance unless the test results confirmed these findings. When they differed, which was often, final decisions were made on the basis of the tests. This meant that not only was the company making poor selection and placements; it was also discharging some employees with admirable service records.

Top management soon began to realize the shortcomings of the tests when used in such manner. Test results often belied an employee's admirable work record for twenty years or longer. Company officials realized that these individuals could not be arbitrarily discharged merely because the testing company said his personality was not suited for the job. Consequently, the entire program was abruptly brought to an end. Several years passed, and during this period, no test was used at Dan River Mills.

When Mr. J. C. Spangler came with the company about ten years ago, he realized an urgent need for at least some measure of testing. But top management still has bitter memories, and he has had to proceed very cautiously in this area. He began working with the supervisory classifications. He studied these jobs and the men, and tried to determine what traits the successful ones had in common. Next, he studied many tests in order to find one or several which would measure those qualities that seemed to be requisites for successful supervision.

Mr. Spangler now uses three tests:

1. Kuder Preference
2. Otis Intelligence
3. Johnson Temperament Analysis.

He relates that the tests have not been fully validated to his local situations. Arbitrary levels of test performance have been placed on these tests and he then tries to relate this with subjective information obtained from other sources. The employment manager then conducts a test performance and job performance correlation at a later date. No test is currently being used as a means of final judgment of any individual. After the applicant

completes the test battery, his results are recorded in graphic form on a Personnel Test Report form (see Appendix D). This becomes a confidential addition to the prospect's permanent file if he is successfully employed. Section I of this form deals with intelligence or mental ability. There are spaces for the raw score, percentile rank which locates the individual on a scale calibrated from one to nine. The second section of the Personnel Test Report describes individual's temperament profile. Here, the scale is divided into three categories:

1. Factors of Drive

- a) Optimistic vs. Depressive
- b) Active vs. Quiet
- c) Aggressive vs. Submissive

2. Factors of Lubrication

- a) Cordial vs. Cold
- b) Sympathetic vs. Callous
- c) Appreciative vs. Critical

3. Factors of Control

- a) Objective vs. Subjective
- b) Composed vs. Nervous
- c) Self control vs. Impulsive

These factors are graphically illustrated on a percentile ranking chart which gives the employer a reasonably accurate picture of the applicant's temperament attitudes. The reason Mr. Spangler chose this particular test is because it measured those subjective character traits which the successful Dan River Mills supervisor was found to possess. Mr. Spangler made a study which revealed that successful supervisors had such traits as aggression and the ability to impose their will on others; consequently, he chose the Johnson Temperament Analysis over other types of personality tests.

This study also brought to light a need for recognizing individual interests. To accomplish this, the Kuder preference test was selected and is presented graphically in Section III of the Personnel Test Report. There are nine divisions in this section as follows:

1. Mechanical
2. Computational
3. Scientific
4. Persuasive
5. Creative (artistic)
6. Literary

7. Musical
8. Social service
9. Detail (clerical).

The graphical picture shows interest measured in each of the above categories by percentile ranking from 0 to 100, and in three groupings - low, average, and high.

Since these tests have not been completely validated the author immediately questioned their accuracy. Spangler said that the reason for this was that he was using the follow-up method of validation¹ and that it may be several more years before the relative reliability of the tests can be determined. This is true because the population of this group increases at a very slow rate.

In the writer's opinion, this does not discount to a great extent the effectiveness of this particular program because the study made of successful supervisors reveals those traits which are or are not desirable. There only remains the question of degree.

The one fact that surprised the writer was that outside of this supervisory testing program, there are

1. Tiffin and McCormick, Industrial Psychology, page 85.

no other groups tested with the exception of the clerical employees. For example, not one of the thousands of production workers have ever taken a test to obtain or retain their present job.

The reason for this total absence of testing on this level as stated by the employment manager, is the belief that the unskilled and semi-skilled labor supply in this area is relatively scarce. In other words, they are inclined to employ almost everyone who applies. The author pointed out that even if this were the situation, it would appear that a much better job of placement could be made if some tests were given. If it were a matter of costs, the services of the Virginia State Employment Service (see Chapter III) could be put to good advantage. Spangler almost agreed but there was some hesitation which gave the impression that some of the old wounds are still not fully healed. This attitude is extremely unfortunate since it only amplifies a previous mistake and causes labor costs to continue to rise unnecessarily.

CHAPTER VII - EVALUATION AND CONCLUSION

After studying the field of industrial testing thoroughly, it is difficult for the writer to understand how any company would voluntarily be without a testing program.

Every company must have employees, and the caliber of these employees determines the future success or failure of the company. It is therefore not logical for management to be satisfied to make only a calculated guess as a basis for its personnel decisions. If management were aware of the actual cost of making an incorrect decision, it would understand the need to discover and put into use any proven scientific device which would enable the company to improve the over-all efficiency of the work force.

However, the writer has found that some large companies, even with these facts in mind, do not avail themselves of the benefits to be derived from a sound testing program. In a recent interview with the personnel representative of one of the country's largest steel producers,¹ it was noted that this particular company, employing many thousands, does not

1. Wheeling Steel Company, Inc.

make use of any form of psychological tests. During the interview it was learned that this company prefers to rely upon a subjective judgment of an individual rather than results obtained by the use of a scientific testing program. Thus, this company has no concrete knowledge of a person's true personality or his potential abilities other than that obtained by subjective devices. This would appear to the writer to be a serious handicap to the selection program. The executive related that in most cases, the company's choice based on judgment proved correct and that it was his opinion that the employment of tests would be a waste of money.

This type of attitude among company officials is in the minority. Those companies who use personnel testing agree as to the positive value of such programs.

Testing appears absolutely essential if a company is to remain in a competitive position in relation to the other companies in the industry. This is clearly indicated by the textile industry in Virginia. In Chapter VI, it was pointed out that Dan River Mills, at the present time, is using tests only in the field of supervisory selection. Hence, this company is forced

to rely entirely upon subjective devices such as the interview in order to make its selection and placement decisions regarding production workers. In effect, the selection test given by this company consists of several months trial on the job. If, at the end of this period the individual is performing satisfactorily, it is assumed that management made a wise decision. If, however, the individual does not meet the job requirements, and consequently must be moved about from job to job, this would seem to be an excessively costly testing program. Certainly a company cannot expect to select its employees in this manner and at the same time, remain competitive.

Burlington Industries, on the other hand, uses an extensive testing program which has proved remarkably successful over the years. The writer talked at some length with Mr. E. W. Gould who is the Industrial Relations Officer for the Pacific Mills Division, and he related that for many years Burlington Industries had been employing psychological tests at all levels of selection and placement. The importance of this technique is that even in those areas where the labor pool is limited, the tests are very helpful in placing the individual on a job where he will be most

effective, and consequently do a better job. Mr. Gould further related that the tests help to recognize potential supervisory talent at an early stage of employment. Thus, Burlington Industries is able to develop this talent within the proper environmental framework. By making use of tests, this company is spared the expense of on the job trials, and consequently is in a position to gain a greater degree of efficiency and productivity from its workers at an early stage in their career.

In this regard, the question of cost is again considered. Mason Haire¹ presents a very logical discussion of this all-important factor in explaining the demand on the labor supply. Haire examines a hypothetical illustration involving the administration of an arithmetic test to salespeople. A cutoff score is established in the neighborhood of the score obtained by the highest 50 per cent of the sample. Thus, to reduce errors, no person should be hired who scores below the score obtained by 50 per cent of the salespeople.

1. Mason Haire, "Use of Tests in Employment Selection," Harvard Business Review, Vol. 28, No. 1 (January 1950), pages 44-45.

The implication is clear: for every salesperson hired, two must be tested. Also, since arithmetical ability may not be enough, other factors must be tested. If another test is added, it must have a low correlation with the first one so that it will add discriminating power rather than just duplicating the findings of the first test. Thus, the two tests will not eliminate the same people; they will eliminate more people, and the cost of testing in terms of applicants required becomes, at least to some extent, cumulative. To this pyramid must also be included the "silent selection factors" such as discriminations due to race, physical condition, age, sex, and the like.

This line of argument is, in principle, true. However, it considers the cost of testing as related to only one function - selection. Mr. Haire fails to consider the future benefit of test scores of those acceptable individuals.

Certainly the cost of testing should be considered, but one must be careful in determining those factors with which to balance the scale. All employers must hire, place, promote, and transfer. The important considerations are the results obtained in the course of performing

these functions. And the results will, in most cases, depend upon the methods or devices which management uses to accomplish these ends.

During the course of this investigation into the field of industrial testing, the writer noted the following observations and conclusions:

Observations

1. The majority of large companies in this area are using some type of testing program in at least one area of usage.
2. Those medium and large size companies which do not use tests can be divided into two groups.
 - a) Those who have never used tests for any purpose (Lynchburg Foundry)
 - b) Those who have, at one time or another used tests; but for some reason have since discontinued their use (Dan River Mills).
3. Among the companies who use tests, most find it difficult to determine the extent to which the program should be carried out. This problem is also significant in determining the cost factor, since the more extensive the program, the less expensive it is when related to the multitude

of advantages derived from its use. However, tests might be used too extensively. Thus, management has difficulty in determining the point of maximum advantage in each individual case. The optimum point of usage is in practice difficult to determine for any specific company. In fact, it appears to be a sort of oscillating equilibrium which changes when conditions change. For example, changing job characteristics might place new demands upon the selection techniques for that particular job.

4. Those companies that do not make use of psychological tests agree that, at times, errors in judgment might have been prevented had tests been used (Chesapeake and Potomac Telephone Company of Virginia, Chapter I).

Conclusions

1. Without exception in this study, those companies which employ a sound testing program agree that better selection and placement decisions can be made when test scores are known. Thus, motivation and training of the individual is, in many cases, all that remains in a complete program to recruit personnel.

2. When used within the framework of an adequate personnel program, tests do, in the long run, ensure a more efficient and productive work force. This condition has been found to be the result of several situations including:
 - a) Some individuals, knowing that they cannot pass the tests do not apply. Thus, the employer's attention can be centered on a more selective group of prospects.
 - b) Individual differences can be more easily determined whereas in the pre-testing era, management was forced to make judgments based only upon subjective data.
 - c) Because of the employer's ability to recognize these individual characteristics, employees can be placed more effectively. Thus, a better adjusted and consequently, more productive employee is the end result.
3. It is essential that tests be properly used and interpreted. Customarily, this requires that they be tried out in each situation to determine their value. The proper use of tests also is dependent upon a clear understanding of the functions performed in a specific job, and

some agreement among managers and supervisors as to what constitutes acceptable job performance. In most instances this requires that a complete system of job evaluation be available so that the tests can be tailored to the jobs.

4. Tests should not be expected to solve all of a company's personnel problems. As a supplementary aid to sound existing procedures tests are of inestimable value. When apparently valid and reliable tests indicate that an individual will do well on the job yet he turns out to be a failure, the tests should not necessarily be thought of as an inadequate device. Motivation is a key factor in satisfactory job performance, and unless this factor is present, the employee is not likely to do good work - no matter how well he performed on the tests. The test is not a panacea. It should not be expected to resolve all of an employer's difficult personnel problems. Rather, the test is a measurement device which enables the employer to acquire more information about an individual's characteristics.

5. Testing does not cost - it pays. In all inquiries made into this matter by the writer, employment managers of all participating companies currently using tests, agreed as to the positive value of testing. Not one indicated that an equally good job could be done without the use of tests.

Testing systems initially are not expensive to install. However, when the personnel administrator is asked to show tangible monetary gains as a direct result of using psychological tests, he has a very difficult task. Seemingly, the expense of any testing program is impossible to justify. The following factors are suggested as barometers by which test results can be measured:

- a) Turnover
- b) Absenteeism
- c) Tardiness
- d) Grievances
- e) Plant morale
- f) Accident rates
- g) Transfers.

The improvement of a few percentage points in any one of the above factors should be more than worth-while

to the employer in terms of increased productivity. How can one measure, in monetary terms, the worth of increased morale which results from more satisfactory placement of the individual on the job? Admittedly, these factors do not easily lend themselves to accurate measurement. But, the fact that they do arise as a direct result of the institution of a testing program is not questioned.

However, management is still inclined to select a testing program on the basis of comparative costs rather than comparative advantage. This is the first step in the wrong direction. If the employer is not convinced that testing pays, he should utilize the services of the local state employment office. This should at least give the employer a better realization of the nature of industrial testing. All too often management officials purchase the mail-order, package-type program merely because of the low initial cost.

The success of any industrial testing program depends, in large measure, upon the director or the person in charge of this function whose responsibility it is to administer the tests and measure and evaluate the results of the tests. In many of the larger companies, a trained industrial psychologist is a

full-time member of the personnel staff. In other companies, consulting psychologists are used on a part-time basis. In still other companies, this function is performed by a staff member who has had some special university training in the testing field.

The type of tests which are available to industry (see Appendix C) depend, to some extent, upon the qualifications of the testing program director. However, only in the very large companies is it considered necessary to staff a full-time psychometrist. Adequate testing programs and services are available to companies at all levels. A partial listing of apparently reputable testing companies is listed in Appendix C.

In summary, the author wishes to emphasize that contrary to much popular belief psychological testing in industry is currently being used successfully on a large scale. With the development of public testing services by the United States Government, a tailor-made program is now within easy grasp of every employer throughout the nation.

With the increased emphasis on specialization of labor, every employer needs to make the first choice the correct choice. As a result of the growing role of the strict seniority system, it has become even more

important for management to do the best possible job of employment screening.

The question in the minds of informed management should not be whether or not to have a testing program; but, rather what kind to have.

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APPENDIX A

Limitations on the Use of Personnel Tests¹

FACTORS DETERMINING THE USEFULNESS OF TESTS. A standardized test or battery of tests is a precision instrument devised for a specific purpose. When properly employed, such an instrument can be of great assistance in the solution of many personnel problems. Improper use and/or incorrect interpretation of personnel tests can cause harm to both worker and employer, and can interfere with the personnel programs of those who use tests properly.

To be of fullest value to the person taking the test, and to the employer relying upon the test results, previous knowledge of the test's contents should not be readily available. All reputable distributors of personnel tests attempt to keep their test instruments out of the hands of persons who would use them in such a way as to make the test results invalid. Distributors sometimes fail in this endeavor in spite of all precautions.

The usefulness of personnel tests is limited by:

1. Adequacy of developmental and standardization procedures
2. Conditions of administration
3. Methods of interpretation.

IMPROPERLY STANDARDIZED TESTS ARE USELESS. It is imperative that tests must be standardized if they are to yield the desired results. Tests are measuring instruments and those applied for the determination of human characteristics and aptitudes should be relatively as valid and reliable standards as are the instruments used for measuring sizes, weights, and other physical factors in industry.

1. Abstracted from Personnel Handbook, edited by John F. Mee. The Ronald Press, New York, N. Y., pages 354-366, 1958.

Validity. Test standardization procedure involves the determination of the validity of the testing instrument. This is an indication of the significance of the test. A valid test will show a significant correlation, or relationship, between success on the test and success on the job. A valid test for insurance salesmanship would be one on which good underwriters make high scores, in general, and on which poor underwriters generally make low scores. A test that provides a significant measure of the capacity, skill, or trait, that it was designed to measure is a valid test.

Test validity is determined by statistical procedures and is usually indicated by a coefficient of correlation. A correlation coefficient between 0.00 and 0.20 is considered too low to indicate any significant relationship between the variables (test scores and job success). The number of personnel used to standardize the test and the reliability of the test are factors to be taken into account in determining the size of significant correlations. These are technical considerations which require the judgment of professionally trained test experts. It is a waste of time and money to give improperly standardized tests, or tests which have not been validated for the specific purpose intended.

Reliability. Test standardization procedure also involves the determination of the reliability of the testing instrument. On the butcher's scale a pound cut of meat should weigh 16 oz. If the identical cut weighed 16 oz. one time, 17 oz. on a recheck, and 15 oz. on a third weighing, the scale would be classed as distinctly unreliable. A test which yields variable results on different occasions is unreliable, in general. Elements of chance and effects of practice will produce some variations in scores, but these will not greatly affect reliability. The correlation coefficient between scores made by a group of personnel on two separate testings should be 0.85 or above if a test is to be considered reliable.

Norms. Test standardization procedure further involves the preparation of tables of performance scores for standard groups of personnel. These are the norms which can be used for comparison in evaluating the test

performance of new applicants or other personnel to whom the tests have been administered. The usefulness of test norms is determined by:

1. The size of the standard group on which the norms are based.
2. The extent to which the standard group is representative of personnel on whom the test will be used later.

Local norms should be prepared as soon as possible after the inauguration of a personnel testing program. Such local norms will be more accurate and useful than published test norms. The standard group upon which the published norms were based may not be representative of the local labor supply.

IMPROPERLY ADMINISTERED TESTS ARE USELESS. The proper administration of personnel tests is essential to the securing of valid and reliable scores. Administrative procedures involve the following steps:

1. Preparing the applicant, trainee, or present employee.
2. Preparing the testing situation.
3. Preparing the test materials.
4. Preparing instructions for the test administrator.
5. Preparing for scoring and reporting results.

Preparing the Person to Be Tested. The applicant, trainee, or present employee will not have a favorable attitude toward personnel tests if he has not been prepared beforehand. Preliminary orientation should provide the following information regarding company policy and experience:

1. Tests are used as part of the hiring process.
2. Job placement has been improved through use of tests.

3. Tests are given to assist the applicant as well as the company.
4. The tests will be of various types, and it is important to follow directions carefully and strive for as high a score as possible.
5. It is best to treat the tests as an interesting and important game to be won, but not to worry beforehand about the final outcome.
6. Test results of present employees will not be the basis for demotion or layoff.
7. Test scores are often used as a partial basis for decisions on promotion and advancement.
8. Test scores become a permanent part of an employee's record with the company.
9. Present employees are sometimes asked to volunteer for testing in connection with the company's personnel research program.
10. Present employees may discuss their test results with the director of the testing program.

Preparing the Testing Room. The testing environment should be as favorable to good performance as possible. Actually, it has been found that unfavorable physical factors affect test scores somewhat less than one might expect. However, from the standpoint of both personnel relations and public relations, good testing conditions are important because of the impression they leave with the applicant for employment. If the test experience is a pleasant one, it will favorably influence his later attitude toward his job and the company as a whole. If he is rejected for employment, the quality of the test experience may determine whether he will be a company booster or knocker thereafter. Good test conditions include:

1. A personable, courteous, patient, and sympathetic test administrator.
2. Pleasant, quiet, well-lighted, well-ventilated, acoustically adequate room or auditorium.

3. A comfortable seat and ample, uncramped, writing area for each individual.
4. Sufficient separation of persons tested to permit and foster individual work without undue or officious supervision.
5. Conveniently located drinking fountains and rest rooms.

Preparing the Test Materials. All equipment must be carefully prepared in advance of testing. Test booklets need to be checked and counted. If reusable booklets are included, they must be inspected for damage by marking or soiling which would make reuse inadvisable. Answer sheets, if used, should be inserted in booklets before distribution. Special pencils should be available for use with answer sheets that are to be machine scored. Stop watches or other timing equipment should be checked. All materials, including test booklets, pencils, scratch paper, and other items, should be counted and arranged according to a carefully prepared plan. No mechanical detail of the actual testing should be left to chance or to last-minute consideration.

Preparing Instructions for the Test Administrator. A test administrator must follow all instructions to the letter. If he is experienced in testing, he will do so as a matter of course. Untrained or inadequately trained test administrators are often prone to deviate from printed instructions. In some cases this will invalidate the whole test procedure.

Clear, concise but sufficiently detailed instructions should be prepared as an aid to test administrators. These instructions should include all essential steps from arrangement of the testing room and materials, through actual administration of the tests, to collection of, and accounting for, all test materials and dismissal of those tested. Here again, every step must be planned in advance and clearly outlined in the written directions to the test administrator.

Preparing for Scoring of Tests and Reporting Results.
--Machine scoring on the newer types of automatic equipment provides the most rapid and efficient way of handling many modern tests. Use of such highly efficient

equipment is justified only where the testing load is large, since average monthly rental of certain scoring machines is around \$50. When scoring is to be done by hand, a number of preparations are recommended:

1. Arrangements should always be made to record answers on separate answer sheets, if possible.
2. Scoring stencils should be prepared to fit over the answer sheets. These are punched so as to reveal all correct answers only. This permits rapid counting of total correct responses marked on the answer sheet. In some cases a stencil for counting wrong answers is an additional aid.
3. A scoring program should be prepared, with a schedule for scoring, checking, tabulating and typing of results. Rest periods should be included in this schedule for recuperative purposes.
4. A report form should be prepared in advance. Ideally, such a form will present test results in sufficiently clear and understandable fashion to insure ease and accuracy of interpretation by management.

An especially comprehensive and useful analysis of the several problems of test administration, reporting, and record-keeping has been made by R. L. Thorndike (Personnel Selection: Test and Measurement Techniques).

Order of Administering Tests.---The needs of the local situation are the main consideration in choosing the test sequence. The following suggestions are offered as a guide:

1. Administer group tests first.
2. When possible, start with a short, interesting test, or a "shock absorber" test, if indicated.
3. Give tests of trade knowledge or skill before aptitude tests, if both types are included in test program.
4. Administer personality tests last among group tests.

5. Individual apparatus tests, if used, should follow group tests. A morning session for written group tests, and an afternoon session for individual apparatus tests has many advantages.
6. The order of test administration should take into consideration the maintenance of interest, avoidance of unnecessary mental and physical fatigue, and motivation for maximum performance of those being tested.

Care in Following Directions.--It is absolutely essential that all test instructions be followed exactly. Many of the "self-administering" tests provide simple directions which almost anyone can master without difficulty. The main essential with such tests is exact timing.

In every case where practice items are provided, it is important that the person being tested work out the practice exercises himself. If he understands the practice items he will have no trouble in comprehending the requirements of the test proper.

Whenever the test items or materials are unusual in nature, test directions must be presented with scrupulous care. Time must be allowed to make certain that the directions are clearly understood. Adequate proctors must be provided to insure that directions are being followed.

Standard directions, and standard answers to questions raised about the directions, are basic to successful test administration.

IMPROPERLY INTERPRETED TESTS ARE USELESS.--Who Should Interpret Tests?--The interpretation of personnel test scores must be done by a staff member or consultant who has had professional training in psychology or education. Test results and conclusions drawn from them, together with recommendations for action, should be presented to management in simple and readily understandable form.

Correlation Scattergrams.--The scattergrams illustrate one form in which test results may be presented graphically. The two variables, performance

on the test and performance on the job, can be further analyzed statistically to secure a correlation coefficient. This is a numerical indication of the degree of relationship between the two variables. If, for example, the person scoring highest on the test also had the best performance on the job, and each of the others tested secured a test score exactly corresponding to his job proficiency, relative to the other members of the test group, then the correlation coefficient would be +1.00. This represents a perfect positive relationship between the two variables under consideration. Obviously, such perfection is not expected in personnel testing. Nor would the expectation be to find a perfect negative relationship between test scores and job performance, which would be represented by a correlation coefficient of -1.00. If no relationship at all were found in such an analysis, the correlation coefficient would be 0.00. In general, in personnel testing the goal is to secure tests which have as high a positive correlation as possible with the criterion. The criterion is some reliable measure of the worker's job proficiency, such, for example, as his production record or an estimate made by his immediate superior. The nearer the correlation between test score and criterion is to +1.00 the more valid the test results will be. A valid test is one that measures or predicts what it was designed to measure or predict, as indicated in the section on test standardization above.

Percentile and Stanine Profiles.--One of the most useful and easily understood of the graphic methods of presenting personnel test results is the Profile. Profile scales may be in terms of percentile ranks, stanines, standard scores or other selected units.

YOUR PROFILE ON THE FACTORED APTITUDE SERIES

This is the story of your profile on the Factored Aptitude Series. Your aptitudes are your ability to learn and do various kinds of tasks. Knowing your aptitude strong and weak points is highly advantageous.

There are many different aptitudes. For example: There is the aptitude to work rapidly with numbers; to understand words and ideas; to coordinate your eye and hand; to perceive likenesses and differences rapidly;

to remember; to write and talk easily; to visualize the sizes, shapes and relations of objects. And many others.

You, and everyone else, have a definite pattern of aptitudes. There are some aptitudes in which you are strong. Others, in which you are weak. For instance, your coordination may be very good, your perception average, your memory poor. Very rarely is anyone strong in all aptitudes, or weak in all of them. Rather you have highs and lows. Also, your aptitude profile looks today much the way it will look five or ten years from now.

Aptitudes play a big part in the things you do. Take as an example, a certain job. The best performers (and also the most satisfied employees) are persons with aptitudes for that type of work. They are doing a job for which they are suited. It is not "over their heads." It gives them outlet for most of their talents. This is the familiar "round peg in round hole" story. A misplaced person (someone doing a task for which he lacks the required aptitudes) is neither satisfied with himself, nor a good producer.

Testing the Aptitudes

The next question is how do we find how much of various aptitudes you have. The answer is relatively simple. Aptitudes can be measured--just as we would measure the length of a table. The temperature of a room, or the weight of a piece of metal. The measuring stick for aptitudes we call the aptitude test.

Aptitude Test Scales

You have taken some tests in the Factored Aptitude Series. Hundreds of people in many different jobs have already taken these same tests. From their scores, a scale has been built. Your scores can now be located on this scale. This is what is shown by your profile.

Percentile. One type of scale is the Percentile. The percentile ranges from a low score of 1 to a high score of 99. It shows the number of people out of 100 above and below you. Let us say you make a percentile score of 32. This means you are better than 31 out of every 100 employed adults in this aptitude. You score

lower than 67 per cent of the employed population. A percentile score of 50 is exactly average. Fifty out of every 100 workers are above you, and 50 are below you.

Stanine. The Stanine is a score on a shorter scale. It ranges from 1 to 9. It is an improvement over the percentile. Here is what your stanine scores mean:

Stanine	Meaning
1	You are in the lowest 4% of the employed population.
2	4% of employees are below you; 89 out of every 100 workers are above you.
3	11% of employees are below you; 77% are above you.
4	23 out of every 100 workers are below you; 60% are above you.
5	40% of employees are below you; 40% are above you. In other words, you are right in the middle 20% of the population, or at the average.
6	60 out of every 100 workers are below you; 23% are above you.
7	77% of employees are below you; 11% are above you.
8	89% of employees are below you; 4 out of every 100 are above you.
9	You are in the upper 4% of the employed population.

General Interpretation. Broadly speaking, a stanine score of 7-8-9 or a percentile score above 75 is above the population average. Stanines 4-5-6 or percentiles between 25 and 75 are average. Stanines 1-2-3 or percentiles below 25 are below the population average.

These scales were built from scores made by employees in various jobs. These are the people who are your "competitors." It is well to see your highs and lows as compared to them.

The profile thus shows your strong and weak points as compared to the employed population. In addition, however, you have strengths and weaknesses within your own pattern. Looking at your profile, you can see longer lines in relation to shorter lines. Possibly you have no above-average scores when compared to employees in general, but within your own pattern are definite highs and lows. You should interpret your aptitudes from these two aspects:

1. as compared to the employee population.
2. within your own pattern.

Aptitudes and Jobs

Jobs, training courses, and other activities are like people. Each has its own aptitude profile. Each requires certain aptitudes for success.

For instance, a certain job requires percentile 60 in speed of perception. You score at 20. It would not be wise for you to train for or enter this job--at least from the perceptual standpoint.

Clerical work, as an example, requires three aptitudes: Ability to understand office terms. To perceive details in words and numbers rapidly. To work with systems (such as the number system).

Most mechanical jobs require knowledge of common tools, quick perception or inspection of objects, ability to visualize spatial relations, coordination of the eye and hand.

Selling demands sales comprehension, fluency in expression, memory.

Studies have shown that for many jobs, aptitudes alone account for 70 per cent of the reason why an employee learns and works efficiently.

In companies where an extensive program of the above kind cannot well be carried on, it is customary to have small groups drifting through to take the tests, with one or two psychometrists administering the tests.

Percentile Scales.--The stanine scale was introduced during World War II to interpret scores made by candidates for aircrew training on tests developed in the Aviation Psychology Program under the direction of Dr. J. C. Flanagan. This scale has not been widely adopted as yet for interpreting industrial test scores. Percentile scales are more generally used by personnel testers in industry, although they tend to obscure the normal frequency distribution aspect.

Aid in Test Interpretation.--Sometimes it is not possible for a company to maintain a professional psychologist on its staff. This does not mean, however, that the organization must forego the use of personnel tests. Almost all the large test-distributing agencies provide trained representatives to assist business and industrial users in setting up proper methods of administering and interpreting personnel tests.

These agencies usually recommend the addition of a trained psychologist to the personnel staff of a company, whenever such an addition is in line with budgetary planning. All the larger test distributors restrict the sale of certain types of tests to industrial organizations that meet staff qualifications of professional competency.

APPENDIX B

Types of Personnel Tests¹

GENERAL APTITUDE TESTS.--The following types of tests fall in this category:

1. Mental alertness (intelligence) tests.
2. Mechanical aptitude tests.
3. Clerical aptitude tests.

MENTAL ALERTNESS (INTELLIGENCE) TESTS.--Tests in this group are designed to measure an individual's alertness in comprehending, and his speed in reacting correctly to, various types of symbols--verbal, mathematical, spatial, and the like. Symbols are the tools of human thought. Success in many types of work depends upon the ability of the employee to manipulate these thinking tools with speed and precision. Carefully standardized tests of intelligence or mental alertness provide one of the most accurate methods of measuring this capacity. It should be noted that:

1. Intelligence tests do not measure all the factors which determine human abilities.
2. Intelligence test scores alone are not likely to be accurate predictors of job success.
3. Intelligence test scores are somewhat influenced by the amount of education of those taking such tests.

Some examples of standardized intelligence tests that are economical in price and easy to score are described below.

The Adaptability Test (J. Tiffin and C. H. Lawshe, Jr.), is a 15-min. mental alertness test for personnel allocation which has been used in industry to locate:

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1. Abstracted from Personnel Handbook, edited by John F. Mee. The Ronald Press, New York, N. Y., pages 366-398, 1958.

1. Individuals who are capable of rapid learning on the job.
2. Individuals who adjust to new situations slowly but who can do well on simple routine machine-operating, assembling, packing, and similar jobs.

This test is one among a very few in this category which was originally designed primarily for use in industrial selection and placement.

The Personnel Test (E. F. Wonderlic) is a brief 50-item, 12-min. test in which the various items of each different type increase in difficulty throughout the test. This test was adapted for personnel selection from the Otis Self-Administering Test of Mental Ability. It can be scored in one minute. It has been found to be generally satisfactory for measuring, in candidates for clerical, sales, and supervisory positions, the factor of mental alertness in the use of types of symbols that are characteristic of jobs in these areas.

The Army General Classification Test.--First Civilian Edition (Science Research Associates), has recently been released for commercial use. During World War II more than 12,000,000 servicemen took the famous AGCT, which measures mental alertness, or ability to learn. No other test has been given to so many persons during such a short span of time. Three types of problems include:

1. Vocabulary, to measure the verbal factor in learning ability.
2. Arithmetic word problems, to measure the number and reasoning factors.
3. Block counting, to measure the space factor.

Administration time is 50 min., with 10 min. for practice problems, and 40 min. for the test proper. Scoring time is 1 min. This instrument has been shown to be useful as an aid in predicting success in a large number and wide variety of job assignments. The test manual presents norm scores for 125 major occupations.

The Personnel Classification Test (A. G. Wesman), is another new test of mental ability, designed to yield separate verbal and numerical scores in addition to the total score. Clear, simple directions make this test virtually self-administering to groups or individuals. Total time required is about 30 min. The wide applicability of the PCT is indicated by meaningful results obtained on groups ranging from chain-store counter clerks with only limited education to highly selected college graduates picked for executive training by one nationally known firm. This test is considered suitable for use with older applicants or employees as well as with recent high school graduates.

In some labor areas where it is desirable to secure a measure of mental ability in illiterate or foreign-speaking personnel who are unable to read English, it is necessary to use special tests constructed for that purpose.

The nonverbal Revised Beta Examination (R. M. Lindner and M. Gurvitz; C. E. Kellogg assisted by N. W. Norton) has been found useful for this type of measurement. This is a well-known revision of the original Army Beta Test which is now published in the 1948 restandardized form. Administration time is 30 min. The applicant is tested with symbols, pictures, and maze patterns instead of words, but the general factors measured are essentially the same as those measured by verbal tests of mental alertness.

The Oral Directions Test (C. R. Langmuir) is one of the most interesting variations of the mental alertness test. It is an intelligence test on phonograph records. This instrument is designed to provide a simple, valid, and practical test for use with adult groups. Many of the standard intelligence tests which are best suited for use in selecting industrial personnel, or for industrial classification, require extra reading of directions, and precise timing of the work periods. The Oral Directions Test simplifies these problems of administration and the test administrator does not need to have special training. The use of phonograph records eliminates attention to exactness in giving directions, and the timing is automatically standardized. Any available office worker will usually have the necessary qualifications for giving this test.

Transcription recordings are available with the text on two sides of a 16-in. recording, to be reproduced at 33 1/3 rpm. Standard recordings have the text recorded on 7 sides to be reproduced at 78 rpm. A complete script of the test and directions for administering and scoring are included with each record album. Administration time is 28 min., and scoring is very simple and rapid after a little practice. This test is especially suitable for screening groups of applicants for positions in business and industry when wide ranges of ability, experience, and educational background are represented in the groups tested. Illiterates can be tested in the same group with high school graduates with no embarrassment to the applicant or the examiner.

Many other mental alertness tests are available commercially, and the particular test selected will depend in each case upon a careful analysis of the personnel problems to be solved.

MECHANICAL APTITUDE TESTS.--The type and degree of mechanical ability necessary for job success varies with the requirements of the job. It has not been possible, nor is there much likelihood that it ever will be to construct a single general-purpose test of mechanical aptitude. This is due to the fact that extensive research has demonstrated the unrelated nature of both simple and complex manual and motor skills. Different industrial operations require different types of motor dexterity. Some operations place a premium on speed, some on accuracy, some on coordination, and some on combinations of these functions. Current personnel testing practice favors the design of mechanical and motor tests which duplicate the specific motor operations of the job in question.

There are available, however, a number of tests of general mechanical aptitude which have been found useful for testing industrial personnel. Some of these appear to measure some form of natural mechanical ability, while others are more accurately classified as measures of acquired mechanical skill or information. But the real question here, as in all personnel testing, is "Does the test 'work'?" If test scores bear a satisfactory relationship to success on the job, the question of what the test measures becomes a purely academic one.

The Bennett Test of Mechanical Comprehension (G. K. Bennett; G. K. Bennett and D. E. Fry; and W. A. Owens and G. K. Bennett), was one of the most widely used pencil-and-paper tests of native mechanical ability during World War II. The basic forms of this test and modifications of them were used by the Air Force and Navy and by many war industries in selection of personnel for specialized mechanical training, and in selecting students for technical and engineering training. The several published forms of this test measure an individual's ability to comprehend various types of mechanical relationships. It has no time limit, but the majority of personnel tested will finish in 25 minutes or less, and scoring requires about one minute. Three standardized forms are available for testing men and one form for testing women. The items consist of drawings representing mechanical principles and practices, with simply phrased questions about them which require a judgment on the part of the person being tested. The effects of special environmental influences and rote memory of physical laws have been reduced to a minimum by the test design.

Results indicate that the Bennett Test of Mechanical Comprehension is a very useful instrument for measuring practical mechanical understanding and insight, but it is not designed to measure manual dexterity or assembly skill.

The Minnesota Assembly Test (D. G. Paterson, R. M. Elliott, H. A. Toops, and E. Heildbreder), provides a good example of a standard apparatus test for measuring mechanical aptitude and understanding of mechanical tools. The test problems consist of a number of simple mechanical items, such as a radio switch, bicycle bell, spark plug, locknut, rope coupling, and the like, which are unassembled. A time limit is set for assembling each item. A short form of the test consisting of 2 boxes of 10 items each, requires only 20 min. to administer. The scoring time for each short-set box is 4 min. This is a type of apparatus test for individual testing which can be adapted to certain personnel selection situations. It assumes some prior knowledge of simple mechanical devices plus some degree of dexterity in manipulating such equipment. It might be somewhat useful where a few young applicants are to be hired for mechanical assembly work comparable in nature and difficulty to that of the test assemblies. However, for industrial use in the selection of adult workers, the value of this test is rather limited.

The Purdue Mechanical Adaptability Test (C. H. Lawshe, Jr., and J. Tiffin) is another of the pencil-and-paper type tests of mechanical inclination, requiring 15 min. to administer and 1 to 2 min. to score. It measures the amount of practical mechanical, electrical, and related information which an individual has acquired through past experience. The items include questions on carpentry, automobiles, plumbing, sheet-metal, machine shop, electricity and radio, and a few miscellaneous materials and processes. The test has been constructed in such a manner as to eliminate questions which might measure mental alertness rather than mechanical aptitude or knowledge. This is a useful instrument for selecting personnel for various types of mechanical work.

The SRA Mechanical Aptitudes test (prepared by Richardson, Bellows, Henry & Co., Inc.), measures 3 aptitudes in the area of mechanical ability: mechanical knowledge, space relations, and shop arithmetic. The battery is published in a booklet of 15 step-down pages and the booklet is constructed for repeated usage. One test of from 24 to 45 problems is presented for each of the 3 aptitudes measured. The person tested marks his answers on a separate answer sheet which is inserted in the booklet, and these answers are automatically recorded by the carbon method. A separate interpretive profile sheet is available.

The test booklet and manual contain all necessary instructions for administration. The total time required is 45 min. Working time on the test problems is 35 min. The battery is self-scored by counting the number of responses which are automatically recorded as correct. Scoring time is 2 min. Percentile norms are available for industrial populations.

The Stenquist Mechanical Aptitude Tests (J. L. Stenquist), were among the first pencil-and-paper tests designed to measure mechanical aptitude. They are more properly classified as measures of mechanical information. There are two forms of the test, the first requiring the person tested to match pictures of parts of machine tools, and the second requiring answers to questions about diagrams of machines and parts of machines. Scores will vary with amount of information possessed about the tools and machines pictured. This test is still used in industry, but on a much more limited scale than before the war.

CLERICAL APTITUDE TESTS.--Rapid perception of similarities among verbal and numerical symbols is an important attribute of the skilled clerical worker. The ability to make accurate decisions regarding the perceptual similarities provided by standard clerical symbols is also necessary. The basic elements of clerical aptitude are these factors:

1. Speed in spotting clerical relationships.
2. Accuracy in interpreting such linguistic and arithmetical cues.

Clerical aptitude tests have been designed to measure these factors.

The Minnesota Clerical Test (D. M. Andrew, D. G. Paterson, and H. P. Longstaff) is a test of ability to compare names, and ability to compare numbers. It requires 15 min. to administer plus time for directions, and it can be scored in approximately 2 min. This test has been widely used, and sets of norm scores are available for men and women workers, for various age groups, for different types of clerical jobs, and for different regions of the country.

The test is very useful for measuring an individual's speed and accuracy in dealing with similarities in names and in numbers. Training and experience in clerical work do not appear to affect the score on this test, so it can be considered as an actual measure of clerical aptitude. It has also been found to be a useful device in selection of workers for certain types of nonclerical jobs, such as department store packers and inspectors (Blum and Candee, Jour. App. Psychol., vol. 25). It has been suggested that the Minnesota Clerical Test should be used in conjunction with a standard intelligence test in the selection of clerical personnel.

The General Clerical Test (G. K. Bennett, Ed.) provides a varied measure of clerical ability. This test consists of nine parts or subtests which measure the individual's ability to perform typical clerical tasks such as checking accuracy of copy, alphabetical filing, simple arithmetical computations, and location of arithmetical errors. The possession of types of knowledge basic to successful clerical work is measured

by subtests on arithmetical reasoning, spelling, reading comprehension of practical office procedures, synonyms, and grammar. The several parts of this test yield scores which may be useful in placement of clerical personnel, while the over-all score can be used for general selection of clerical workers. This test should prove helpful as a supplemental aid in selection of clerical workers for promotion to more varied and less routine types of work. The General Clerical Test requires approximately an hour for administration, and can be scored in 5 min.

The SRA Clerical Aptitudes (Richardson, Bellows, Henry & Co., Inc.) provides a measure of office vocabulary, business arithmetic, and office checking. Administration time is 25 min., and scoring time is 2 min. or less. This test is designed to discover an applicant's ability to learn clerical jobs.

TESTS OF SPECIAL APTITUDES AND SKILLS.--The following types of tests are included in the special aptitude and skill category:

1. Tests of manual and motor skills.
2. Tests of spatial relations.

Manual and Motor Skills. Many types of apparatus and performance tests are available for testing steadiness, dexterity, coordination and speed of reactions, as well as other specialized muscular skills. Only a few of those currently in use will be described briefly below.

The Finger Dexterity Test (J. O'Connor) is an individual apparatus test consisting of a metal plate with a recessed tray containing brass pins. The other section of the plate contains 100 holes into each of which the person being tested must insert 3 pins which he is required to pick up together with one hand. Thus the test is a measure of a specialized form of manual dexterity, and has value as an instrument for selecting workers for some types of jobs requiring grasping and manipulation of small objects with thumb and fingers.

The Hand-Tool Dexterity Test (G. K. Bennett), measures proficiency in the use of a wrench and a screwdriver. Four bolts of 3 different sizes are mounted on one upright of a U-shaped wooden frame. The 12 fastenings of these bolts must be disassembled in a prescribed order and then the nuts, washers, and bolts must be reassembled on the opposite upright. The score is the time required to complete the task. Another candidate can be tested immediately by merely turning the frame around with no time required for rearranging the mountings.

Considerable use was made of this manipulative test in war plants, and it was found that applicants for mechanical work or training readily accepted it as a suitable device for measuring their manipulative skill. This factor of acceptance is of considerable importance in the choice of apparatus tests. A performance which appears unreasonable or silly to the applicant being tested is likely to yield unreliable results because of his refusal to take the task seriously.

The Minnesota Rate of Manipulation Test (W. A. Ziegler), is an individual performance test of hand and arm work-speed in placing and turning 60 identical colored discs. The discs are colored yellow on one flat side and red on the other surface. Four trials are given, and the total time required is 8 min. or less. The time required for the last 3 trials is taken as the score. Occupational norm scores are available for a number of types of work involving hand skills. These are useful chiefly for suggesting tasks, most of which are in semiskilled occupations, for which the test might prove a helpful personnel selection aid. It is suggested that each company using the test for selection purposes should develop its own norms.

The Purdue Pegboard (Purdue Research Foundation), is a simple and easily administered apparatus test which is designed to measure manipulative dexterity. It presents two types of problem:

1. Insertion of pegs.
2. Assembly of pegs, collars, and washers.

The Pegboard provides separate measurements for right hand, left hand, and both hands together. The first of the activities measured involves gross movements of hand, fingers, and arms, and the second activity measured involves the "tip of the finger" dexterity needed in small assembly work.

Total time for administration of the Pegboard is only 10 min., of which the working time on the test problems is less than 3 min. It is possible for a single examiner, using 10 boards, to test approximately 50 employees per hour. This type of group testing is especially desirable in industrial situations. The requirement of individual testing is the objection most often raised against the use of apparatus tests in industrial personnel testing.

The Purdue Pegboard has been tried out experimentally on several thousand employees in numerous plants, and percentile norms are available for male and female industrial workers.

Other tests have been developed by the Purdue Research Foundation. (Tiffin, Industrial Psychology.)

The Tweezer Dexterity Test (J. O'Connor), is an individual apparatus test for measuring ability to manipulate small objects rapidly with tweezers. It can be administered in from 8 to 10 min. and yields an immediate score. The apparatus consists of a metal plate containing 100 holes into which the subject places a pin which he picks up with a pair of tweezers from a recessed tray. This test cannot be considered as a general measure of manipulative dexterity, but it has value in selecting workers for specific tasks similar to that measured by the test problem.

Selecting Apparatus Tests.--In selecting performance tests involving apparatus techniques, it is always important to remember that the local situation is the prime consideration. A test which works well for one plant may be valueless for another, even though the industrial operations for which it is used as a selective instrument may appear to be quite similar. Superficial resemblance between the objective or external characteristics of test and job may be misleading. In many instances the subjective or attitude factors of the job are of most importance in determining job success or failure. That is why individual apparatus tests alone

are seldom sufficient for personnel selection. That is the reason, also, for insisting upon the necessity for developing local norm scores to fit local personnel requirements. In modern employment practice, the test battery (discussed at a later point) has been found to yield greater reliability and validity than individual tests, particularly individual tests of the apparatus type.

Users of tests of mechanical and motor skills require considerable information so as to be able to administer and score these tests accurately. (G. K. Bennett and R. M. Cruikshank, A Summary of Manual and Mechanical Ability Tests.)

SPATIAL RELATIONS.--Many types of industrial work require skill in visualizing 2-dimensional spatial relationships, and others require ability to think in terms of 3-dimensional space. Some jobs requiring such abilities are packing, wrapping, assembling, drafting, and automobile repair. Ornamental iron workers, detailers, machinists, and engineers are a few of the many other classes of workers needing ability to visualize tri-dimensional structure and spatial relations of irregular shapes.

The Revised Minnesota Paper Form Board Test (R. Likert and W. M. Quasha), is a pencil-and-paper test containing 64 items which require mental assembly of disarranged geometrical figures. Each item consists of one disarranged figure having 2 to 5 parts, plus 5 other assembled figures. The person tested indicates which of 5 assembled geometric figures would correspond to the disarranged figure if its parts had been assembled also. The administration time is 20 min. plus time for directions and practice problems. Scoring requires 1 to 2 min. only.

This is one of the tests which have been found especially useful in selecting apprentices for skilled-trade training, for screening workers already on the job when new operations requiring spatial visualization are being inaugurated, and for selecting personnel for some types of semiskilled work involving this visual factor.

The Minnesota Spatial Relations Test (D. G. Paterson, R. M. Elliott, L. D. Anderson, H. A. Toops, and E. Heidbreder), is an individual apparatus test consisting of 4 form boards with one set of blocks to be used on Boards A and B, and another set on Boards C and D. Board A is usually used as a practice test and Boards B, C, and D as the main test. Norms have been developed for different combinations of the boards. The examiner is required to pay close attention to error and time scores during administration, which means that the test can be given to only one person at a time. Administration time is 15 min. for each board, and scoring time is 1 min. per board.

This test has been found useful in the selection of personnel for tasks which require some attention to spatial details among with rapid and accurate manipulation of the work objects.

Survey of Space Relations Ability - Form A (H. W. Case and F. Ruch), consists of a geometric figure series. Each figure is subdivided into two or more parts. The problem is to indicate the component parts of the main figure from among a group of 10 accompanying parts. There are 32 items in the test. Administration time, including directions and practice problems, is 20 min. Scoring requires about 1 min. Adult norms, representative of industrial applicants of both sexes, are available.

PROFICIENCY (TRADE) TESTS.--In personnel testing there is frequently a need for a rather accurate measure of an applicant's, or present employee's, proficiency in the job or trade in which he has had prior experience or is now working. Typists, stenographers, bookkeepers, machine operators, electricians, machinists, draftsmen, and other skilled craftsmen usually apply for work on the basis of their prior experience in the trade or craft concerned. In evaluating the progress of employees during training, in selecting personnel for supervisory positions, and in recommending workers for increases in pay and responsibility, it is often helpful to have ready access to objective proficiency test scores on the personnel under consideration. Such tests are used to award merit pay increases and for retention of workers on jobs where skill may be in question. The tests are often oral.

There are a number of proficiency tests available for use in employment and promotion of personnel. Some industrial companies and large department stores use from 15 to 25 different tests of this type to select, classify, and advance their employees, but most such tests are specially constructed to meet the needs of the local situation. One store uses 20 different proficiency and aptitude tests, only 5 of which are standardized instruments, the remainder being constructed to meet the particular personnel situation.

Proficiency or trade tests are also called achievement tests. This latter terminology is used in connection with the development of written and performance tests of achievement for predicting job performance of public personnel. (Adkins, with collaboration of Primoff, McAdoo, Bridges and Forer, Construction and Analysis of Achievement Tests).

A few proficiency tests are described below to illustrate some of the types most frequently used.

The Elwell-Fowlkes Bookkeeping Test (F. H. Elwell and J. G. Fowlkes) measures knowledge of general bookkeeping theory, journalizing, classification of balances, entry adjustment and ledger closing, and various types of business reports. Administration time is 50 min., and scoring time averages less than 3 min.

The SRA Dictation Skills (M. W. Richardson and R. A. Pedersen) presents tests of speed and of accuracy on phonograph records. The Speed Album contains 3 records and the Accuracy Album 2 records. The administration time is about 40 min., and scoring can be completed in less than 5 min. on the average. The material is practical in nature and represents the kinds of letters a stenographer is generally required to transcribe.

The Seashore-Bennett Stenographic Proficiency Test: A Standard Recorded Stenographic Worksample (H. Seashore and G. K. Bennett), is designed to measure a stenographer's proficiency in producing letters from oral dictation. The test and instructions are phonographically recorded. Five letters of increasing complexity are dictated at increasing speeds. Stenographic notes are taken by the person being tested and are transcribed (without a time limit)

into typewritten letters. The five letters are dictated in 15 min. with about 5 min. additional time for instructions. Transcription requires 30 to 60 min. A summary chart and schedule of penalties is provided for scoring results. Typing is scored for neatness and accuracy, arrangement of the letter on the page, quality of stroke, and errors; English is scored for punctuation, spelling, and division of words; and shorthand is scored for omitted and substituted words. Simpler scoring methods are also suggested. Mailability of the letter is the ultimate criterion.

Sale of current forms of this test is restricted to business organizations.

A summary of tests used in selecting and upgrading clerical workers is helpful as a means of properly evaluating the different tests in the clerical field (Bennett and Cruikshank-Bussey, A Summary of Clerical Tests.)

The Purdue Blueprint Reading Test (H. F. Owen and J. N. Arnold), contains 79 problems on the theory and practice of blueprint reading. The test booklet contains instructions for self-administration. The total administration time is 35 min., and scoring time is 2 min.

The Purdue Interview Aids Series offers a number of pencil-and-paper measures of from 10 to 23 questions each, which help an interviewer in determining the skill of a particular applicant. The aids are:

1. Interviewer's rating scale (to provide an over-all rating for employment).
2. Can you read a working drawing?
3. Can you read a micrometer?
4. Can you read a scale?

Either the applicant or the interviewer may enter the information on the forms. Total administration time for each interview will range from 5 to 10 min., and scoring time is about 1 min. This type of proficiency measure provides a quick indication of the gaps, if any, in a worker's training and experience in his specialty. The

oral trade tests which have been used by employment interviewers for many years are still useful for checking proficiency of individual applicants. But pencil-and-paper interview aids similar to those listed above are preferable in many cases because they permit the testing of several applicants at one time, and are more comprehensive in their coverage of the trade or craft in question.

The Purdue Test for Electricians (C. W. Caldwell, H. R. Goppert, H. G. McComb, and W. B. Hill) is a 65 item test designed to measure technical knowledge of electricity. Problems involving the theory and practice of electrical occupations are included. The test is published in the increasingly popular self-scoring booklet form. The person being tested pin-punches the alternative which he selects from among the several possible answers provided for each question. The built-in answer sheet automatically records the selection as correct or incorrect by localizing it within a small circle if it is correct. Since there is a circle beneath the correct alternative for each question, scoring is speedily accomplished by counting the circles which are pin-punched. The person tested cannot see this answer sheet while taking the test. Total administration time is 30 min.; scoring time is 1 min.

The Purdue Test for Machinists and Machine Operators (H. F. Owen, C. C. Stevason, H. G. McComb, and C. D. Hume) measures technical knowledge of machine-shop operations by means of 133 problems on the theory and practice of machinist occupations. Besides a total over-all score of general proficiency in, and knowledge of, machine-shop practice, the test yields 5 subscores for lathe, planer and shaper, grinder, milling machine, and general bench operations. Instructions for self-administration are included in the test booklet. Total administration time is 55 min., and counting the automatically recorded scores requires about 3 min.

The Thurstone Examination in Typing: Form A (L. L. Thurstone), is one of the Thurstone Employment Tests series and has been in use for nearly two decades. This is a self-administering work sample of some common requirements of typists. There are 3 subtests in the examination booklet:

Test I -- A speed and accuracy measure of ability to retype hand-corrected copy;

Test II -- A measure of ability to arrange and type a table from handwritten copy;

Test III -- A measure of ability to recognize and delete the incorrectly spelled items in a list of 48 words.

Administration time varies from 10 min. to more than half an hour. Scoring requires about 5 min.

"Custom-built" proficiency tests are recommended for the solution of local personnel problems which involve the determination of employee experience and present skill. When it is desired to measure achievement on the job, or to measure proficiency of employees considered for transfer, or to locate departments in the plant which require supplemental training programs, the use of a specially designed achievement (proficiency) test will often simplify the process.

Proficiency standards vary from industry to industry, and in the same industry from locality to locality. This consideration is the basis for favoring the use of proficiency tests which are developed locally to meet local needs, whenever the construction of such tests is practicable.

MEASURES OF VOCATIONAL INTERESTS.--Ever since World War I, American psychologists have recognized the importance of interests in connection with personnel selection and classification. It is obvious that an employee with a strong interest in his particular job or kind of work is more likely to be a good employee than one lacking such interest, other qualifications being equal. However, it is not so immediately obvious or generally recognized that successful workers in many trades and professions exhibit characteristic patterns of interests. These patterns of interests have been scientifically analyzed by E. K. Strong and others, and instruments have been constructed for measuring the vocational significance of the patterns displayed by a particular individual.

Interests have also been measured by means of vocational information tests, by the use of vocabulary profiles, and by a number of other methods. Some of the more important commercially available measures of interests are described briefly in the following paragraphs. Many of these are possibly of greater significance in vocational counseling than in personal selection, since they were originally designed as counseling aids. Some, too--notably the Strong Vocational Interest Blanks--pose certain scoring problems which must be given careful consideration before selecting them for personnel testing. It should also be pointed out that interpretation and assessment of the significance of interest patterns require professional training and experience in the field of psychological measurement.

For the above and other reasons, some companies have failed to include the measurement of interests in their personnel testing programs. This omission is justifiable on a practical basis in many selection situations, and also in connection with some promotion and transfer procedures. But where testing is designed to locate personnel for specialized sales, accounting, research, and similar assignments, a measure of interests is definitely indicated as an essential element in the test battery. Such a measurement should also be secured in connection with the screening of personnel for specialized training programs.

The Brainard Occupational Preference Inventory (P. P. and R. T. Brainard), is a self-administering and self-interpreting inventory of individual interest patterns. The test has no time limit. Sentence form descriptions are given of 140 occupations, for each of which the person tested expresses his degree of preference. These occupational preferences are divided into 28 occupational Sections, and the 28 Sections are combined into 7 major occupational Fields: Commercial, Personal Service, Agriculture, Mechanical, Professional, Esthetic, and Scientific. Norms are provided for these Sections and Fields. There are 378 related occupations classified under the 28 Sections, and the inventory is keyed to a very large number of related occupations in the United States Employment Service Dictionary of Occupational Titles, Part II.

The Kuder Preference Record (G. F. Kuder) is a widely used inventory which is designed to measure the fundamental areas of educational and vocational interest. Nine areas are included in the measurement: Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service, and Clerical. The person tested selects the activity which he likes most and the activity which he likes least in groups composed of three activities each. There are 168 of these activity groups. Total administration time is about 45 min., and there are both self-scoring and machine-scoring forms of the record available. The self-scoring form requires approximately 5 min. for completion of the scoring process.

A short form (B1) has been developed for use in industrial situations where the longer form is impracticable. This shortened form reduces the groups of activities from 168 to 120 significant groups. Administration time is approximately 30 min. and scoring time 5 min.

The Michigan Vocabulary Profile Test (E. B. Greene) is a self-administering information test of interests. It is a measure of specialized vocabulary designed to indicate interest and predict success in a number of occupational areas. A Profile Chart facilitates the interpretation of test results for any particular individual. Administration time is approximately 50 min. and scoring is rapid.

The Primary Business Interests Test (A. J. Cardall, Jr.) was constructed to measure preferences for clerical activities. It has been found particularly useful for differentiating the various patterns of clerical interest. The person tested records his liking for, dislike of, or indifference toward specific office practices. The 75 activities measured give preference scores for: Accounting, Collections and Adjustments, Sales-Office, Sales-Store, and Stenographic-Filing. No working time is set, but total administration time is approximately 20 min. and scoring time is 2 min.

The Strong Vocational Interest Blank (E. K. Strong, Jr.) is one of the best known and most widely used measures of interest. There are forms for both men and women. The blank is designed to indicate the likelihood of success in a given field. Scoring scales for men are available for the 39 occupations and 6 occupational groups. The scores obtained on these scales provide measures of how nearly a man's interests coincide with those of the average man successfully engaged in each of the occupations. It has been found that successful people in any one of these particular fields of work tend to have fairly similar interest patterns. Therefore, a score indicating degree of resemblance between and individual's interests and the characteristic interest pattern for a particular occupation affords some indication of his chances for success in that occupation. The closer the resemblance, the greater the chance of success, other factors being equal.

The 400 items of the Strong Vocational Interest Blank are numerically weighted to yield a single plus or minus over-all score for each of the 39 occupations. A score above a critical level for any occupation is given an A-level classification, which means that the interests of the person receiving that score correspond closely to the interests of the upper 69% of individuals in the occupation. A B-level classification score indicates an interest pattern like that of the lowest 31% in the occupation, and a C-level score matches the interests of the lowest 2% in that occupational field.

MEASURES OF PERSONALITY AND ADJUSTMENT.--It is a generally accepted axiom that personality traits are related to individual success or failure in business and industry. It is also pretty generally agreed that some measure of these traits should be included in any well-rounded program of personnel testing for selection, placement, training, promotion, transfer, employee counseling, or staff reduction. Many measuring instruments have, therefore, been constructed to appraise the presence, or absence, and relative strengths of such commonly accepted personality traits as introversion, extraversion, sociability, aggressiveness, neuroticism, submissiveness, self-sufficiency, and the like.

Just how these traits are related to occupational success or failure is not always clear, and the determination of the exact degree of relationship is certainly not a simple task in any case. There can be little doubt, however, that information concerning such traits is of practical value in attempting solutions of many specific personnel problems. For example, if past experience has shown that a particular job requires a high degree of aggressiveness, a valid and reliable measure of aggressiveness will be useful in selecting future candidates to fill that position.

Current procedures in personnel testing emphasize the desirability of matching personality traits which are known to be necessary for success on the job with the traits measured by a particular test. In other words, the goal is not the measurement of personality in general, but only to measure those specific personality attributes, factors, traits, or characteristics which differentiate successful and unsuccessful employees now on the job.

It should be recognized, however, that general measures of personality adjustment can be utilized with profit in many personnel situations. This is especially true in preliminary screening of applicants for employment, and also when staff reduction is necessitated. There are always some applicants (and present employees) who are so poorly adjusted, or so emotionally disorganized, or so suspicious, depressed, or uncooperative in general that they upset the balance, warp the attitudes, and destroy the morale of everyone around them. Some of the general personality inventories now available, such as the Guilford-Martin Personnel Inventory I, are effective in locating such personnel liabilities among both potential and present employees.

The Bell Adjustment Inventory (H. M. Bell) has been used extensively in college personnel work for over a decade, but has been somewhat neglected by industry until recently. This is partly due to the fact that all measures of this type require considerable professional training in psychology for adequate interpretation of results.

The Adult Form of the Bell Adjustment Inventory has 160 items which are to be marked "Yes," "?," or "No." The 5 areas of adjustment measured by the test are Home Adjustment, Health Adjustment, Social Adjustment, Emotional Adjustment, and Occupational Adjustment. The Occupational Adjustment score gives an indication of how well a person likes his job, his working environment, his associates, and his superiors.

Administration time is usually less than half an hour although there is no time limit for completing the inventory. Scoring time is approximately 5 min.

The Bernreuter Personality Inventory (R. G. Bernreuter) is a time-saving combination of the best features of several earlier personality appraisal tests. This self-administering inventory contains 125 items designed to reveal evidences of neurotic tendencies, dominance, introversion, self-confidence, self-sufficiency, and sociability. There is no time limit for the inventory, but most persons finish in less than 30 min. The test consists of one basic form, with 6 separate scoring stencils for determining scores on the 6 component traits. The original lengthy scoring process has been shortened considerably by scaling only the values for neurotic tendency (BI-N), dominance (B4-D), self-confidence (FI-C), and sociability (F2-S). These four measures provide an appraisal which is closely related to that obtained by use of all 6 of the original scales. This reduction of scoring time by one-third has extended the practical usefulness of the inventory.

The Bernreuter Inventory has been utilized for locating leadership and executive talent among present workers, and it has also been used extensively as a device for screening out the maladjusted applicant, and potential trouble-maker, during the personnel selection process.

The Guilford-Martin Personnel Inventory (J. P. Guilford and H. G. Martin) provides 150 questions which are related to common experiences of business and industrial workers. Unlike the questions on many personality scales, the Personnel Inventory items do not arouse antagonism because of being too personal in nature. This scale is designed to uncover individuals

who tend to be extremely self-oriented and to take everything personally (lack of objectivity), belligerent (lack of agreeableness), and hypercritical (lack of cooperativeness).

No time limit is set for the inventory. Over-all time is usually 30 min. or less. Answer sheets are published for machine scoring of results, and these are recommended over hand-scoring keys on this and most all of the current measures of personality, whenever IBM (International Business Machines) machine-equipment is available.

The Heston Personal Adjustment Inventory (J. C. Heston), is one of the more recent measures designed to avoid some of the main objections to earlier personality questionnaires. This is an objective analysis of the basic personality patterns which are characteristic of the normal individual. It measures the following well-established and easily interpreted personality traits:

1. Analytical thinking.
2. Confidence.
3. Sociability.
4. Personal relations.
5. Emotional stability.
6. Home satisfaction.

There is no time limit, but most people require about 45 min. to complete the items. Separate answer sheets for machine scoring are available, or the test may be scored easily by hand in less than 5 min. Stable and representative norms are provided for the different age levels and for both sexes.

The Incomplete Sentence Test (G. Spache) is a new type of projective personality test which has recently been designed for industrial use. This device shows considerable promise as an indicator of emotional problems, feelings toward certain situations and people, and attitudes toward work, energy output, and vocational adjustment. It is also intended as an aid in the study of labor relations, morale, and employee turnover.

This sentence completion test consists of 84 words or phrases to which the person tested adds the first thought that comes to his mind. It can be administered in approximately 15 min., but it cannot be easily scored or interpreted. It is not a mechanical device for classifying workers. It promises, however, to be especially valuable as a method of turning up definite clues concerning the sources and nature of a particular employee's personality difficulties.

Specimen sets of this test, consisting of Form M (for men), Form W (for women), and a manual of directions, are available from its originator.

MISCELLANEOUS TESTS.--Among the great variety of miscellaneous personnel tests currently in use in industry, there is one that relates to the key person in industrial production--the industrial supervisor:

How Supervise? (Q. W. File and H. H. Remmers) is designed to aid business or industrial organizations in obtaining a clearer picture of its supervisors' understanding of the more important aspects of their jobs. It can be valuable as an aid--

1. In selecting candidates for supervisory training.
2. In measuring the results of supervisory training programs.
3. In selecting individuals for upgrading.
4. In checking the attitudes of present supervisors to discover their areas of weakness.
5. In indicating how supervisors feel about certain company policies.
6. In the counseling and interviewing of supervisors.

The supervisor's knowledge and insight concerning human relations in industry is recognized as being of vital importance to the success of any industrial undertaking. Therefore, a measure of this knowledge and insight, such as is provided by How Supervise? can be a very important tool in industrial production. The

test measures the supervisor's understanding of the general aspects and problems of supervision. However, a supervisor may know what he should do, but still may not make the best use of his knowledge. On the other hand, it is quite certain that a supervisor who lacks an understanding of the basic principles of good supervision will fail to make the right decisions on the job. How Supervise? is a convenient aid in selecting candidates for supervisory training who already possess considerable knowledge about correct supervisory practices.

There are two forms, A and B, of this test, with 70 items on each form. It is recommended that both forms be administered when the test results are to be used to interpret individual cases. Administration time varies from 15 to 40 min. (there is no time limit) with most individuals finishing in less than 30 min. Scoring time is about 2 min.

The Personnel Measurement Factored Aptitude Series (J. E. King) contains 17 miscellaneous tests for use in business and industry. The aptitude factors and the names of the tests designed to measure them are listed below:

8 Factors	17 Tests
1. Comprehension	1. Office terms 2. Sales terms 3. Scientific terms 4. Mechanical terms 5. Tools
2. Reasoning	1. Judgment 2. Differences
3. Systems	1. Numbers
4. Perception	1. Perception 2. Precision
5. Fluency	1. Fluency
6. Memory	1. Memory
7. Space Relations	1. Dimension 2. Parts 3. Blocks

8. Coordination

1. Motor
2. Dexterity

The Factored Aptitude Series offers the great practical advantage of short testing time. Five-minute time limits for the separate tests were established after extensive research. It is possible, therefore, to achieve complete coverage of the aptitudes in any one of the 6 basic Job Families (1, Clerical; 2, Mechanical; 3, Sales; 4, Scientific-Technical; 5, Office Administrative-Supervisory; 6, Factory Administrative-Supervisory) in 30 min.

Ease of administration and ease of scoring are additional features of the series. A clerk can be trained to administer and score the tests. Scoring requires less than 1/2 min. per test. However, the mechanical ease and simplicity of these measures should not mislead anyone to the conclusion that interpretation is also a mechanical process. Only a person trained in psychology or education is qualified to draw conclusions from scores obtained on the Factored Aptitude Series.

APPENDIX C

A REPRESENTATIVE LIST OF STANDARDIZED PERSONNEL¹ TESTS.--The following list includes a large number of the tests available in the personnel field. Brief descriptions of many of these tests have been given under the heading of "Types of Personnel Tests" in Appendix A.

Mental Alertness (Intelligence) Tests:

Adaptability Test
Army Alpha Test
Army General Classification Test
Benge Test of General Knowledge
(Benge Employment Tests)
California Test of Mental Maturity
Oral Directions Test
Otis Self-Administering Test of Mental Ability
Personnel Classification Test
Revised Beta Examination
Wonderlic Personnel Test

Mechanical Aptitude Tests:

Bennett Tests of Mechanical Comprehension
Detroit Mechanical Aptitudes Examination
MacQuarrie Test for Mechanical Ability
* Minnesota Assembly Test
Purdue Mechanical Adaptability Test
SRA Mechanical Aptitudes
Stenquist Mechanical Aptitude
* Stenquist Mechanical Assembly Test

Clerical Aptitude Tests:

Benge Clerical Test D
General Clerical Test
Minnesota Clerical Test
Purdue Clerical Adaptability Test
SRA Tests of Clerical Aptitude

1. Abstracted from Personnel Handbook, edited by John F. Mee. The Ronald Press, New York, New York, pages 407-408, 1958.

Special Aptitudes and Skills Tests:

- * Finger Dexterity Test
- * Hand-Tool Dexterity Test
- * Minnesota Rate of Manipulation Test
- * Purdue Hand Precision Test
- * Purdue Pegboard
- * Tweezer Dexterity Test

Spatial Relations Tests:

- * Kent-Shakow Industrial Form Boards
- * Minnesota Spatial Relations Test
- Revised Minnesota Paper Form Board
- Survey of Space Relations Ability

Proficiency (Trade) Tests:

- Blackstone Stenographic Proficiency Test
- Elwell-Fowlkes Bookkeeping Test
- Employee Skill Series
- Purdue Blueprint Reading Test
- Purdue Industrial Mathematics Test
- Purdue Interview Aids Series
- Purdue Test for Electricians
- Purdue Test for Machinists and Machine Operators
- Scott Company File Clerk Test
- Seashore-Bennett Stenographic Proficiency Test
- SRA Test of Dictation Skill
- Thurstone Examination in Typing

Interest Inventories:

- Brainard Occupational Preference Inventory
- Kuder Preference Record
- Michigan Vocabulary Profile Test
- Primary Business Interests Test
- Strong Vocational Interest Blank for Men
- Strong Vocational Interest Blank for Women
- Thurstone Vocational Interest Schedule

Measures of Personality and Adjustment:

- Bell Adjustment Inventory
- Bernreuter Personality Inventory
- Employee Attitude Series
- Guilford-Martin Personnel Inventory
- Heston Personal Adjustment Inventory

Miscellaneous Tests:

How Supervise?
Factored Aptitude Series

Test Batteries:

Industrial Test Battery
The Differential Aptitude Tests
Personnel Measurement Series

Tests marked with an asterisk are individual apparatus tests which require close supervision by the examiner during administration. They can be given to only one or, at most, to a very few individuals at one time. This limitation adds greatly to the cost of administration.

ORGANIZATIONS PRODUCING STANDARD TESTS (A Partial List)

Eugene Bengé and Associates
20 North Wacker Drive
Chicago, Illinois

California Test Bureau
5916 Hollywood Boulevard
Los Angeles 28, California

Houghton Mifflin Co.
432 Fourth Avenue
New York City 16, New York

D. G. Humm, Personnel Service
P. O. Box 1433, DeValle Station
Los Angeles, California

Johnson O'Connor Research Foundation
11 East 62nd Street
New York City 21, New York

Management Service Company
3136 North 24th Street
Philadelphia, Pennsylvania

Industrial Psychology, Inc.
New York, New York

National Office Management Association
545 Fifth Avenue
New York 17, New York

Psychological Corporation
522 Fifth Avenue
New York, New York

Psychological Institute
3506 Patterson Street, N. W.
Washington 15, D. C.

Public School Publishing Company
Bloomington, Illinois

Science Research Associates
57 West Grand Avenue
Chicago 10, Illinois

Stanford University Press
Stanford University
Stanford, California

E. F. Wonderlic
750 Grove Street
Glencol, Illinois

World Book Co.
Yonkers-on-Hudson
New York

For Interview By: _____

Disposition: _____

Name _____

Date ____ / ____ / ____

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SUMMARY COMMENTS

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EVALUATION OF INDUSTRIAL TESTING PROGRAMS

by

William Leonard Owens, Jr.

ABSTRACT

This study is concerned with the desirability and feasibility of a well-planned industrial testing program which will improve a company's over-all efficiency by improving the skill, knowledge, and attitude of the employees.

A careful study has been made of the material already published and available on the subject of testing programs, consisting of a historical background of training, consideration of the use of testing as a personnel device, and a detailed discussion of the various types of tests and testing programs. Case studies have been made of several selected industries and personal interviews made with management and personnel officials to determine their attitudes toward testing.

An evaluation has been made as to the justification of testing programs, pointing out some of their weaknesses and suggesting possible solutions.