RECENT DEVELOPMENTS IN INDUSTRIAL SELECTION TECHNIQUES.*

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INTRODUCTION.

THIS paper is chiefly concerned with the recent developments in industrial selection techniques at these works. However, below its chocolate covering, I hope you will find that its centre, although still recognisably confectionery, contains ingredients, varied in origin and possible other use, possessing, if properly masticated and adequately digested, fundamental values not specific to chocolate.

INFLUENCES SHAPING THE PROCEDURES.

Before going on to describe to you the current practices of the Selection and Training Department in this organization, I should like to indicate very briefly what has mainly influenced us in shaping these procedures. To the established personnel policy of this company as outlined by Seebohm Rowntree in *The Human Factor in Industry*, the psychologists in the Personnel Division owe their existence of course. This foresight I wish only to acknowledge before describing the forces that have chiefly influenced us in the last three years. These are the psychological research in the field of mental measurement, the personnel selection procedures of the Army and the Navy from 1942, recent studies in industrial mental health and, lastly, the present-day labour supply in this area.

Psychological research in the field of mental measurement has not been confined to test construction and test experimentation. Much work has been done on studies of the reliability and validity of these instruments of mental measurement so that there is available for the practising industrial psychologist very many well tried statistical devices with which to examine his procedures. The examination of testing programmes with such statistical procedures as the calculation of correlation coefficients—particularly in examining reliability and validity of the testing procedures—and analyses of variance and covariance (with particular reference to the grouping of data) has resulted in the rejection to the rubbish heap of a fair collection of imposing psycho-physical apparatus and shattered many dearly held beliefs of the significance for prediction purposes of many aspects of human behaviour.(1) So-called tests of aiming, steadiness, finger reaction and endurance, on electrical-contact apparatus and dynamometers have not survived an examination of the relationship between

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test and re-test scores. Furthermore, factor analysis methods of studying the inter-correlation of test results and job performance have provided a means of indicating on the one hand the extent to which performances on apparently dissimilar tests are expressions of one ability, and on the other hand, the pattern of human abilities involved in doing satisfactorily a particular industrial task.

The net practical results of our own application of the research worker's statistical methods are (1) we have very much reduced the number of psychophysical tests used in our selection procedures; (2) we know a group of our tests can be combined to give a measure of a practical ability somehow related to efficiency in the workrooms, and (3) a short test of verbal intelligence is a useful component in a selection battery used in this organization.

Statistical mathematics are a fascination in themselves and some notion of them is essential to the establishment of technically sound procedures. From the application of selection techniques in practice, however, much is to be learned in terms of administrative convenience and practical feasibility. In this direction the psychologists at the Cocoa Works, as elsewhere, owe a great deal to the widespread use of psychological techniques of selection in the Armed Forces during the war.

From the industrial psychologist's point of view the greatest effect of the services' procedure has been the publicity accorded psychological selection methods. I am not referring to the correspondence columns in *The Times* and *Telegraph*, but to the spread of knowledge of selection tests among those who took them. In our daily contact with present and future employees we meet few men who have not already had personal experience of the kind of procedure we have adopted. This in the great majority of cases is a great help. Furthermore, the services showed that within agreeably acceptable limits it was possible to apply sound selection procedures to large numbers in a short time. This has naturally brought the industrial psychologist to pay attention to considerations of administrative convenience in his design of procedure. Those techniques of academic psychology that make great demands on the time of subject and examiner are not appropriate in employee-employer situations. Somehow or other the psychologist must fit his procedure into the existing administrative machinery of engagement procedure. Two further influences of service experience are related to details of practice. The first of these is the use of standard biographical questionnaires suitably designed to contain information supplied by the candidates, interviewer's notes and data for record and research purposes. The second is the importance placed on the interview—not only as a means of eliciting information about the candidate, but as a final opportunity to ensure that the candidate is fully informed on every aspect of the many possibilities of the selection proceedings—to this is closely associated the importance to good selection of obtaining the candidate's co-operation in choice of job where a choice is available. A last lesson from services selection procedure relates to the evidence provided by certain Naval investigations(2) in which it was demonstrated that psychiatric screening within an acceptable range of errors either way could be carried out by lay assistants given appropriate training in "spotting."

The possibility of this screening is important in view of the recent findings of that important contribution to industrial mental health—Russell Fraser's report on incidence of neurosis among factory workers. This report undoubtedly implies a need for careful personal interviewing of applicants for work and for careful examination of jobs for the demands they make on workers not only in terms of physique, intelligence and aptitude, but also in terms of social interaction with which an inability to cope constitutes, in greater or less degree, what has commonly become known as instability. The service investigations and the Russell Fraser report have together contributed to the shaping of that part of our present procedure concerned with questions of personal stability in a factory environment.

Overriding all other influences in the development of our procedure is that of the demands made on our services. Naturally we are attempting to provide the service called for. It might appear at the present time in York (and, indeed, in very many other parts of the country) that as long as there are fewer candidates than there are jobs there is no need for specialist services in the field of selection. But in my view psychological methods are being used at their best in just such a situation—in which the problem shifts from "which few of these many shall I have" to "what is the best possible way of matching these few to the jobs available."

The Procedures Described.

Having made that brief introductory acknowledgment of some of the influences that have shaped it, I should like now to go on and describe our selection procedure in detail.

Procedures have been evolved to meet the following requirements:

Selection and placement of beginners in the factory (girls, boys, women); the assessment of beginners in the offices (girls, boys, women and men); the selection of apprentices (building and engineering trades only); assessment of applicants for promotion in the factory; assessment of applicants for staff appointments (promotion candidates, depot managers, technicians, salesmen, etc.).

In all cases three distinct tools are employed: First, a biographical questionnaire completed by the candidate; secondly, an individual interview; and thirdly, appropriate standardised psychological tests. The use of these together constitutes a fairly recent development in selection techniques in a private firm, although the National Institute of Industrial Psychology has been making use of the combination in its vocational guidance work for a very long time and is at present doing much to spread its use throughout industry.

The biographical questionnaire we use is a single sheet, foolscap size, with a 2-inch blank margin down the right-hand side and a 3-inch section at the bottom marked "Do not write here." This section contains a row of 12 mystic letters. Beside each of the first seven of these the interviewer enters a query (?) if during the interview there has come to light anything unusual with reference to work record, attitude to health generally, eating and sleeping in particular, powers of endurance, feelings of sensitiveness, relations with the

police. The last five refer to height, weight, vision, colour vision and handedness. Below these hieroglyphics is a table for the entry of test results.

The rest of the form has, in addition to a section at the top asking for name, address, age, date of birth, married or single, four sections. These relate to the occupation, education, recreation and social contact activities of the candidate (i.e. membership of youth organizations and clubs and experience of controlling other people).

In Section 1—occupation—the form covers candidate's present job, how long at it, job wanted here, relatives and friends here, time in Services and rank held; there then follows a blank section in which the interviewer traces the candidate's work history from age on leaving school—given in the next section—to present age, recording time spent on each job and the reason for leaving.

In Section 2—education—the questions relate to name of last school, age on leaving school, class, certificates won, training since leaving school.

In Section 3—recreation—the instructions are: "Underline any of the following things you do or have done in your spare time, add any other hobbies you may have." Then follow three columns of items and a column of blank lines. In the first column are mainly activities of a practical nature (mechanical repairs, woodwork, painting, etc.), the second mainly aesthetic and intellectual (music, reading, discussion), and the third mainly physically active (games, swimming, etc.). The blank lines are for the addition of interests not quoted.

Section 4 is concerned with the social contacts of the candidate, asking him if he was a member of clubs or youth organizations, if ever in charge of someone, if he has ever taught anyone anything.

This form is completed by the candidate with the aid of one of the department's technical assistants. It is important that this assistance is at hand at this time.

The candidate then does whatever tests are appropriate. Before discussing these in detail I should like to go to the next step in the procedure—the psychologist's interview, as this is closely tied up with the form's design.

This interview does not follow a particular sequence, but the ground covered is well defined. This has already been indicated by the biographical questionnaire on which the interview is based. It is the interviewer's aim to supplement the contents of the form, noting special points in the blank margin and conclusions in the blank space at the bottom. It is usual to get the candidate to give a brief *résumé* of his school, work and service career, to expand on the interest items underlined, to describe his family background and his general health over the last five or six years. The contribution of the interview to the selection procedure is two-fold. First, it provides additional information in the way of personal explanation on the actual attainments and experience of the candidate. Secondly, it provides the evidence upon which some picture of the candidate's disposition can be formed. It is on the interview entirely that we depend for clues of an instability likely to limit a candidate's industrial usefulness. Instability may be inferred from either verifiable facts about the candidate or, less tangibly, the attitude adopted in relation to certain topics. The facts we have found bearing useful clues to instability are those relating

to job record (many jobs with poor reasons for leaving), reduced social contacts (no clubs, no friends, or close associates), few interests (no games, hobbies, pets, etc.), no roots (no regular home contact or family associates), and, in contrast, overwhelming domestic responsibility. The subjects to which too emotional an attitude is a danger signal are ill-health, sleeping and eating, and lack of physical endurance.

I do not want to emphasize this particular aspect of our selection procedure, but it is of interest that we find about a third of our women candidates need special consideration for placement and follow-up on these grounds—this figure is similar to the proportion of women in industry reported by Russell Fraser as having suffered from neuroses.

The final step in the interview is to try as far as possible to come to some agreement with the candidate on the kind of job for which he or she is best suited.

That, with minor adjustments to suit the case, is a brief indication of the part played by the interview in each of the selection procedures I have mentioned. Whatever the job, it is desirable to have a well designed biographical questionnaire on which all data on a candidate can be assembled, which can be used in the competitive situation as the basis for candidate comparison, and later, in all cases, as the instrument for records and research.

Selection Procedures at Different Levels.

Whatever the job, it is sound personnel practice to know all there is to know of the employee's occupations, education, recreation and social contacts. Consequently our programme of biographical questionnaire and individual interview by a psychologist is the same for all jobs—beginners in the factory, beginners in the offices, apprentices in the engineering and building departments, promotion candidates in the factory and applicants for staff appointments. The testing practices, however, vary considerably. I should now like to describe the tests we use at these different levels.

The Selection and Placement of Beginners in the Factory.

This is the area of our activities in which most research has been done on testing procedures. Girls and women, before engagement, take a battery of psychological tests which cover (1) intelligence, (2) practical ability for factory purposes, (3) strength of grip, and (4) specific aptitude for certain types of factory jobs.

The use of tests for the selection of factory operatives is not a recent development in industry, but their systematic use for all entrants, including those for non-competitive vacancies, is unusual in this country. The actual battery used here is unique, containing components devised and standardized at these works.

The intelligence test has been introduced to give a rough assessment of intelligence—we are interested in knowing whether an applicant is in the top 5 per cent. or bottom 5 per cent. of the factory population—for both of which sections we think rather special placing and training is required. This, we

believe, a short ten-minute intelligence test might tell us accurately enough. It is, however, very difficult to construct a reliable short test. The one we have produced contains 17 items of the completion type :

Hot, cold ; up, down ; in . . .

11, 9, 7, 5, . . .

It has a high reliability within itself and a very high correlation with one of our longer intelligence tests. Its shortness gives it a great deal of value in terms of administrative convenience.

The so-called practical ability test is the combined scores of two card-sorting tests, the Seguin Form board and a specially designed form board. The test scores are totalled because analysis has shown that the four tests measure much the same qualities, though in varying amounts. The name given to the summed score—practical ability—seems a reasonable description from the performance nature of the component subtests and from the fact that there is a significant positive correlation between the battery's total score and the efficiency of workers assessed in terms of quarterly outputs.

To measure strength of grip we use the dynamometer—taking a measure of the strength of grip of the dominant hand. There is an area of work in the factory for which a weak grip renders the operative unsuitable. The test/re-test reliability of this instrument is not as high as would be desirable.

Now for three new tests which have recently been designed for the specific purposes of assisting us in the placing of candidates in one of three broad groups of factory jobs. It is possible to go over all the jobs in a factory and classify them in a variety of ways—physical requirements, mental requirements and so on. It is also possible to classify them according to differences in the conative elements of the working situation—that is, differences in the striving aspect of the situation. In this respect a large proportion of our factory jobs can be classified accordingly as the operative is :

(*a*) Being fed by a machine.

(*b*) Feeding a machine.

(*c*) Assembling by hand individual units to form larger units.

(In the first, things are coming at you and you are striving to do something about it ; in the second, you are striving to push things into the ever-opening jaws of an insatiable monster, and lastly, you are sitting by yourself striving to keep at it, putting little things together into bundles.)

So we have devised three analogous test situations.

(1) The candidate stands at a conveyor belt arrangement and turns the knobs of passing units.

(2) The candidate feeds with her hands wooden plates to a semi-automatic machine that she operates with her foot, so that a plunger may be directed through the holes in the plates.

(3) The candidate is given sets of imitation chocolates and cartons and asked to pack the chocolates into the cartons.

Now these three tests make, we believe, a sensible finish to the selection procedure. Their relevance to jobs in our factory is obvious. Although the tests can be scored and although they have been proved reliable and shown to be in some measure valid for selection purposes they have an additional value

as media through which the candidate can express a personal preference for kind of factory work. Whether preference for a test is a reliable guide to suitability for an analogous job is a subject we are now investigating.

That is the group of tests we use for factory entrants—women and girls. For boys and youths the three analogous tests are replaced by a standardized arithmetic test, since arithmetical attainment to a certain level is the *sine qua non* of success of a whole group of jobs filled by boys and youths—packing and stores, stores control, sampling, etc.

Office Entrants.

The tests used for office entrants are exclusively paper and pencil tests of intelligence, arithmetic attainment, English attainment and a so-called clerical aptitude—this last consists of exercises in coding, sorting and checking a whole mass of clerical detail. The intelligence test in this group is the standard test used for all promotion selection procedures and staff appointments. It is a verbal test of 38 items and has a time limit of 20 minutes. It has been standardized on a factory population of over 1,000. Its validity in this organization is shown in the differences of distribution of scores in different working groups—significant differences existing among factory men, apprentices, chargehands, office entrants and staff applicants.

Apprentices.

Vacancies for apprentices are offered from time to time in open competition. The screening is done by the paper and pencil tests of intelligence, arithmetic and English, used for office entrants. For each vacancy three candidates are entered on a short list. The boys chosen for this then go through a series of interviews by the employment manager, education officer and foreman of the appropriate department, and each candidate does a series of practical tests with these gentlemen looking on. This, I may say, is done informally—about four or five boys working at the same time in the room and the observers just wandering around. The tests are:

(1) A set of assembly problems from putting together six simple interlocking links of a chain to the assembly of a valve that has 11 separate parts.

(2) Manual dexterity test that consists of screwing and unscrewing a set of nuts and bolts.

(3) A peg board test that consists of fixing a number of small pegs in a wooden board.

The final selection of apprentices is made by a committee of the observers —foreman, education officer, employment manager, psychologist—after consideration of *all* the data collected. The results of these tests are only part of the evidence.

Promotion and Staff Vacancies.

For promotion candidates in the factory and applicants for staff appointments the only tests used have been our standard intelligence test and some kind of group situation tests.

Although the details of the latter varies slightly with the vacancy under consideration we have over the last two years evolved a pattern of procedure that appears to be giving satisfaction to candidates and managers alike. A group of six candidates are invited by letter to take part in a group selection test on a given date, being invited to York the evening before to meet two of the company's officials socially in the "local," where they are introduced to each other and have a meal together. In the morning at the works the programme consists of series of discussions among the candidates with the interested parties sitting in the background.

The first is a leaderless discussion in which a general problem involving the handling of a mass of material—packets of goods, loose goods, correspondence files, detailed analysis of some commercial situation and so on. The candidates are given some specific problem relating to these and asked to work out a solution. They are allowed to go on at this for about half an hour. It is not, however, expected that they should have reached a solution in that time. Each candidate then in turn takes the chair of a committee composed of the other candidates and in his own words sets the committee on to discuss a topic provided. In each case there is some specific instruction to the committee—e.g. "A youth Centre is to be set up in an industrial area. You, as representative citizens are asked to say how such a centre should be planned and what it should provide." "Many boys aged 17–18 have applied for deferment of, or exemption from, military service. Your committee is asked to devise a set of rules for the guidance of tribunals dealing with such applications."

At the end of the morning exercises the candidates go to lunch with members of the staff of the department in which the vacancy exists, who are about the level at which the successful candidate will be entering. The afternoon is spent in a series of individual interviews and the writing of reports by each candidate of the meeting he conducted in the morning.

The development in selection technique represented by this group procedure is not without its dangers. Certainly the procedure breaks down the nervousness and cautious reserve of most candidates and induces the observer to match one candidate against another, time after time, for an appreciable period till preference crystallizes, but it is, I think, a matter of some concern that the dynamic group discussion part of the programme makes so much stronger an appeal to the layman than more objective selection methods. The collection of factual evidence by interview and other means, such as by psychological testing and the analysis of the requirements of the job, are more laborious tasks than forming a preference for one of an observed group, and are, therefore, in danger of being neglected or relegated to an insignificant place in the total selection procedure.

If this new technique in social behaviour study led in selection work to an ignoring of the factual evidence of a candidate's ability from other sources and the omitting of an analysis of the job itself with a view to finding the best possible match of candidate to job, then it would not, in my view, be a progressive development.

Reporting the Conclusions.

I have described to you three tools of modern industrial selection and illustrated the use of psychological tests at a number of different industrial levels. You will appreciate that the provision of efficient tools is not enough; a practical plan of action must also be devised, to ensure their use. As far as the factory is concerned the Selection and Training Department, which uses the techniques I have been describing is informed from day to day of the current factory vacancies and endeavours to match the current supply of candidates to these vacancies—as it is responsible for the training of these beginners in their factory jobs this matching is done with all the care possible. In the competitive situation where there is a number of candidates for one post, the department's practice is to endeavour to encourage the manager concerned to make the selection himself on the basis of all the evidence that can be amassed—the data from the psychologist on each candidate being presented in a brief non-technical report. This deals with the candidate's personal appearance, with notes on physical attributes; a brief history of his achievements in school, leisure and work, and in the Services with a comment on whether this is above or below the average of candidates for the post under consideration; an assessment of his intelligence and an opinion on the quality of his ideas, his powers of expression; a note on any special aptitude (mechanical, mathematical, musical, etc.); a description of his chief interests with an indication of any emphasis—practical, physically active, intellectual, aesthetic or social. This is followed by an attempt to describe the general disposition of the candidate in terms that are relevant to most industrial situations—from what has been gleaned from the candidates in interview, tests, group discussion—how may he be rated for (*a*) dependability (does he complete things, has he achieved much starting from little, can he be relied upon?); (*b*) acceptability (does his school, work and Service career and sparetime activities indicate that he is the kind of man other people have accepted readily?); (*c*) dominance (does his past history show any evidence of a bias in favour of taking a leading part or a submissive role in the groups to which he has belonged?).

The report concludes with a description of the candidate's background, upbringing and his present domestic situation. A note of general comment is added tying the whole thing together and drawing out contrasting and complementary features of the report to illustrate suitability for the vacant post.

With such reports on each candidate the manager is then in a position to match candidate with candidate and even to arrange them in an order of preference. It is important for the sake of the successful candidate's future career that he should be firmly established in the manager's opinion as the best available candidate for the job and not be a nominee of some external authority.

Conclusion.

These, then, are some of the recent developments in industrial selection procedures with which we are acquainted in Rowntrees.

You will appreciate that all I have said about selection techniques in industry must be considered against the background of some industrial organization. Selection procedures lie within a company's personnel policy. Only in so far as that policy is a sound one in every respect, and is conscientiously put into effect throughout the organisation will success attend the application of selection procedures of the kind I have described.

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