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PROBLEMS AND METHODS OF VOCATIONAL GUIDANCE

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PROBLEMS AND METHODS OF VOCATIONAL GUIDANCE

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PREFATORY NOTE

The economic and social importance of vocational guidance is now so generally recognised that it hardly requires to be emphasised. Apart from the value of judicious selection of workers in increasing the output of labour, it is no exaggeration to say that vocational guidance will improve industrial organisation and raise the status of the working classes, through improved methods of recruiting labour and the organisation of vocational and technical training, and by reducing unemployment, securing a reasonable wage for the worker, protecting him against sickness and disease, whether general or industrial, and by protecting women, children, and young persons.

The International Labour Office was naturally led to consider a question which is arousing interest in almost every country today, and which is closely connected with the problems of production, industrial organisation, and working-class conditions. The Office was fortunate in securing the collaboration of the experts at the Jean Jacques Rousseau Institute at Geneva, and of Professor Claparède. The latter, whose authoritative knowledge of the matter is well known, has undertaken to give a general survey of the principal problems arising in vocational guidance, which the International Labour Office publishes in this volume.

The International Labour Office.

CONTENTS

Problems and Methods of Vocational Guidance

I

Vocational Guidance and Industrial Psychology

Vocational guidance must first be placed in its correct relation to other scientific investigations of the conditions of labour — in other words, to psychology as applied to industry, commerce, and occupations in general. This branch of applied psychology may be called vocational or industrial psychology. Vocational psychology covers two types of problem : those relating to production — the psychology of labour — and those relating to distribution — the psychology of selling.

The following classification gives, better than any long description, a general view of the scope of the psychology of labour and the place of vocational guidance therein.

INDUSTRIAL PSYCHOLOGY

PRODUCTION *(Psychology of Labour)*	Technical factors	1. Habit and practice; fatigue and rest. 2. Motives of work; interest. 3. Various factors : alcoholism, age, etc. 4. Methods of work.
	Selection of workers	1. Vocational selection (Choice of an individual for an occupation). 2. Vocational guidance (Choice of an occupation for an individual).
	Training of workers	1. Vocational education. 2. Apprenticeship. 3. Retraining of the disabled.
DISTRIBUTION *(Psychology of Selling)*	Selling	1. Methods of sale; art of salesmanship ; psychology of the buyer and the public; psychology of the salesman. 2. Selection of salesmen.
	Publicity; psychology of advertising.	

The problem of vocational guidance or selection therefore arises both in the psychology of labour and the psychology of selling. It is difficult in practice to draw a sharp distinction between this problem and the others on which it borders. While guidance is not to be confused with technical factors, vocational education, or the social theory of apprenticeship, it is very nearly related to all these questions, and depends to some extent on the solution found for them. For example, some applicants who might be regarded as unsuited for an occupation carried on under unsatisfactory conditions might be allowed to enter it if these conditions were improved. However, vocational guidance is an entirely distinct problem, as will be pointed out later.

II

Historical Outline

The following is an attempt to explain the origin and development of the problem of vocational guidance. It may first be pointed out that, although the word is new, the fact it represents is by no means new. From the earliest times attempts have been made to adapt the work more or less to the worker and vice versa. Persons with very obvious defects were instinctively excluded from certain work. For a long time attempts have been made to effect a certain selection among candidates for admission to the army, while all colleges, technical schools, and universities refuse to admit students who are not in possession of a secondary school certificate.

The most striking fact in these traditional methods of selection is their crudity. They certainly served to sift applicants, but the sieve used was either too coarse or too fine, so that a crowd of inefficients might enter the occupation, while some individuals who would have been perfectly fitted for it were hindered for minor reasons or entirely excluded from work which they might have done. Inadequate or unnecessarily strict tests, or, in other words, inadequate adjustment of the test to the information desired, is the general defect of all the traditional systems, which for the most part consist of examinations drawn up haphazard without careful study based on experiment. Some years ago, so a French professor stated, the only examination required in France for candidates for admission to the police force was a spelling test.

The drawbacks of such a state of affairs could not fail eventually to attract attention, and were pointed out by various persons whose conclusions, drawn from very different premisses, tended to coincide. The present movement for vocational guidance sprang from very various sources; the fact that these ideas all came into prominence at almost the same time — between 1908 and 1912 — may be due to mere coincidence or, on the other hand, to the general though vague realisation of a common need.

Accidents

Accidents and the means of preventing them were one of the first factors to draw attention to the question of

vocational abilities. Half a century ago it was realised that a number of shipping and railway accidents were due to failure to distinguish certain signals on the part of ship's pilots or locomotive engineers suffering from colour blindness. From that time, therefore, applicants for employment in these occupations were required to undergo eyesight tests; but it is curious that these tests have always been limited to vision and have not included other abilities. The question was raised again in 1907 at the Fourteenth International Congress on Hygiene and Demography held at Berlin. In his report on industrial overwork, Dr. Roth of Potsdam called attention to accidents caused by overstrain of the workers, and asked, among other measures, for selection "by which each worker might be allotted to work suited to his individual qualities"(1). This, however, was only an incidental observation, and it remained for Münsterberg to state the problem with precision.

About ten years ago the American Association for Labour Legislation, in view of the large number of street accidents caused by electric tramways, invited Professor Münsterberg, Director of the Psychological Laboratory of Harvard University, to investigate the psychological causes of the errors made by tramway drivers. Some American tramway companies had to compensate as many as 50,000 cases of accident per year, so that the companies as well as the general public stood to gain from investigation of the matter. It may be noted in passing that the statistics of the German tramways show that nearly 3,000 pedestrians were injured every year (2,714 in 1907; 2,686 in 1908; 2,781 in 1909; of these about 170 per year were killed). It was recognised that the errors of the drivers were due to their mental and physical constitution rather than to actual fatigue.

Münsterberg then began laboratory investigations into the special abilities required by tramway drivers, and drew up tests to detect these abilities in applicants for employment in this occupation. These tests when applied to drivers already employed showed that about 25 per cent. of them ought to leave the occupation for others for which they were much better fitted (2).

These early researches of Münsterberg gave an entirely new direction to the problem of vocational guidance, namely, that of experiment, and at the same time made the question of vocational selection much more definite by giving it also a basis of experiment.

(1) Quoted from IMBERT: *Le Surmenage professionnel*, in the *Année psycholog.*, Vol. XIV, 1908, p. 243. Paris.

(2) Hugo MÜNSTERBERG: *Psychology and Industrial Efficiency*, p. 63; Boston, Houghton Mifflin, 1913; in German: *Psychologie und Wirtschaftsleben*, p. 44 et seq.; Leipzig, 1912.

Mistaken Choice of Occupation

The increasing competition in all trades makes it necessary for the worker to be increasingly efficient in his work if he wishes to be able to perform it fully. Experience shows that quite a number of young people of both sexes are obliged to change their trade after a certain time because they have not the necessary abilities to follow it successfully. Such changes of trade are as injurious to the employers and the industry as to the workers themselves.

According to Lipmann (3), the number of workers who change their trade every year may be estimated at 3 or 4 per cent. of the total. The employment exchange and statistical office for the Department of the Seine reckoned that 11 per cent. of its applicants changed their employment one or more times during 1919 (4). Of 9,520 men for whom employment was found, 8,483 were placed only once during the year; 620 were placed twice; 215 three times; 98 four times; 43 five times; 26 six times; 15 seven times; 8 eight times; 6 nine times; 2 ten times; 1 eleven times; 2 twelve times; and 1 fourteen times.

> There can be no doubt that when the employment of workers is preceded by judicious vocational guidance it will be much more rare for a worker to change his occupation, which will be to the advantage both of the employee himself and of the community in whose service he works (5).

According to Bernay (6), changes of occupation take place more frequently with increasing age.

PERCENTAGE OF PERSONS CHANGING OCCUPATION BETWEEN GIVEN AGES

Number of changes	Men			Women		
	14-21	22-30	31-40	14-21	22-30	31-40
One	32	25	36	32	38	21
Two	8	3	11	8	2	5
Three	—	6	—	—	1	6

The cause of these changes of occupation is sometimes boredom, sometimes actual unsuitability, whether physical or mental, sometimes fatigue resulting from the occupation; in every case the change is a sign of inadequate ability, and

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(3) O. Lipmann : *Psycholog. Berufsberatung*, p. 9. Berlin, 1919.
(4) See *L'Orientation professionnelle*, Nov. 1920, p. 36. Paris.
(5) Ibid.
(6) Bernay : *Auslese u. Anpassung der Arbeiterschaft der Grossindustrie.* Leipzig, 1910.

consequently of a mistake in the original choice of occupation.

The frequency of unsuitability for the occupation of telephone operator gave rise to one of Münsterberg's experimental researches about 1911 (7). It was observed that more than one-third of telephone operator apprentices were obliged to give up their work during the first year through overstrain. This occupation is particularly fatiguing owing to the necessity for constant and alert attention. Of 29 telephone girls questioned by Fontègne and Solari (8), 28 stated that during the day they felt a certain amount of fatigue, with nervousness and occasional headache. At the request of the Telephone Operators' Association, Professor Münsterberg drew up a set of tests for discovering among applicants for employment those likely to be successful in the occupation.

The number of failures in different occupations emphasises the need for determining not only the abilities required for any given trade but also counter-indications against an occupation and means of detecting or forecasting these.

In this connection attention may be drawn to Levenstein's careful investigation of the extent to which workers were adapted to their employment, although this was not made with a view to vocational guidance strictly so called. His book (9) shows very clearly the individual differences between workers and the effects of various psychological types on occupation.

Low Output and Scientific Management

In the books which have made his name famous the American F. W. Taylor (1856-1915) also concluded that vocational selection was urgently necessary, though he arrived at this from a very different starting point. Struck by the waste of strength and time involved in the ordinary methods of work, he endeavoured to introduce scientific organisation of labour into factories. He proved that output increased considerably if a better adjustment was made, first of the machinery and tools, then in methods of work, and finally if for each type of work the most suitable individuals were selected.

The discussion of the first of these factors would be out of place here; only the third, the human factor, is of importance at the moment. It is strange that Taylor did not bring his

(7) Münsterberg : op. cit., p. 65.

(8) Fontègne and Solari : *Le Travail de la téléphoniste*, in *Archives de Psychologie* (hereafter referred to as *Arch. de Psych.*), Vol. XVII, 1918. Geneva.

(9) Levenstein : *Die Arbeiterfrage*. Munich, 1912.

powers to bear on the problem of vocational selection. He devotes his attention primarily to the training of the worker, methods of regulating his movements, of improving them, and of stimulating him; but he passed over the question of selection properly so called effected by means of suitable tests ([10]). The same may be said of Gilbreth and Thomson, who emulated him. In the view of all these writers selection is more or less negative, involving the exclusion of unsuitable individuals rather than systematic investigation to determine for what each is most suited. It is none the less true that the study of scientific management, by bringing to the fore the human factor in industry, made a great contribution to the problem of vocational selection.

Parsons' Philanthropic Work

Vocational guidance, in so far as it involves advising young people as to the occupation they should enter, grew directly out of this kind of consideration. At the beginning of this century, until his death in 1909, Parsons turned his attention to the unemployed street urchins of New York. He tried to find them employment, to discover what jobs suited each of them, questioning them systematically on the subject of their inclinations, abilities, and reading. He also used small experiments to throw light on their psychology. For example, he made them read a book and then asked them certain questions about it ([11]). In 1908, at Parsons' instigation, Mrs. Quincy A. Shaw founded a Vocational Guidance Bureau in Boston. The method adopted was that of the questionnaire. The young applicants were asked to reply to 110 questions on the most varied subjects. It need hardly be pointed out that such replies should be accepted with the greatest caution and that it is essential, if not to replace, at any rate to supplement, the questionnaire by investigations to determine more objectively the actual abilities of the individual.

Mention should also be made at this point of the office founded at Basle in 1907 by Mr. Stocker to advise parents and young people on the choice of an occupation and on apprenticeship. These modest beginnings were the germ from which sprang the vocational guidance offices or institutes which at present exist in Brussels, Barcelona, Berlin, Bordeaux,

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(10) F. W. Taylor : *The Principles of Scientific Management.* New York, 1911. Taylor very truly states (pp. 58 and 61) that the first step is rigid selection of the worker, but he does not develop this idea further in his book.

(11) F. Parsons : *Choosing a Vocation* (posthumous work). Boston, 1909. Also Meyer Bloomfield : *Vocational Guidance of Youth.* Boston, 1911.

Geneva, Strasburg, London, Amsterdam, Prague, Zürich, and elsewhere, and which will soon exist in every town, since the need for them is being increasingly felt (12).

The School and Vocational Training

In former times educationalists had no concern with the occupation which their pupils would one day enter. Education was the formation of the general qualities and the imparting of the elementary knowledge which are the basis of all specialisation. At the present time this point of view is gradually being discarded. On the one hand there arises the educational question whether the school, which should prepare for life, ought not to endeavour to provide preparation for occupations. On the other hand, teachers are often consulted by their pupils, by parents, or by vocational guidance offices on the occupation which a given child just leaving school should enter. For both these reasons the educationalist is naturally led to consider the question of vocational guidance.

> The school is not made for the school, but for life. It must provide the society of the future with men. It is a cruel mockery suddenly to abandon its little pupils on the day they reach their thirteenth year, when they are flung unarmed into the battle of life. It is also the most foolish waste. What madness, having done so much for the school boy, to do nothing for the apprentice! From this has arisen the idea, which has so rapidly spread, that the social functions of the school must be greatly extended, that there are many new services which it must give. The first of these is supervision of the transition from the schoolroom to the workshop (13).

Mr. John Dewey, the American educationalist (14), says that an occupation is an activity carried on with a definite object in view, and that education by vocational training is consequently richer in factors providing for the development of character than any other method. Without entering into discussion of the important and complex question whether the primary or secondary school should or should not offer vocational instruction, it may be taken for granted that the school should at least give its pupils information regarding the different trades which they may enter on leaving school, and the abilities required. Thus the teacher is brought face to face with the problem of psychology as applied to occupa-

(12) For fuller information regarding current developments in vocational guidance see F. Gauthier: *Vocational Guidance*, in the *International Labour Review*, Vol. V, No. 5, May 1922, pp. 707-722 (Geneva); also the *Notes on Vocational Guidance*, which have appeared in that *Review* since June 1922.

(13) F. Buisson: Preface to Fontègne: *L'Orientation professionnelle*. Paris and Neuchâtel, 1921.

(14) J. Dewey: *Democracy and Education*. New York, 1916.

tions (15). As Mr. J. A. Puffer, the Director of the Beacon Vocation Bureau at Boston, very truly points out, vocational education is not enough. It must be linked with vocational guidance. The teacher himself should learn to discover embryonic talent, to rouse the child to the realisation of his special capacities and to develop these capacities for his future life. Schools should not only teach, they should also encourage and direct. Only thus will the schoolroom acquire vivifying contact with reality (16). The means by which the teacher can discover more or less hidden talents are supplied by psychology.

The schools have been led to consider vocational guidance and selection for their own purposes as well as for the determination of the future careers of their pupils. The desirability of adapting instruction to the various types of pupils is increasingly being realised. It is a waste of time to thrust higher mathematics on a child with no gift for mathematics, who will never do anything in this subject, or to compel the pupil with a bent for science to learn dead languages. The idea of the "school made to measure"(17) is steadily gaining ground. But intelligent guidance and advice to pupils must be based not only on their inclinations but on their abilities, which must be determined objectively.

In several places classes for specially gifted children have been established or are in course of establishment, for example, at Hamburg and Berlin. The problem of selection of gifted children thus arises. Interesting research in this direction has been carried out, notably by Stern (18). At Geneva, the Society *Pour l'Avenir*, which provides scholarships for gifted children leaving the primary schools, has asked the Jean Jacques Rousseau Institute to assist in selecting these children — a very difficult task in view of the youth of the candidates. On turning from the ordinary schools to vocational schools, the need felt by teachers and headmasters for methods of detecting abilities becomes even more apparent.

At the Second International Conference on Practical Psychology as applied to Vocational Guidance held at Barcelona in 1921, Mr. Petitpierre, Principal of the School of Arts and Crafts at Lausanne, pressed for special tests for the elimination of youths without manual ability from among candidates for admission to the school. The present system

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(15) The Canton of Geneva has recently included instruction in occupations in the curriculum of the last year in the elementary schools. See *International Labour Review*, Vol. V, No. 6, June 1922, pp. 999-1000. Geneva.

(16) J. A. Puffer : *Vocational Guidance*, p. 27. New York, 1914.

(17) Claparède : *L'école sur mesure.* Lausanne and Geneva, 1920.

(18) Peter and Stern : *Die Auslese befähigter Volksschüler in Hamburg.* Leipzig, 1919.

of examination, including tests in French, arithmetic, etc., is useless for the purpose of such selection. It allows pupils quite without manual dexterity to enter the school, which involves waste of time and strength both for themselves and for the instructors. Every year more than eighty candidates apply for about thirty vacant places, and the speaker wished to ensure that the most unsuitable from the point of view of manual dexterity were eliminated. Both in vocational schools and in apprenticeship a distinction should be drawn between entrance and leaving examinations. In both cases selection must be effected.

Experimental Psychology of Abilities

While practical men were putting forward the requirements which have been briefly mentioned, experimental psychology was making progress; at this very time it was stating the problem of abilities more clearly than had previously been done, and endeavouring to study the problem by experimental methods. Cattell in America (1890), Kräpelin, and later Stern in Germany, Binet and Toulouse in France, Decroly in Belgium, de Sanctis at Rome, Rossolimo at Moscow, Heymans at Gröningen, and others endeavoured by drawing up special mental tests to determine and analyse the various psychological characteristics of an individual, and to discover what distinguished and differentiated one individual from others in this respect. This branch of psychology has been called psychology of the individual, or psychology of individual differences.

More recently attempts were made by Spearman, Pearson, Thomson, and Brown in London to investigate by new methods of measurement the constituent elements of abilities, and especially to discover if abilities had certain relations between themselves, certain common origins, or if they were completely independent. These very complex investigations have not yet produced definite results. It will readily be understood, however, that the practical problem of abilities as raised by the requirements of vocational guidance has aroused the keenest interest among psychologists, who have enthusiastically taken up the new subject for research thus offered them. The last thirty years have seen the rise, side by side with theoretical psychology, of applied psychology : psychology as applied to medicine (psychotherapy and psycho-analysis), to education, to legal questions (criminal psychology and the psychology of evidence), and as applied to military science. In all these matters the question of abilities has arisen, and the idea of applying psychology to economic and industrial questions has also attracted the attention of psychologists.

For some years past various psychological institutes or laboratories have given some place in their syllabi to research connected with vocational guidance. Münsterberg initiated the movement at Harvard University some twelve years ago. The psychological laboratory of the Ecole des Hautes-Etudes Sociales in Paris followed with Lahy's work to determine the psycho-physiological abilities required for typewriting. The psychological laboratory of Geneva from 1914 onwards conducted experimental investigations in the watchmakers' trade, and in 1917-1918 carried out a number of experiments on abilities required by telephone operators. It is surprising that German psychological institutions, which are so well equipped, have been rather slow in making their contribution to the new science, though this is no doubt due to the war. They only took up this work in 1918, but appear likely to make up for lost time very rapidly. It is only necessary to mention the Institute of Applied Psychology at Berlin under the direction of Lipmann, Möde's laboratory at Charlottenburg, and that of Piorkowski at Berlin.

On the Continent this experimental application of psychology to industrial and vocational questions has been generally described as psychotechnics. The choice of word is not very happy, as it is more a question of diagnosis than of technique, strictly so called, but the word has come into use, and will probably remain ([19]). It may be mentioned in passing that considerations connected with the choice of an occupation have arisen in another branch of psychology, namely in psycho-analysis. Psycho-analysts, in investigating the fundamental motives governing the conduct of the individual throughout his life, have come to ask what leads him to chose one occupation rather than another ([20]).

The War and After

The movement whose various origins have been sketched reached its most rapid development in the years immediately preceding the war, which itself accelerated this development and emphasised its importance. The various belligerents

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(19) 'Psychotechnics' means, strictly speaking, that which exerts an influence on the psyche. as in psychotherapy and in education. If it is a question of diagnosis it would be more correct to use the word 'psychognostics', as Stern proposed. In the new sense in which it is employed 'psychotechnics' is obviously an amalgamation of the words 'psychology' and 'technology'. It would, therefore, really be better to use 'technopsychology', as Lipmann quite rightly pointed out (*Der Betrieb*, 1920-21, No. 1).

(20) De Maday : *Psychol. der Berufswahl*, in *Monatshefte für Pädagogik und Schulpolitik*, 1912. Also Adler and Furtmüller : *Heilen und Bilden*. Munich, 1914. O. Pfister : *Die psychanalytische Methode*, pp. 277, 330, 349; Leipzig, 1913.

had to act rapidly and decisively, and were therefore compelled by circumstances to consider the most productive utilisation of the forces at their disposal, and to prevent anything which might hamper the success of their cause either by errors or unnecessary accidents. Branches for vocational guidance and selection thus sprang up of themselves, as it were, in the different armies. Practically the only object of these branches in Europe was the selection of aviators, which was begun in France, Germany, and Italy in 1916. Offices for psycho-physiological tests for aviators were set up in Paris, at Grand-Palais, Turin, Brussels, and the Hamburg Psychological Laboratory. The object of the tests was to determine the strength of the candidates, reaction to emotion, and the rapidity of their reactions, and to test their sense of equilibrium and sensory acuity. These tests were proved to be most valuable, and experience showed that the number of accidents decreased considerably after the institution of systematic tests for candidates for admission to the flying services ([21]). According to Dr. Brabant of Brussels, the number of accidents due to the inefficiency of the pilot decreased by 60 per cent. ([22]). In the United States vocational selection for the army was developed to a much greater extent, and was applied to the enlistment of all soldiers ([23]). In that country, where there was no standing army, it was necessary to build up the most efficient possible army in the shortest possible time. It was realised that the presence of men of low intelligence among the intelligent might greatly retard the technical training of the latter, and those of low intelligence were therefore segregated in groups for special treatment. It was also most important to select from the outset men likely to make good non-commissioned or commissioned officers. This was done by means of a large number of mental tests which produced valuable results. Experience showed that in an officers' training school where the students had not first been tested those whom the tests showed to be of low intelligence had gradually to be eliminated. Much time and trouble would have been saved if the tests had been administered before admission to the school. The value of psychological tests in the army has helped to popularise the principle of vocational selection in the United States, where it is now used in a great many industries.

The war also stimulated vocational guidance by throwing on the labour market a large number of disabled men for whom

(21) H. Piéron : *L'examen des aviateurs* (with bibliography), in the *Année psycholog.*, Vol. XXI, 1920. Paris. Also Benary : *Untersuchungen über die psychische Eignung zum Flugdienst*; *Schriften zur Psychol. der Berufsberatung*, Vol. II, 1919-1920. Leipzig.

(22) *Première Conférence internationale d'orientation professionnelle*, in *Arch. de Psych.*, Vol. XVIII, p. 177.

(23) Yoakum and Yerkes : *Army Mental Tests*. New York, 1920.

some occupation had to be found. The difficulty of finding occupations for which a disabled man was fitted encouraged psycho-physiological analysis of occupations.

The economic disturbances of the post-war period emphasised the need for maximum production combined with maximum economy. Victory in industrial and commercial competition between nations will fall to those who have made the best use of the abilities at their disposal. Thus, especially in Germany, employers themselves are organising vocational guidance offices.

It is now clear why the movement for vocational guidance, with all these different yet converging streams to feed it, should be as strong as it is today. In a word, its object is to put the right man in the right place, thus serving the interests of the community by serving those of individuals. To quote the head of the Paris Employment Exchange :

> When everything emphasises the industrial, social, and national necessity of taking special steps to find employment for young persons, it must be admitted that they were distributed among the various branches of industry without discrimination or foresight, and too often without even taking into account actual unfitness due to the health or abilities of the individual (24).

The question now to be solved is how these mistakes may be remedied, and how a youth or girl may be intelligently advised on the choice of a suitable career. In order to reach a solution the various factors of the problem call for scientific study — a task which is undertaken in the pages which follow.

Chronological Summary

1907	Hygiene Congress at Berlin; Roth, Imbert.
1908	Parsons' Vocational Guidance Bureau at Boston.
1911	Taylor's work.
	Levenstein's *Arbeiterfrage*.
	Spearman's work on general ability.
1914	Psycho-analysis of trades; de Maday, Adler.
1915	Selection of aviators for war service.
1917	Army tests in the United States.

(24) Gauthier : *L'Orientation professionnelle en France*, in the *Bulletin du Ministère du Travail*, July-Aug.-Sept. 1921, p. 258. Paris.

III

The Two Problems

Two forms of the problem under consideration must be distinguished from the outset in order to avoid confusion. On some occasions the problem takes the form of the choice of an occupation for an individual (vocational guidance); on others that of the choice of an individual for a given occupation (vocational selection) (1).

Vocational selection chiefly interests the proprietor, management, and employer. Their desire is to find the best possible workers. For example, there are 20 vacancies to be filled in a factory or telephone exchange, and 100 applicants. The problem is to select the 20 most efficient among this hundred. The whole problem of selection is contained in the choice of these most efficient workers, and the discovery of means of making this choice. When once the choice is made the employer gives no further thought to the 80 unfortunate unsuccessful applicants. He will not offer them other vacancies.

The problem of vocational guidance, on the other hand, is to discover the most suitable occupation for a given individual with given abilities. Guidance is mainly concerned with the success and welfare of the individual, but it need hardly be pointed out that it thereby serves the best interests of the community. It is at once personal and social in scope. Vocational guidance will in the end gradually absorb vocational selection, for if vocational guidance is effective only suitable workers will apply for vacant posts. This ideal is certainly distant, and until it is reached vocational selection and guidance will continue to exist side by side.

The two questions frequently overlap in practice. For example, in a district where the chief industry is watchmaking or mining, vocational guidance consists very largely in informing the young man who comes for advice whether he

(1) The International Conference at Barcelona in 1921 unanimously adopted this definition of the terms 'selection' and 'guidance'. The French and German equivalents of vocational selection are *sélection* and *Auslese* respectively, and of vocational guidance *orientation* and *Berufsberatung*.

is or is not fitted for mining or watchmaking. The examination for purposes of vocational guidance will be very similar to that for purposes of selection. Or, to take another case, a youth with inclination for a certain occupation, such as that of engraver, will come to ask if he has the necessary abilities. In this case selection tests will first have to be applied, but if they give a negative result the methods of vocational guidance will again be required to find another more suitable occupation for the young man. Vocational guidance and selection mutually support and assist each other. The antagonism between them which has occasionally appeared has no justification in fact. Each movement can profit by the experience of the other, but it is none the less a fact that guidance is a wider question and of greater social significance, since it is both economic and moral.

In the case of entrance examinations to vocational schools the tests required are selection tests.

The object of vocational guidance is to direct any given individual (most frequently a young person, but he may also be an unemployed adult or a disabled man) towards the occupation in which his chances of success are the greatest, because it is most suited to his mental or physical abilities. The solution of the problem depends on three main factors: knowledge of the individual to be advised; knowledge of the abilities required for various occupations; the supply of labour in the district and the posts vacant. The last-named — the state of the labour market — recalls the fact that the laws of supply and demand apply to vocational guidance as to everything else. Even if an occupation is entirely suitable for a young man, he must not be advised to enter it if it is already overstocked. The position of the labour market may, and should, therefore, modify the final pronouncement of the vocational counsellor. This fact in no way diminishes the importance of the first two factors, since, even if the most suitable occupation is closed, it is still necessary to find to what other occupation the applicant is suited. This raises the question of abilities, which is the principal subject of this report.

IV

Occupational Analysis

Methods

The chief problem of vocational guidance is the determination of an applicant's abilities. Before considering this problem, however, the abilities required by the various occupations must be determined, as well as their requirements, dangers, characteristics, effect on health, the length of apprenticeship required, and the remuneration offered. This is the first task of the new science which is growing up. This psycho-physiological analysis of occupations may be effected by one of three methods: (1) enquiry, verbal or by questionnaire; (2) observation; (3) experiment.

Enquiry

The first method likely to occur to the investigator is interrogation of those actually engaged in the trade. Questions may be addressed either to employers or workers, and may be put either verbally in the course of conversation, when the person questioned describes the abilities required for the work, or by means of questionnaires drawn up beforehand, when the person interrogated has only to reply to questions asked. The method of conversation has the advantage of not giving any suggestions to the person from whom the information is desired, and of giving a clear idea of his own estimate of his trade. Its drawback is that replies tend to be very vague, and are liable to considerable omissions. Many things may not be mentioned because, though important, they are not thought of at the moment (1). The questionnaire method was invented to overcome this drawback, and has the additional advantage that, being more precise, it is possible to draw up statistics of the replies if so desired. The two methods are not mutually exclusive, and it appears desirable to use both of them — free conversation followed by the questionnaire.

(1) An example of these occupational descriptions (*Berufsbilder*) will be found in the chapter headed *Psychol. der Berufe*, by O. Lipmann, in the *Handbuch der vergleichenden Psychol.* Munich, 1922.

As an example of a questionnaire, that drawn up by Lipmann on the basis of the work of various other writers may be cited (2). It includes 86 questions regarding various abilities, each question requiring the reply 'yes' or 'no'. For example: "Does the position of..... require the following abilities: (1) perception of inadequately illuminated objects; (2) perception of slight noises; (3) perception, recognition, and discrimination of faint odours, etc. ?" Other questions refer to memory, strength or accuracy of movement, drawing, etc.

It is possible thus to list the chief abilities required in different trades, but such a list should be supplemented by adding to each capacity desired a coefficient indicating its relative importance, and the moment at which this ability is specially necessary. An ability may be regarded from various points of view, and Piorkowski (3) also asks –

(1) if an ability is (*a*) essential, (*b*) merely desirable, (*c*) of no importance, for the exercise of a trade;

(2) if an ability is required (*a*) constantly, (*b*) occasionally, (*c*) never, in the exercise of a trade;

(3) if the ability is developed (*a*) considerably, (*b*) moderately, (*c*) not at all, either by the exercise of the trade, by training, or by natural development.

Even with the assistance of a questionnaire, however, the results obtained by enquiry are often very difficult to use, especially in the case of higher-grade occupations. Different representatives of the occupation will give entirely contradictory replies to the same questions (4). Great prudence must, therefore, be exercised in following this method.

Observation

Although the questionnaire is necessarily the starting point in analysing occupations, it cannot in itself attain the desired end. The complex characteristics of different trades cannot all be provided for in a questionnaire drawn up beforehand. In any trade there are a number of other factors to be ascertained which must influence the selection of applicants, and these factors can only be discovered by close observation of the trade, its effects, and factors affecting it.

The difficulty is to know who can undertake such observation. The worker himself will usually be unable to do so; it is

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(2) O. Lipmann : *Zur psycholog. Characteristik der mittleren Berufe*, in the *Zeitschrift für angewandte Psychologie* (hereafter quoted as *Ztschr. f. angew. Psych.*), Vol. XII, 1916. This questionnaire is reproduced in Fontègne : *L'Orientation professionnelle*, p. 95.

(3) Piorkowski : *Die psycholog. Methologie*, p. 93. Second edition, 1919.

(4) Lipmann : *Wirtschaftspsychol.*, p. 22. Second edition, Leipzig, 1921.

difficult to observe and analyse a complex process. Frequently foremen or engineers will be equally unable to do so. The psychologist is ignorant of the trade and would have difficulty in following its complex processes. There is only one method of solving the problem, which is to initiate the psychologist into the work to be analysed, since he alone is really able to carry out the necessary observation. The best method is for him actually to work the trade under consideration for a certain period.

In addition to direct observation of the processes of the trade, observation of the effects produced on it by certain causes, or its influence on other factors, may be considered. Thus, the causes of failure in any occupation and the reasons for changes of occupation should be investigated, also the relative importance of overwork, distaste due to monotony, physical or mental unsuitability, defects of character, sickness, etc. Just as pathology throws light on physiology, and breakdowns in machinery explain its normal working, so difficulties in following an occupation may explain its inner working and analyse it, so to speak, by a kind of natural dissection. This is, in fact, an application of the methods of pathology to occupational analysis (5).

Observation and analysis of accidents may also prove fruitful. By way of example Otto Selz's book on the analysis of aeroplane accidents may be mentioned (6). Statistics drawn up by the Bavarian flying schools in 1918 showed that 53 per cent. of flying accidents were due to a cause connected with the individual ability or predisposition of the aviator. By means of an analysis of each accident Selz was able to distinguish the most necessary abilities, including ability to divide attention, resistance to distraction, rapidity of apperception, presence of mind, absence of nervousness, skill in estimating distance. This analysis was the basis of the tests which Selz proposed for the selection of aviators.

Analysis of injuries to health in the different occupations, as well as of the causes of occupational diseases, may also be of assistance in determining the abilities required. To return to the example of aviators, it has been found that the extreme fatigue which they have at times to endure may lead to injury to the heart or other organs (aviators' disease). Such information should be noted in recruiting aviators.

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(5) For an illustration of the light thrown on the psychology of typewriting by a study of errors made by typists, see W. Heinitz : *Untersuchungen über die Fehlleistungen beim Maschinenschreiben*, in *Ztschr. f. angew. Psych.*, Vol. XVIII, 1921.

(6) O. Selz : *Ueber den Anteil der individuellen Eigenschaften der Flugführer und Beobachter an Fliegerunfällen*, in *Ztschr. f. angew. Psych.*, Vol. XV, 1919.

Experiment

Experiment is observation carried out under conditions making it possible to determine with absolute accuracy what factors are involved in the phenomenon under consideration. It is necessary in undertaking an analysis of these factors, and essential in checking data obtained from mere observation or enquiry. Mere observation cannot, in effect, explain the exact ability which is of most importance in a series of manual or other operations. Take for example a girl employed on inspecting bicycle balls. She has to sort the balls, and eliminate all those with flaws such as dents, scratches, or fire cracks. Ordinary observation would no doubt show that good eyesight was required, as these defects are very difficult to detect. Good eyesight, however, is not sufficient. The work also requires a trained eye, judgment, discrimination, and great promptness and skill in movement, in order to pick up balls rapidly from one box, throw defective balls into another, and sound balls into a third box. The whole process requires sustained and untiring attention. Other questions, however, arise which can only be answered by experiment, such as the relation between the abilities mentioned, their relative importance, and whether attention is actually necessary, or is semi-unconscious and automatic.

Mr. Edmond Degallier, who is at once a technical expert and a skilled psychologist, shows in his article on conditions of work in watchmaking (7) that the watchmakers' chief difficulty is to achieve accurate dimensions. "Variations in the dimensions of the pivots are measured in hundredths of millimetres." The worker often polishes the pivot too much, and exceeds the limit required. According to Mr. Degallier "the object is to discover the causes of excessive polishing, turning, or filing in given practical actions. Possibly the problem is one of manual dexterity, but control of movement, foresight, and attention are also involved. For instance, the longer and thinner a steel pivot is to be, the greater is the skill needed to turn it; now, every watchmaker's apprentice has at one time or another had cause to regret that the result of applying extra 'skill' was to produce a pivot which was too small after all." Only systematic experiment will make it possible to assess the relative importance of the various factors in a watchmaker's work, such as estimate of dimensions, accuracy in this estimate — which is an intellectual process, as it "involves complete understanding of the mechanical operations involved" — decision, practical application of

(7) E. Degallier : *Horlogerie et psychol.*, in *Arch. de Psych.*, Vol. XIV, 1914, No. 54. Geneva.

the decision, choice of process to be used, choice of tool to carry out the decision, distribution and shifting of attention. " In view of the complexity of the problem it appears that only accurate experiment can solve it ", adds Mr. Degallier.

Experiment as applied to occupational analysis takes two forms. It may be, or attempt to supply, either an objective or a subjective analysis. Objective analysis consists in resolving into their component parts the motions involved in a occupational activity. This may be done by photography, especially by cinematography, with the use of the slowing-down process by which the different parts of each movement can be shown. Another method of analysing movements is to attach an electric light to the hand or other limb of the worker, and photograph it. The moving lamp leaves a track on the film or plate which enables the observer to follow every detail of the motion. This use of the cyclograph, as it is called, was devised by the American Gilbreth. It is also possible by means of other graphic processes to trace the movements of a tool (8).

All such methods, however, are rather those of recording instruments than of actual experiment. Experiment is required in the comparison of good and bad workers, or in the performance of certain movements for analysis under given circumstances : for example, the work of learners may be measured in such a way as to follow the process of acquiring the necessary movements. It should be noted that this objective analysis is of no value for vocational guidance or selection except in so far as it helps to determine the subjective abilities which the worker has to use in carrying out the necessary movements.

Subjective analysis is intended to determine the psycho-physiological abilities or functions involved. Experiments to provide such an analysis may be carried out in various ways. A method of experiment which meets ordinary requirements and has already been frequently used is to take a number of good and bad workers of the occupation under consideration and compare them in respect of a given psychological ability. For example, if there is reason to suppose that a given kind of work, e. g. typewriting, requires a good verbal memory, this hypothesis may be verified as follows. A test of verbal memory is chosen (repetition of long sentences read only once), and this test is applied to see whether the better typists succeed and the bad typists fail in it. The value of this experiment is dependent on its being applied to a large enough number of subjects for the results to be independent of chance. If of 30 good typists 25 produced results above the average, while of

(8) e. g. the self-recording plane in Amar : *Organisation physiologique du travail*. p. 71. Paris, 1917. See also Schulte : *Die Berufseignung des Damenfriseurs*. Leipzig, 1921.

30 bad typists only 5 were above the average, one would be entitled to conclude that there is a certain relation — a correlation, as it is called (9) — between the abilities required for the memory test (attention, memory) and abilities required for the occupation of typewriting. Verbal memory would then be noted as one of the abilities required for this occupation (10).

By this method it is possible to determine not only the kind of ability required for a trade, but also the minimum degree of these abilities which is essential. Thus, while it is doubtless essential to be able to see distinctly in order to be a grocer, it is not necessary to have as good eyesight for this occupation as for that of tramway driver or watchmaker.

Job Analyses and Occupational Psychographs

When an occupation has been analysed by the various methods just described, the results obtained are presented in a job analysis. Its psychological characteristics are summarised in a schedule which may be called a psycho-vocational inventory or occupational psychograph. The ideal would be for this psychograph to be presented as a pscho-vocational graph, i. e. a diagram showing the relative importance of the psychological abilities required by the different occupations.

A job analysis generally contains information of three kinds :

(1) Technical information : the technical characteristics of the occupation; types of machinery or tools used; whether the worker is seated, standing, or moves about; whether he lifts light or heavy weights; whether the occupation is clean or

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(9) As reference will frequently be made to correlation and correlation coefficients, it may be explained, for the benefit of those to whom these terms are unfamiliar, that the correlation coefficient measures the degree of correspondence between two series of phenomena. When the correspondence is perfect (i. e. when one phenomenon is always accompanied by the other), the correlation coefficient equals 1. When the correspondence is completely inverse (i. e. if, when one phenomenon is present, the other is always absent, the two being thus mutually exclusive), the coefficient is negative and equals —1. When there is no correlation, the coefficient equals 0. For details see Claparède : *Psychol. de l'enfant*, p. 366 (eighth edition, Geneva, 1920); Stern : *Die differentielle Psychol.*, p. 279 (Leipzig, 1911); Thorndike : *Mental and Social Measurement* (New York, 1913); Brown and Thomson : *The Essentials of Mental Measurement* (Cambridge, 1921).

(10) Examples of this kind of experimental research are to be found in Fontègne and Solari : op. cit., in *Arch. de Psych.*, Vol. XVII, 1919; Streller : *Die Berufseignung des kaufmännischen Bureaubeamten* (Leipzig, 1921).; Brugmans en Prak : *Een psycholog. Analyse van de Telefoniste* (The Hague, 1921).

dirty ([11]), noisy or otherwise, if it involves exposure to great heat or cold, dust, damp, smells, poisonous fumes, etc.

(2) Industrial information: period and cost of training; initial wages; increases; opportunities for promotion; proportion of unemployment; daily hours of work; etc.

(3) Psycho-physiological information.

(*a*) Physical abilities required: height, muscular strength, etc.

(*b*) Psychological abilities required: knowledge (previous education), degree of general intelligence, special abilities, character traits.

(*c*) Dangers to health; diseases which the trade may involve.

Ideally the occupational psychograph should be as objective as possible. It is of little value to state that a trade requires manual skill, attention, perseverance, energy, enthusiasm, common sense, or judgment, as no two persons interpret these terms alike. In any case such terms have not the precision required by science. A doctor attending a case of pneumonia could not be satisfied with saying that to begin with the invalid becomes very hot and subsequently his temperature falls slightly. Fixed points of reference and standards are required, and vocational psychology is aiming at their discovery. The abilities noted in the psychograph must be objectively defined, and, as Link very truly says ([12]), it should be possible to define the psychological characteristics of a trade by saying that it requires success in tests Nos. 2, 6, and 8, for example. This ideal, however, will only slowly be attained, and moreover only meets the needs of vocational selection.

For vocational guidance something further is needed. In this case the characteristics of an individual are the starting point, and it is practically impossible to dispense with descriptions in terms of psychology. If it is desired to ascertain the relations between certain abilities and certain occupations, it is essential to consider the latter from the psychological standpoint in order to decide what trade a young man with certain mental abilities should be advised to enter. In order to meet this requirement a systematic classification of occupations is necessary; job analyses will help in building up such a system, but subsequently they will merely be complementary to it.

(11) Link (*Employment Psychol.*, p. 263. New York, 1920) rightly points out that some of this information is only of relative value. An occupation which one person would consider dirty would seem clean to another.

(12) Link: op. cit., p. 259.

Classification of Occupations

The ideal of those who have to advise individuals of known abilities as to the occupation most suitable for them would be to have a systematic classification of occupations to which to refer. What is wanted is something which gives at a glance all the possibilities in the way of vocational guidance; it should make it possible, by a process of elimination and choice, to find exactly what was sought, just as a botanical Flora makes it possible to identify a plant when its characteristics are analysed. The ideal to be striven for is the determination of an occupation by the analysis of abilities in just the same way as the genus of a plant is determined by an analysis of its characteristics.

The first step is to decide on the method of classifying occupations. All occupations should first be known and analysed by the methods already described. This would evidently be a long and arduous task; in the meantime a general classification may be attempted on the lines of common experience of the various types of occupation. This classification will of course be a psychological one, as this is the only kind which is of importance for the present purpose. The best general classification appears to be that of Piorkowski ([13]). He divides all occupations into two main classes : (*a*) unskilled occupations which require no special ability, (*b*) skilled occupations requiring special abilities.

Unskilled occupations would include, for example, those of navvy, hawker, errand boy, etc. It may be questioned whether there really are any entirely unskilled occupations. Certain physical and muscular abilities, such as ability to walk, etc., are required even by a navvy or porter. What the author probably means is that these occupations call neither for special training of these abilities nor for apprenticeship to the trade ([14]). Employment in these occupations might therefore be offered to abnormal persons who cannot be educated, or rather taught, but who are amenable in character, and may make good bread or parcel carriers ([15]).

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(13) Piorkowski : *Die psycholog. Methodologie.* Second edition, 1919.

(14) According to Link (op. cit., p. 182) 76 per cent. of trades need no special previous experience and can be learned in periods ranging from one hour to one month.

(15) For criticism of the term , unskilled occupation ' see Baumgartner : *Einige Bemerkungen zur Frage der Berufseignung*, in *Ztschr. f. angew. Psych.*, Vol. XV, p. 79. This writer points out very truly that even in such a simple trade as that of hotel boy no two persons are equally successful. He mentions two boys of 14, one of whom did his work very well, ran to the telephone, etc., while the other was slower and did not give satisfaction.

Skilled occupations are divided into three classes :

(1) *Specialised (or Semi-Automatic) Occupations*, involving certain types of attention and certain reactions which do not vary. These cover the majority of factory workers, miners, etc. Various sub-divisions could be made according to the type of attention required.

(*a*) Continuous and regular attention applied to a single object, e. g. weavers, miners.

(*b*) Distributed attention applied to a variety of objects, e. g. workers in charge of two machines, tramway drivers, observers of several signals, workers who sort and classify samples.

(*c*) Rhythmic attention, e. g. a spinner whose work requires him to alternate his attention between different objects.

(*d*) Concentrated attention which is only required at a given moment and then intensively, e. g. foundry men at the pouring of moulds, and chemical workers watching the critical moment of a reaction.

(*e*) Fluctuating and intermittent attention, e. g. a hotel porter who has to watch several things at once and to change the object of his attention constantly without the need for any great effort of concentration.

Further sub-divisions can be introduced according to the various reactions required by the different trades.

(2) *Medium-Grade Occupations.* These require a certain amount of intelligence and a certain combination of mental abilities which, however, are fixed in advance and limited. As examples may be quoted the work of compositors, telephone operators, typists, goldsmiths, school teachers, gymnastic instructors, and teachers of music, languages, etc., in fact all those whose work lies within definite limits and is not creative. The systematic classification of these medium grade occupations, which are very varied and in many cases border on higher-grade occupations, is not yet completed. As Lipmann points out ([16]), they may be classified according as they require more mental or more manual work; intelligence, memory, or attention; accuracy or taste; collective or individual work. The abilities required will also differ according to the material worked, whether wood, iron, textiles, etc.

(3) *Higher-Grade Occupations.* These require primarily creative intelligence (organisation, construction, discovery, etc.) and judgment (distinction between essential and non-essential factors, etc.); examples of these are the occupations

(16) Lipmann : *Wirtschaftspsychol.*, pp. 20-21. Second edition, Leipzig, 1921.

of engineer, architect, or doctor ([17]). Lipmann proposed to classify these occupations from two points of view, which combined give nine subdivisions. The two points of view are those of the mental activity involved and the nature of the object to which the intelligence is applied.

Type of intelligence	Higher-grade occupations connected with		
	Persons	Things	Ideas
Gnostic (scientific)	Magistrate	Anatomist	Logician
Technical	Educationalist	Engineer	—
Artistic	—	Sculptor	Author

Gnostic activity is applied to knowledge and is therefore scientific. Technical activity is applied to changes to be made and is practical. Artistic activity has no need of definition.

Lipmann also introduced further sub-divisions according as the activity in question deals with persons, i. e. with human minds, which are complex wholes and must be treated as indivisible entities, or with things which must be analysed, or with ideas. The fact which distinguishes a man working on ideas from a man working on things is that, while the latter finds his raw material in nature, the former creates his material himself. There are, of course, imperceptible shades of transition between the various classes. Lipmann observes that the difference between the gnostic and the technical types corresponds roughly to the distinction drawn by Ostwald between classic and romantic and by de Maday between worker and combatant ([18]). The chief types of higher-grade worker may thus be described as follows :

Characteristic	Type	
	Gnostic (Classic or Worker)	Technical (Romantic or Combatant)
Temperament	peaceful / phlegmatic	lively / sanguine
Reaction	slow	rapid
Interest, attention	concentrated	divided
Mental attitude	theoretical / inductive	practical / deductive
Work	intensive	extensive

(17) On the subject of higher-grade occupations see M. Ulrich : *Die psycholog. Analyse der höheren Berufe*, in *Ztschr. f. angew. Psych.*, Vol. XIII, 1917.

(18) Lipmann : *Psychol. der Berufe*, in the *Handbuch der vergleichenden Psychol.* Munich, 1922.

These notes are only given by way of example and suggestion, but serve to show the great practical value of classification. To simplify the work of the vocational counsellor it would also be desirable to have special systems of classification for individuals with some disability or abnormality which excludes them from a great many occupations (e. g. blind, deaf, or one-armed men). Fontègne, on the basis of the work of Mlle Ioteyko, even proposes a separate classification for left-handed persons. In his opinion, work with the left hand is particularly injurious to the heart, and left-handed persons should therefore be advised to avoid very heavy work. It is also obvious that separate classifications should be drawn up for each sex (19).

But this is not all. Up to the present only the sensory, mental, and motor abilities required by the various classes of trade have been considered. There are still the problems of the emotions, traits of character, and temperament. Some trades are more specially suited to placid temperaments, others to lively temperaments; one trade may require continuous, another spasmodic, work. Some occupations demand exceptional moral qualities, such as power of resisting temptation and honesty (e. g. in bank cashiers). The good salesman should have a special talent for persuasion. The ideal classification should be dichotomic, and should be based on the foundamental abilities needed. Such a system, however, will not be completed without long and persistent hard work, which will require widespread and general co-operation.

(19) Lipmann (*Psychol. der Frauenarbeit*, in *Die Frau*, Aug. 1920) raises the question thus : (1) Is a woman in general more or less suited to occupational employment than a man ? (2) Are there occupations for which a man or a woman is more specially or exclusively suited? Are there any occupations which are specifically women's occupations ? (3) In occupations suited to both sexes, is the output of a women equal to that of a man ?

on the children themselves instead of on photographs, but no real science of physiognomy has yet been evolved. Binet examined a large number of children with this in view, but was only able to establish a connection between a prominent chin and strength of will (10).

One cause of error in judging a person by observation is the fact that the sympathy or antipathy which he arouses may be influenced by causes of which the observer is unconscious, as, for example, a vague resemblance to another person whom he likes or dislikes. Unfortunately these impressions are the strongest. Nevertheless, observation of the subject can provide a certain amount of information regarding his character, his behaviour, or his temperament (nervous, phlegmatic, diffident, courteous, attractive, etc.). Until means are found of determining character by experiment, observation is the only means of obtaining information on this subject.

Some investigators think that graphology may be used. For some years Binet in France, Klages in Germany, and Downey and Osborn in America have been endeavouring to reduce this art to an exact science (11). It is very probable that some characteristics have a definite effect on handwriting, but it is still open to question exactly what characteristics do this and how the resulting modifications of handwriting can be estimated. Up to the present data provided by the graphologist — even assuming agreement on the part of different graphologists — can only be admitted as presumptive evidence.

Medical Examination

We need here only mention medical examination, which for the most part is a matter of observation. It should be carried out by a doctor. There are, however, some tests of the heart and other organs which are experimental; sensation, motor ability, muscular strength, and anthropometric factors may be determined by a psychological or physiological expert in vocational guidance who has the necessary special training. The object of the medical examination is rather to discover counter-indications against a given trade than to determine special abilities.

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(10) Binet in the *Année psycholog.*, Vol. XIV, p. 24.

(11) For a general survey of the subject cf. Downey : *Graphology and the Psychology of Handwriting.* Baltimore, 1919.

Anthropometric Examination

It may be asked whether anthropometry, i. e. the anatomical measurement of man (height, chest measurement, length of limbs, cranial dimensions, etc.), is of value in vocational guidance and can give information on physical or physiological abilities. An eminent French anthropologist, Professor Manouvrier, is extremely sceptical of this. In his opinion it is —

> illusory to rely on anthropometry for the diagnosis and prognosis of abilities, as even in manual occupations and games the value and success of individuals depend on conditions too complex to be discovered even by the most minute and numerous anatomical measurements (12).

Anthropometry does not sufficiently emphasise activity. The shape or the anatomical measurement of a limb is only one factor in the ability to use the limb. Moreover, in the case of children, the proportions of the various members change more or less with age. Professor Manouvrier continues:

> From the point of view of predicting the future abilities of children, data regarding the variations to which an individual is subject up to the age of 18, 20, or more should be accepted with great caution. Abilities should be determined by careful experiment and not by measurement. When the child, after receiving a physical and intellectual education in the school, has to choose an occupation, his abilities should be estimated directly and not by guesses based on anthropometry.

This pessimistic estimate of the practical value of anthropometry is no doubt justified by the present contribution of this science to vocational guidance. It can hardly be denied, however, that it may make progress and produce useful results, if it is developed in this new direction (13). This view gains strong support from the hopes which Dr. Godin, a follower of Manouvrier, bases on anthropometry.

It is, of course, certain that anatomical development may in some cases determine the type of occupation. There are different muscular occupations, as Dr. F. Regnault (14) points out. Two opposite types may be contrasted: the man with short stumpy limbs who is strong but slow (the strong type), and the tall, thin man, swift and agile, but less strong (the extension type). These two types are combined with various other characteristics (nervous or cold

(12) L. Manouvrier: *Anthropométrie et aptitudes* in the *Revue anthropologique*, 1911. Paris.

(13) Godin: *Manuel d'anthropologie pédagogique*, p. 8. Neuchâtel and Paris, 1920.

(14) Regnault: *Les types et les vocations musculaires*, in the *Revue scientifique*, 12 Oct. 1912, p. 458. Paris.

However, information supplied by the school may be very valuable, provided it is given by men who know how to observe their pupils. But even in the most favourable circumstances this information cannot take the place of an objective examination (7).

At the Barcelona Conference Dr. Lipmann, in his report on the function of the school in vocational guidance, drew the conclusion that the school cannot itself carry out vocational guidance but that its co-operation is necessary (8). The Conference unanimously agreed to these conclusions. The school as at present understood is certainly not well fitted to estimate abilities of value in occupations. It is too bookish, too much attached to words, not sufficiently active, and too remote from life. But it may well be asked whether the school as it should be and as it is already in some pioneer institutions (e. g. Dr. Decroly's school at Brussels, and the Ecoles nouvelles) is not more fitted than any other body to estimate, investigate, and even to stimulate these abilities. By giving the children information regarding various occupations and showing them something of different trades, for example, by means of cinematograph films, the school could certainly arouse latent interests or suppress illusory inclinations.

In conclusion it may be said that, while at present the school is in no way equipped or adapted to co-operate usefully with the vocational counsellor, there is no reason why the school of the future should not do so. This presupposes a special preparation of the teachers, including a better study of psychology. They should be instructed in the difficult art of observing the child and enabled to make such observation as objective as possible.

Observation of the Subject

Mere observation will not give the vocational counsellor much accurate information, for the very good reason that he will rarely have an opportunity of watching the behaviour of his subject in everyday life, and in the various circumstances

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(7) Experiments have been made to find to what extent teachers' opinions of their pupils correspond with the results of tests. Cf. F. Engelmann : *Vergleich von Begabungsprüfung und Lehrerurteil*, in *Ztschr. pädagogischer Psychol.*, Mar. 1920. Wilhelm : *Beiträge zur Begabungspsychol. auf Grund des Lehrerurteils*, in *Ztschr. f. angew. Psych.*, Vol XIX. Stern : *Die Intelligenz der Kinder*, p. 194 (*Intelligenz und Schulleistung*). Leipzig, 1920.

(8) See Lipmann : *The School in the Service of Vocational Study*, in the *British Journal of Psychol.*, Vol. XII, 1912 (Cambridge), for full English translation of this report. The original German is given in Deuxième Conférence internationale de Psycho-technique appliquée a l'Orientation professionnelle : *Compte rendu*. Barcelona, Institut de l'Orientacio professional. 1922.

arising in it. Observation will be limited to forming an opinion from his face, movements, manner, language, and possibly handwriting. It is impossible to avoid judging by appearances to a certain extent. One proverb tells us that "clothes make the man", but the errors into which this may lead are well known. Another proverb, as true as the first though directly contradictory, says that "It is not the cowl that makes the monk". "Judge not by appearances" and other similar aphorisms insist on the same truth.

The human face does not necessarily indicate the presence or absence of intelligence. Binet and Pintner (9) realised how frequently mistakes may be made in this connection. They put before a number of persons a collection of photographs of normal and abnormal children and asked them to distinguish between them and arrange them in order of intelligence. Even doctors and teachers showed a considerable proportion of errors.

Binet showed some teachers a collection of forty portraits of children, half of whom were normal and half abnormal. When asked to give an opinion, the teachers made some very bad mistakes, and 35 per cent. of the estimates were incorrect. Pintner took twelve photographs of children whose intelligence had been measured by means of tests and whose coefficient of intelligence was known. He then asked doctors, teachers, psychologists, students, and others to arrange the photographs in order of intelligence. The grades so estimated were then compared with the actual grades in the tests, and the correlation between the two was calculated. The coefficients were very low, the best being 0.52 and the worst −0.63. The average correlation coefficients for the different groups of observers were as follows:

Group	Correlation coefficient
15 psychologists	0.18
17 teachers	0.09
9 doctors	0.05
11 miscellaneous persons	0.05
11 students	0.03

The conclusion to be drawn, in view of these unsatisfactory results, is that it is impossible to estimate children's intelligence merely from photographs. In the experiment described above the most intelligent child had an intelligence coefficient of 1.93 and the least intelligent one of 0.47, calculated on the Yerkes-Bridges intelligence scale. The estimates would probably have been more satisfactory if they had been based

(9) Cf. Binet in the *Année psycholog.*, Vol. XII, 1906, p. 271; Borel in the *Année psycholog.*, Vol. XIV, p. 141. Also Pintner: *Intelligence as estimated from Photographs*, in the *Psycholog. Review*, 1918, p. 286.

means to give the child a taste for work for which he is fitted and to dissuade him from occupations to which he is uselessly attracted. A distinction should be drawn between real inclination resulting from deep-seated aspirations and superficial ambition arising from suggestions derived from friends or books. Nor should inclination be confused with ambition. Many people wish to enter certain trades from no interest in the trade itself but for the sake of certain indireet advantages which they hope to gain. Mr. Jonckheere, a Belgian professor, investigated the motives which led the students of the normal college at Brussels to enter the teaching profession, and discovered that none of them had a real vocation for the profession, i. e. they did not enter it because of a real taste for it, but because the choice was dictated by secondary factors such as parents' advice or utilitarian considerations (3).

The precise relation between inclination and ability can only be determined by observation and experiment. The first experiments in this sphere were carried out by the American psychologist Thorndike on a number of students. He found a high correlation (0.89) between ability and interest. On the other hand, more recent experiments by Bridges and Dollinger lead to the conclusion that a person's interests are an extraordinarily inaccurate indication of his relative capacities. Hartmann and Dashiell in similar experiments found that of 31 persons 25 showed a positive correlation between ability and interest, the average correlation for the whole number being 0.243. In short, it appears that there certainly is a correlation but that it is uncertain and inconstant (4).

The variation of tastes with age should also be studied. The tastes of the child are often modified during adolescence and vary with age, as is shown by a large number of investigations which have been carried on during the last twenty years into the ambitions of children (5). As yet, however, there is no information available regarding the extent to which the inclinations of the adolescent persist in adult life.

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(3) T. Jonckheere : *Devient-on instituteur par vocation?* in *Arch. de Psych.*, Vol. VIII, 1908.

(4) Thorndike : *Interests and their Relation to Abilities*, in the *Popular Science Monthly*, 1912. New York. Bridges and Dollinger : *The Correlation between Interests and Abilities*, in the *Psycholog. Review*, 1920. Princeton, N. J. (Thorndike replied to this in the same *Review*, 1921, p. 374). Hartman and Dashiell, in the *Psycholog. Bulletin*, 1919. Princeton, N. J. These experiments are inadequate to prove any thesis, and should be extended and completed by observation in everyday life.

(5) On the question of the favourite trades of children see, among others, F. Baumgarten : *Berufswünsche und Lieblingsfächer* (Langensalza, 1921); and the report on the investigation made by the Rousseau Institute : M. Chavannes and H. Jezler : *Le choix d'une profession*, in the *Intermédiaire des Educateurs*, Jan. 1919, Geneva.

Occupation and Vocation

The ideal case is that of the person whose interests and abilities coincide. In such a case it may indeed be said that the occupation which he wishes to enter is a true vocation. Vocation signifies the union in any individual of interest and abilities in one branch of activity. 'Occupation' is an objective term, 'vocation' has a psychological content.

Interrogation of Persons Acquainted with the Subject

Interrogation of the subject may with advantage be supplemented, especially in the case of a child, by information obtained from persons who know him, the family, neighbours, friends, school, and societies. Greater or less importance will attach to information from these sources according to the circumstances. If the child to be advised is a boy scout, the scout masters will be able to give useful information, as the scouts are organised according to their chief abilities, and it is possible to watch them in their various activities, many of which have certain features in common with the chief trades. The most valuable information, however, can be obtained from the school. The value of the statements made by the candidate's teachers is very variously estimated. In some respects a teacher who has had a child in his class for one or more years is in an excellent position to know him and give an opinion on him. On the other hand, however, the scholastic work on which the children are judged is very different from occupational work. It may be questioned whether the school affords opportunities for evincing the qualities which will be the most useful in the majority of trades. Mr. Christiaens, who is well qualified to give an opinion on this matter, as he was formerly a head master and is today head of the vocational guidance office in Brussels, writes as follows (6):

> The detection of abilities cannot be left entirely to the teacher, the professor, or head of an institution, nor to a committee of teachers appointed solely on the ground of their educational qualifications. The atmosphere of the school does not reproduce that of society at large; that is obvious. The abilities resulting from adaptation to the former are not those produced by adaptation to the latter. There are sometimes fundamental differences between the two environments. The abilities developed by the school are only indirectly of use in employment.

Mr. Christiaens recalls the number of famous men whose school reports were always bad, and points out that six times out of ten the predictions of teachers are not realised.

(6) Christiaens : *L'orientation professionnelle des enfants*, p. 52. Brussels, 1914.

V

Diagnosis of Vocational Abilities

Methods of Diagnosis

Once the abilities required by various occupations have been determined and suitably classified, the next step is to determine whether a given individual possesses a specified ability — the problem of vocational selection — and to diagnose the abilities of a given individual — the problem of vocational guidance. The methods described in connection with occupational analysis are also applicable here : enquiry (from the individual and those acquainted with him), observation, and experiment.

Interrogation of the Subject

Conversation with the person concerned is essential before any advice is given on the choice of an occupation. The value of this conversation is, however, very differently estimated. While some give it the most important place, others regard it as of practically no value and try to replace it by an entirely objective examination.

Parsons, as has already been pointed out, employed solely the method of interrogation. In so far as his questions refer to the occupations or inclinations of the child or youth they are quite legitimate, even though the person questioned, through timidity or deliberately, may perhaps feel that he must conceal the fact that he smokes or drinks or likes going to the cinema; but when it comes to estimating the subject's own abilities, the value of questioning becomes very doubtful. Knowledge of self is the most difficult thing in the world. There are very few people who could give an accurate estimate of their intelligence, memory, hearing, or manual skill. In one direction or another anyone may be completely mistaken about himself. Bloomfield truly says that self-knowledge is easier for children than we think; it is certainly possible to obtain reliable information by this means, but some independent

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and object check must be applied (1). The interrogatory method is of little more value with an adult than with a child, but it may supply valuable suggestions. The questions should refer principally to :

(1) family conditions : occupations of the parents, etc., financial position;

(2) health and heredity;

(3) physique, appetite, sleep, strength, fatigue, endurance;

(4) habits : smoking, theatres, reading, games or hobbies;

(5) education, schools attended;

(6) ambitions : occupation desired, inclinations, interests, ideals;

(7) various intellectual and moral qualities;

(8) defects : vices, lack of ability.

Inclinations and Abilities

One of the greatest drawbacks of the interrogatory method is that it gives far more information regarding the inclinations and interests (subjective phenomena) of an individual than his actual abilities (objective phenomena). It is by no means proved that inclination always coincides with ability; in fact it is certain that in a great many cases there is no relation between the two. In support of this it is only necessary to mention the many artists ardently devoted to their work who have never succeeded in having their pictures hung in any exhibition and the number of 'orators' who have a mania for long speeches though totally devoid of eloquence.

The question of the relation between inclination and ability is of great importance. To ignore the inclinations of a child is often to depress him and rob him of any joy in his work (2), but to do so may be in his own interests. The intervention of the school may be of value here in endeavouring by some

(1) The questionnaire method is used in a large number of vocational guidance offices. Its chief supporter is Mr. MAUVEZIN, Director of the Bordeaux office. In his interesting book *La Rose des Métiers* (Paris, 1922) he reprints his questionnaire, which comprises more than one hundred questions. It is asking rather much to expect a child to say if he is imaginative, if he sleeps with his mouth open, if he is frank, etc.

(2) It is well known how little interest the majority of workers have in their work (cf. LEVENSTEIN : *Die Arbeiterfrage*, Munich, 1912) and how desirable a restoration of this joy in work would be. Cf. H. HERKNER : *Die Bedeutung der Arbeitsfreude*, in *Theorie und Praxis der Volkswirtschaft*, Dresden, 1905.

the theoretical interpretation of the phenomenon it is clear that there are remarkably accurate processes now available for determining the level or degree of intelligence especially in children.

General intelligence may also be determined by means of a number of different tests which all require the use of active or integral intelligence. These tests propound a problem to be solved. The tests given for general intelligence very frequently include a group of tests for integral intelligence.

But it is also important to determine the quality of this general intelligence as well as its degree. It has been observed that problems which are identical in logical construction are solved differently by different persons according to the subject of the problem. Thus one person will be more successful in solving abstract problems, another in solving concrete problems; some have an aptitude for mathematical problems, others for mechanical problems, others again for literary problems. Clearly these various aspects of general intelligence ought in practice to be treated as variations in special abilities.

The following may be cited, in addition to those of Binet and Simon, as examples of general intelligence tests : Terman's tests ([24]), which are a revised and supplemented form of the Binet-Simon tests, the numerous tests recently issued in the United States, such as the army Alpha and Beta tests, the Otis tests, Haggerty's tests, the Mental Survey Scale of Indiana University, the National Intelligence Tests constructed by Haggerty, Terman, Yerkes, and Whipple, the Detroit First-Grade Intelligence Test, the Miller Mental Ability Test, and Myers' Mental Measure ([25]). To this list may be added the tests of Mlle Descoeudres, which it is true are only graduated for children from 2 to 7 years of age, but could be carried further. These tests make it possible to determine the mental age of a child within a few months (provided it is a normal child). The tests proposed by Peter and Stern for the selection of gifted children in the Hamburg Schools may also be mentioned ([26]). The value of these tests for vocational guidance and selection will be considered later.

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(24) Terman : *The Measurement of Intelligence.* Boston, 1916. Also Yerkes : *A Point Scale for Measuring Mental Ability.* Baltimore, 1915.

(25) For the Army tests cf. Yoakum and Yerkes : *Army Mental Tests.* New York, 1920. The *Otis Tests*, Haggerty's and Miller's tests, the *National Intelligence Tests*, and the *Detroit Test* are published by the World Book Co., Yonkers-on-Hudson (N.Y.). Myers' *Mental Measure* by Newson and Co., New York.

(26) Descœudres : *Le Développement de l'enfant de deux à sept ans.* Neuchâtel and Paris, 1921. Peter and Stern : *Die Auslese befähigter Volksschüler in Hamburg.* Leipzig, 1919. For a list of the principal tests proposed for measuring intelligence, cf. Stern and Wiegmann : *Methodensammlung zur Intelligenzprüfung.* Leipzig, 1920. Unfortunately no information is given regarding the rating of these tests, and without this it is impossible to make use of this list.

Ability Tests

These tests may be divided into two main classes referring either to natural or to acquired abilities. It may justly be objected that knowledge, especially knowledge acquired by memory, above all by verbal memory, is not ability. This is true; but in practice it is very difficult to separate the two entirely. For one thing the acquisition of knowledge depends to a large extent on natural abilities (observation, memory, etc.), and for another the development of natural abilities is largely influenced by acquired knowledge (for example, mathematical ability will depend on the acquisition of knowledge on which this ability can act; literary ability depends on wealth of vocabulary; writing ability on temperament). Tests of knowledge may therefore be considered as a sub-division of ability tests.

Knowledge Tests. These tests may apply either to knowledge naturally acquired by contact with environment (information tests) or knowledge acquired in school. Information tests consist of questions regarding matters of everyday life. At the Rousseau Institute a series of such questions have been drawn up; e.g. What are the duties of a magistrate? If oil and water are mixed, what happens? How many days does a good liner take to go from Havre to New York? etc.

In addition to questions on ordinary knowledge, mention may be made of tests of vocabulary, including wealth of vocabulary. The latter depends much more on environment than on school progress. Mlle Descoendres observed, in the course of her investigations and experiments in the language of children, that children of the well-to-do classes had a much larger vocabulary than those of the working classes, and in certain language tests there was a difference of as much as 100 per cent. There are as yet no good series of suitably graduated tests of information and knowledge for adults.

Tests of scholastic knowledge cover arithmetic, spelling, geography, etc. Psychologists in various countries are engaged in drawing up scales for the evaluation of such knowledge. It would also be desirable and doubtless not difficult to find a means of estimating accurately and rapidly a person's knowledge of a foreign language. A distinction would have to be drawn between understanding the language when spoken or read, speaking it, and writing it.

Tests of Natural Abilities. These tests are intended to determine the actual psychological abilities, tendencies, and capacities of the individual. The name 'natural abilities' does not imply that they are solely the result of heredity and in no way of education. In my opinion, Christiaens goes too far

any more than a hundred other tests which ought to do so much more fully. Moreover, as the test was discovered by chance, it is at least possible that it may itself be the result of purely accidental causes; the number of subjects may not have been sufficient to eliminate the possibility of the correlation being the result of chance. Even if repeated experiments produce the same result, it is impossible to avoid the idea that what the completion test measured was not specific engineering ability but rather general intelligence, in which case the so-called occupational test would not deserve its title. It is hardly necessary to say that selection by empirical tests involves the use of a number of such tests; a single test could not be made the basis of a decision.

General Criticism of Occupational Tests

In theory all occupational tests have the disadvantage of using as a means of diagnosis an operation which is successfully performed by individuals who have learned the trade, are well acquainted with it, and have practised it. It must therefore be proved that ability to pass the test is not the result of apprenticeship or training, and it may be questioned whether it is fair to judge a candidate before training by means of a test which possibly presupposes training.

If, in a given individual, A is his ability to pass the test before training and A' his ability to pass the same test after training, what guarantee is there that A will give any real indication of A' (for it is A' which is of the greatest practical importance)? In order to make such a prediction, it is necessary to ascertain that in a number of individuals their final abilities (A', B', C') are in proportion to their initial abilities (A, B, C) so that

$$\frac{A}{A'} = \frac{B}{B'} = \frac{C}{C'} \text{ etc.}$$

This, however, still remains to be proved. Further development of this criticism, which is of great importance, will be deferred to the sections on natural and acquired abilities and educability.

Psychological Tests

The object of psychological tests is to indicate and measure the various psychological capacities, whether simple (e. g. auditory acuity or sense of pitch) or more complex (e. g. arithmetical or drawing ability or motor dexterity). For purposes of vocational guidance psychological tests may be

divided into two main classes, each comprising two subdivisions thus :

Tests of general intelligence	Tests of total intelligence Tests of general integral intelligence
Tests of special abilities	Tests of knowledge Tests of natural abilities

Tests of general intelligence are intended to estimate the degree of intelligence — for example, in the case of a child, whether it is retarded or advanced, and if so, by how many years, or what is its "intellectual quotient" (degree of intelligence expressed as a percentage). The object of tests of ability, on the other hand, is to determine the type of intelligence, its quality and characteristics, the special capacities of the subject (for example, if he is or is not artistic or good at mathematics, or if he has a good memory), and in what respect he is specially gifted ([22]).

Tests of General Intelligence

Since the famous work of Binet and Simon, general intelligence is usually estimated by giving the subject a number of different tests which are not necessarily tests of pure intelligence (e.g. comparison of weights, copying drawings, repeating sentences, naming colours). It is remarkable that the average of the results of these different tests gives a figure expressing the general intelligence of the subject. Intelligence regarded from this standpoint may be called total intelligence *(intelligence globale)* ([23]).

The success of experiments with the Binet or similar tests shows that every mental operation involves, in however small a degree, a certain amount of intelligence. Every operation results as it were from the combination of two factors, one of special ability and one of general intelligence. When a number of different tests are given to a single subject the factors corresponding to special abilities (positive and negative) tend to cancel one another, while the effect of the general intelligence factor, which is constant, is cumulative. Whatever

(22) Cl. Claparède : *Des diverses catégories de tests mentaux*, in the *Arch. suisses de neurologie et de psychiatrie*, Vol. III, 1918; and *Classification des méthodes psychology.*, in *Arch. de Psych.*, Vol. VII, 1908. Also Stern : *Die Intelligenz der Kinder*. Leipzig, 1920.

(23) For the Binet-Simon tests, cf. the small volume : *La mesure du développement de l'intelligence chez les jeunes enfants*. Paris, 1917. For an example of determination of total intelligence, cf. the experiment of Mlle Descœudres in *Arch. de Psych.*, Vol. XI, No. 44, 1911. This writer gave 15 different tests to 14 backward children. She found that the classification of these children by the average results of the tests performed by each of them corresponded almost exactly with the classification of the children according to their general behaviour in everyday life.

Synthetic Analogous Tests

The principle is the same as in the first type, but the test, instead of reproducing exactly the operations of the occupation, imitates its conditions more or less closely. An example of this type of test is that constructed by Münsterberg in his early researches at Harvard University. The machinery which the tramway driver has to handle is reproduced in its principal features only. The street down which the imaginary tram runs is represented by a strip of squared paper and pedestrians and vehicles by letters of different colours. Many intermediate varieties of test will be found between this and the first type, as well as between it and the following.

Analytic Tests

These tests are constructed by analysing the occupation into its elementary operations. Tests to cover these component operations are sometimes an exact reproduction of the actions in the trade, sometimes only an analogous representation. Thus, when Fontègne and Solari studied the problem of telephone operating, they decided that the work of the telephone operator required (1) memory for numbers; (2) memory for names, (3) attention, (4) rapidity of movement, and so on, and they constructed tests to measure each of these abilities. In Lipmann's investigation a compositor's work is similarly reduced to ability to spell, read, etc.

The reader is here entitled to ask how it is known if these elementary tests actually correspond to the elementary operations of the occupation and whether this analysis might not give rise to errors. It is obvious that before using a test to detect or measure an ability the first step is to ascertain that the test actually applies to this ability and brings it into play. To make certain of this the tests themselves must first be tested in order to discover their exact significance. A similar problem has already been encountered in connection with the experimental analysis of occupations ([18]). The question was then raised how it could be proved that a given elementary ability was required for a given occupation. It was shown that in order to ascertain this the correlation method must be used to find if workers regarded as satisfactory were more successful in a given elementary operation, or gave clearer evidence of a given elementary mental function, than unsatisfactory workers. The same method must be used in testing the tests, finding their correlation with

(18) See above, p. 26.

the abilities shown in the work of the occupation itself (19). It should be added that tests constructed for occupational analysis may be included as they stand among occupational tests, if they are proved by experiment to be sound.

Empirical Tests

The use of the foregoing method has led to some disillusionment. Some tests, which were chosen as reproducing most accurately certain elementary factors in an occupational operation, gave no satisfactory correlation in the control experiment. For example, a good telephone operator immediately finds the point on her switchboard where she must insert the plug; this, it appears, requires ability to judge distance accurately. Experiment, however, showed that the test constructed to detect this particular kind of spatial judgment gave a very low correlation (20).

A certain number of psychologists therefore thought that, instead of devoting themselves to theoretical analyses of occupations on which to base tests, it would be simpler to choose a number of tests at random, to find the correlation of each with any given occupation, and to retain those with a high correlation, without considering what exact psychological relation there was between the test and the elementary ability. The discovery of one or more tests revealing a given occupational ability would thus be entirely empirical. For example, it was found that the completion test (test for completion of sentences) showed a very marked correlation (0.63) with engineering ability, and the Knox cube test an even higher correlation (0.73) with bill-posting (21).

This method is at present in favour in the United States. It certainly has the advantage of being entirely objective, since it requires no psychological hypothesis and no conception of the constituent element of abilities; moreover, it is most convenient. But it is impossible to place complete reliance on results so obtained. The mind is not satisfied when it does not understand. It may be asked why a test for completion of sentences should indicate engineering ability

(19) Thurstone (*The Predictive Value of Mental Tests*, in the *Educational Review*, Vol. LXIII, Jan. 1922. New York) proposed another method of controlling tests. The pupils are tested on entering the school and divided into four groups according as their results are ' very good ', ' good ', ' poor ', or ' bad '. After one or two years it is ascertained whether a larger number of the ' good ' than of the ' bad ' pupils have had to leave the school. Experiments on these lines have enabled the author to estimate the " predictive value " of his tests.

(20) Fontègne and Solari : op. cit., in *Arch. de Psych.*, Vol. XVII, p. 116.

(21) Quoted from F. Watts : *The Outlook for Vocational Psychol.*, in the *British Journal of Psychol.*, Jan. 1921, p. 198. Cambridge.

temperament, etc.), and thus produce varying types of activity.

For the moment, however, it may well be asked if a simple inspection of the subject and his behaviour does not give as much information regarding character as exact measurements.

Tests

The last method to be mentioned is that towards which all efforts are tending — the theoretically ideal method of psycho-physiological tests by which the motor and mental abilities of an individual may be determined by a rapid examination. It has already been pointed out that occupational analysis provides information on the abilities needed in the various occupations. The data now required are those regarding the abilities possessed by a given individual so that they may be related to a given occupation. The determination of the existence and extend of these abilities may be effected by means of tests.

The word 'ability' is here taken in its most general sense, namely, any aptitude, natural or acquired, to perform a certain act or a certain piece of work, to feel or to react in a certain way. It is used to describe any physical or mental quality when considered from the point of view of its effects. There are, therefore,

sensory abilities (e. g. ability to distinguish colours);
motor abilities (e. g. skill or accuracy of movement);
intellectual abilities;
emotional abilities (e. g. aesthetic sense, will-power).

The great problem of today is the construction of tests which will demonstrate and measure these abilities. A solution of the problem is essential for satisfactory vocational guidance and will repay hard and enthusiastic work. The use of tests, as against the other methods mentioned, has four advantages.

(1) It is objective; i. e. its results are obtained by experiment and are independant of the opinion of the subject or the experimenter.

(2) It can produce results in a relatively short time; instead of enquiring into what an individual does it seeks to determine immediately what he is capable of doing.

(3) It provides a measure of the psychological quality under consideration. It is thus possible to determine not only the existence but the extent in an individual of a given ability. Thus, individuals can be compared and classified and the variations of a single ability in a given individual may be traced. The numerical data given by measurement also make it possible to measure qualitative variations.

(4) Provided that the measurements obtained refer to a common base, it is possible to compare the results obtained by different investigators, and thus to provide a numerical form of statement which can be understood by all without ambiguity. If a child of 10 is said to have a poor memory while his friend's memory is quite good, this means nothing to anyone; whereas, on the contrary, the statement that in the 15-word test one child gave a result corresponding to the 25th percentile, while his friend reached the 75th percentile, is perfectly clear and precise and leaves no room for ambiguity ([15]).

After these general remarks, the following section gives a rapid survey of the various types of test, the methods of administering them, and their reliability.

Occupational and Psychological Tests

The distinction between psychological and occupational tests is most important from the point of view of this study. Occupational tests are of most value in vocational selection, and psychological tests in vocational guidance ([16]), but there is no absolutely clear distinction between these two categories and intermediate cases will be encountered.

Occupational Tests

Occupational tests are based on the structure and working of the occupation, psychological tests on the structure and working of the mind. The object of most occupational tests is to reproduce more or less accurately the actuel operations involved in the occupation. Hitherto four forms of test have been employed.

Synthetic Sample Tests

These tests reproduce exactly the operations to be performed in the future occupation, with the same complexity and the same technique as in the reality. Thus at the training school for tramway drivers in Berlin the experimental laboratory has been fitted up with machinery exactly like that found on the trams themselves. The only addition is that of appliances to record promptness of movement, errors, etc. ([17]).

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(15) For the meaning of these expressions see below, p. 57. See also Claparède : *Tests d'aptitude*, Geneva, 1920 (reprinted from *Arch. de Psych.*, Vol. XVII).

(16) For the distinction between these two questions, see above p. 20.

(17) Tramm : *Ueber psychotechnische Bewegungsstudien an Strassenbahnnotbremsen*, in *Praktische Psychol.*, Vol. I. 1919-1920, pp. 118 and 252.

in reserving the word 'ability' ([27]) solely for predispositions which owe nothing to acquired experience. He says that "we cannot admit the term 'ability' as describing an acquired capacity of any kind". The individual is nevertheless a product of both heredity and environment. The mere fact of living, the development and working of our bodily organs, has developed all our innate abilities and helped to bring them to their present state of advancement. It seems hardly possible in practice to distinguish between the innate and the acquired. Christiaens himself admits this later when he says that.—

> ability always corresponds to a particular organic tendency produced by the action of environment on the inheritance, which itself is the result of the conditions under which the child's family has prospered.

The term 'natural abilities' is intended to emphasise the distinction between such abilities, on the one hand, and, on the other, knowledge or habits resulting mainly from study or training, i. e. those dependent on memory, whether for ideas or movements. Obviously, however, for the reasons already mentioned, it is impossible to draw a sharp line of demarcation between the two processes.

It is nevertheless true that in practice tests of natural ability should be clearly distinguished from tests of knowledge. According to circumstances the same test may be classed either as a knowledge test or as one of actual abilities. The permutation test, for example (in which the subject is required to write down in a given time as many permutations as possible of a certain number of letters), is certainly a test of true ability for a person who has never done such a thing before, but becomes a mere test of knowledge for the mathematical student. When a candidate in an ability test is already acquainted with it, the test may become merely one of knowledge and thus lose its value. The solution of a problem obviously means nothing to a person who has already had to solve it a short time before. It is therefore necessary to keep the general public in ignorance of the composition of tests, so that candidates cannot prepare for them beforehand. For the same reason every test should include a large number of equivalent and interchangeable tests in order to frustrate the stratagems of candidates.

It should be added that a test of knowledge may in some respects be a test of ability, for example, a test in speed of addition. For persons who are perfectly well able to add, speed in addition is rather a natural ability than knowledge, and the same holds good of speed in writing. Therefore subjects of such tests should not have had special practice in

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(27) '*Aptitude*'. See CHRISTIAENS: *L'orientation professionnelle des enfants*, p. 62. Brussels, 1914.

adding or writing rapidly. Thus it is clear that the classification of a test as one of knowledge or ability is mainly a matter of common sense and intuition.

Ability tests include the determination of :

(1) mental functions or abilities considered in isolation (sensory, intellectual, motor, or emotional abilities);

(2) variations in time of these abilities (practice, adaptability, educability, liability to fatigue, constancy);

(3) type of general intelligence (abstract or concrete, theoretical or practical, mathematical, verbal and literary, mechanical, philosophical, etc.).

(4) originality.

It is impossible to go into the details of all these tests here ([28]). They are intended to measure the various mental functions in their most elementary form, or, in the case of more complex functions or abilities, to select clearly defined operations. It is easy to construct tests, but more difficult to know exactly what they measure. The examiner reads 15 words to the candidate and asks him to repeat them, but it is hard to say whether memory or attention has been measured. The candidate makes a drawing, but this may measure either his aesthetic sense, his memory for form, his sense of proportion, his powers of observation, or his manual dexterity. This illustrates the number of delicate questions which face the psychologist in his attempts to place psychological tests on a scientific, rational, and not merely empirical basis.

Tests of Emotion and Character. Hitherto research connected with tests has turned mainly to intellectual or motor abilities. Tests for the determination of character or the measurement of the whole personality have been almost entirely disregarded. In recent years, however, certain American books have opened this new field of investigation. In 1908 Norsworthy tried to measure personality by the method of judgment. In 1916 Moore proposed to test the strength of instinct by means of association of ideas. In 1919 Downey constructed a test of will power. In 1912 Fernald (and in 1914, Mlle Descoeudres at Geneva) endeavoured to measure moral sense by the classification of anecdotes describing faults of varying degrees of gravity. In 1919 Pressey suggested tests of emotion and Filter in 1921 tests of character ([29]). It

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([28]) Tests which may be mentioned are STENQUIST's *Mechanical Aptitude Tests*, which test ability to understand drawings of machinery, and THURSTONE's *Vocational Guidance Tests* of geometrical, algebraic, and technical skill. (Both published by the World Book Co., Yonkers-on-Hudson, N. Y. 1922.)

([29]) NORSWORTHY in *Essays in Honour of W. James*. London, 1908. MOORE : *Testing the Strength of Instincts*, in the *American Journal of Psychol.*,

is impossible to go into details here. These are only preliminary efforts, which nevertheless deserve attention. The practical value of the determination of character, however, will readily be grasped. Without character and energy to overcome obstacles the gifts of intelligence are of little worth. The late Professor P. A. Guye, who as a chemist had opportunities of following his old pupils in industrial life, often said that he had observed that moral worth was at least as important a factor in success as intellectual worth.

Among tests of emotional abilities, attention may be called to those recommended by Revesz to measure musical ability. It would be most desirable, before advising a child to take up music as a profession, to ascertain whether he will be successful in it ([30]).

The subjects' power of resistance to monotony should also be investigated. The monotony of work for workers who have to repeat the same movement throughout the day with nothing to distract their mind is known in many cases to have a depressing and demoralising effect, while this is not so with others. It would therefore be well if power of resistance to monotony could be forecast ([31]). It would also be useful to obtain information — though this concerns the instincts rather than the emotions — regarding the effect on the individual of the presence of others. Some persons work better alone, others if they are among a number of other people doing the same work. Möde proposed interesting experiments on which tests for this quality may be based ([32]).

Synthesis of Elementary Functions. Psychological analysis of the subject and the determination of his separate mental functions may or may not give an accurate estimate of his aptitude for an occupation. The accuracy of the estimate is a new question which can only be settled by experience. The great majority of occupational operations require the co-ordination of these elementary functions. The possession of these abilities and the power to co-ordinate them are two different things. This illustrates the possible value of the synthetic tests previously mentioned ([33]).

1916. Worcester, Mass. Downey : *Individual Will-Temperament Tests.* Washington, Carnegie Institute. 1919. Fernald in the *American Journal of Insanity,* 1912. Baltimore. Descœudres : *Test sur le jugement moral,* in the *Intermédiaire des Educateurs,* Jan. 1914, p. 54; June 1917, p. 91. Geneva. Pressey in the *Journal of Applied Psychol.,* 1919, Worcester, Mass.; and *A Group Scale for Investigating the Emotions.* in the *Journal of Abnormal Psychol.,* 1921. Boston. Filter : *An Experimental Study of Character Traits,* in the *Journal of Applied Psychol.,* Dec. 1921. Allport : *Personality Traits; their Classification and Measurement,* in the *Journal of Abnormal Psychol.,* 1921.

(30) Revesz : *Prüfung der Musikalität,* in *Ztschr. für Psychol.,* Vol. LXXXV, 1920.

(31) For a study of monotony, see H. Winkler : *Die Monotonie der Arbeit.* Leipzig, Barth. 1922.

(32) Möede : *Experimentelle Massenpsychol.* 1920.

(33) See above, p. 42.

The Problem of General Intelligence

The next question to be considered is the importance, both for vocational selection and guidance, of measuring general intelligence; whether, in particular, it is of any practical value to know the degree of intelligence possessed or whether it is enough to determine the nature and tendency of special abilities. It seems quite evident that the determination of general intelligence is the first step when an individual, especially a child, has to be advised on the choice of an occupation. If this person appears to have a high level of intelligence, or to be backward or feeble-minded, entirely different groups of occupations are open to him.

Here again, the question arises of the relation for a given occupation between general intelligence and special abilities. It must be decided which of the two is the more necessary. For example, four workers must be chosen from 100 applicants to fill four vacancies in an engineering shop; it is necessary to decide whether the men chosen should be those with the greatest manual dexterity, the best eyesight, the most sensitive fingers, the most rapid reaction, or those who appear to be the most intelligent. No definite answer can be given to a question of this nature. Some occupations require more general intelligence than special ability, while in others special ability is the more important. It may be said that hitherto the facts give sometimes one answer and sometimes another. Some specialists, like Mr. Petitpierre, whose remarks have already been quoted ([31]) complain that in entrance examinations at vocational schools too much attention is paid to the general tests and there is no test of special ability.

Good results have also, however, been obtained by selecting workers solely according to general intelligence. In this connection the army tests used in the United States should be recalled ([35]). Although these tests only referred to general intelligence (they included problems of attention and reflection, and small arithmetical problems) and included no test even remotely connected with the work of a soldier, they were wonderfully effective in estimating military ability. Men who had bad results in the tests made bad soldiers and even worse officers, while those who on service evinced real military qualities gained the best marks in the tests. Other factors than intelligence, however, are involved in military ability, such as courage, obedience, endurance, and physical abilities. The intelligence tests made no attempt to measure these

[31] See above, p. 15.
[35] See above, p. 18.

qualities, but experience showed that there was a fairly high correlation between intelligence and these other qualities. In other words, they are more likely to be found in men of superior intelligence than in those of low mentality.

This correlation between general intelligence and special abilities is only of practical value in large-scale classification. If a single individual is under consideration, his general intelligence gives only a slight indication of his special abilities. In the United States some psychologists of wide knowledge now complain of the importance attached to general intelligence tests. Porteus, for example, insists that intelligence is no measure of 'social competence', and that a very low level of intelligence is in no way incompatible with real social capacity ([36]).

Another question, differing slightly from the last, is whether, other things being equal, general intelligence increases the value of the special abilities of the subject, or — which comes to the same thing — if general intelligence can supplement in part a lack of special abilities. These difficult questions can only be solved by experiment. The relations between general intelligence and special abilities are not yet known. It has already been mentioned ([37]) that this problem has only recently become the subject of psychological investigation. At present psychologists are much divided in opinion. Some hold that the mind is only an assemblage of abilities which are completely independent of each other; others think that the mind in all its aspects is dependent on a central capacity of general intelligence, while the various abilities are only different aspects of this. Others again, with Spearman of London, support the theory of two factors, according to which every ability is the result of the interplay of two factors, a special factor and a central factor (general intelligence) ([38]).

The question of general intelligence also arises in connection with the interpretation of certain tests. Mr. Cyril Burt, the London psychologist, pointed out that Münsterberg's famous tests for tramway drivers, while apparently special ability tests, in reality refer much more to general intelligence than to special psychomotor qualities. According to Münsterberg's

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(36) Berry and Porteus : *Intelligence and Social Valuation*, p. 5. Publications of the Training School, Vineland (New Jersey), 1921.

(37) See above, p. 16.

(38) On this subject see W. Brown and G. H. Thomson : *The Essentials of Mental Measurement*. Cambridge, 1921. These writers criticise Spearman's theory, and support a new theory that the various abilities are merely the result of the combination of a number of elementary psychological factors. In place of the theory of two factors they put forward a theory of group factors or sampling theory of ability.

own report, university students who took the test gave much better results than the most experienced tramway drivers (39). The same question may be asked in connection with most ability tests. Do they measure ability or general intelligence? The practical importance of this question is obvious, and suitable research should be undertaken in order to solve it. It will then be possible to know for certain whether tests of ability eliminate the 'misfits' or 'unfits', to quote Watts.

Meantime, the paradoxical results obtained by Münsterberg or others may be roughly explained by means of the theory of two factors. If an intelligent person, not specially skilled, is more successful in an occupational test than a skilled worker in the occupation concerned, this may be due to the fact that the ability is the result of a combination of intelligence and ability. Some such equation as the following may be constructed: success in an occupational test = ability + general intelligence. Thus in a worker whose ability equals 10 and intelligence 2 the result would be 20; but this may be exceeded by a student whose ability equals 3 and intelligence 10, giving a total of 30. This example is given merely by way of illustration to make the ideas involved more concrete and with no intention of taking sides in the still unfinished controversy regarding the nature of abilities.

Methods of Applying Tests

There can be no question here of giving practical directions for applying tests, but certain general principles and essential conditions may be indicated, so that the requirements of the psychologist may be better understood, and that he may be assisted to satisfy them. If a psychological test is to be of any value, it must be carried out under conditions resembling as nearly as possible those of ordinary life. The subject of the test should be as far as possible also in a normal state. Any test requires two essential conditions: (1) The subject of the test must be willing to undergo it. It is essential that he gives it all his attention, and takes as much pains as possible. (2) The subject must not be in an abnormally nervous, timid, or excitable state.

The realisation of the second condition depends mainly on the experimenter. It is for him to take care not to frighten his subject, to reassure him and put him at his ease by his manner of receiving him and speaking to him. No

(39) Quoted from Watts: *The Outlook for Vocational Psychol.*, in the *British Journal of Psychol.*, Jan. 1921, p. 197. Cambridge.

candidate for a test should be treated in a brusque and hectoring manner. These requirements should be carefully followed, especially in the case of working men or children. To a certain extent the achievement of these conditions depends on the psychologist having won the confidence and sympathy of the candidate, to whom he should explain the interest of the experiment in which he is to assist. It depends even more on the prejudices with regard to psychological experiment which are current in the environment of the candidate.

At the present time workers tend to obey the orders of their trade unions blindfold. They readily accept opinions without judging them on their merits. If the opinion of the trade union is unfavourable to applied psychology the worker will refuse to submit to selection tests, or, if he is compelled to undergo them, he will regard them with distrust, and in consequence the results will be far inferior to those he would have obtained had his attitude been different. It is therefore in the interests of the candidates, even more than in those of the psychologist, that general opinion should be favourable to the tests. All who have the welfare of the workers at heart should endeavour to explain to them that applied psychology is working in their interests, and that, even if it has made little progress as yet, it may come to be a valuable aid to the workers. In the case of vocational selection the candidates obviously stand to gain by taking as much pains as possible. This may not be so true in vocational guidance, if the candidate tries to conceal his real abilities in order to follow his inclinations.

The tests will be made, according to circumstances, either in a psychological laboratory where the persons to be advised or selected are required to attend, or in the factory itself, or in the school. Attendance at a laboratory is almost inevitable if the tests require special apparatus which it is difficult to move, but the drawback is that the workers are obliged to enter an unfamiliar place, which involves the risk of arousing timidity or excitement. In the near future all large factories, as well as schools of arts and crafts, technical schools, etc., will probably have their own psychological laboratories, as is already the case with many firms in Germany, the United States, and Switzerland.

The next important question to be answered is who shall give the tests. It may be thought that, in the case of vocational selection, the engineers or managers of the factory who engage the workers are suited for this task, and, in the case of vocational guidance, that the tests might be entrusted to employment exchange officials or school teachers. It is, however, a more delicate task than might appear to apply a test, and it is absolutely necessary that it should be entrusted,

if not to a professional psychologist (as would be the most desirable), at any rate to some one who has seriously studied psychological methods. Vocational guidance, even more than vocational selection, requires extensive psychological knowledge, and especially a fine psychological sense. In any case every test should be accompanied by instructions showing exactly how it is to be applied.

Standardisation and Rating : Graphs

When the test has been given, with all the precautions necessitated by so delicate an operation, the results must be evaluated for the purpose of the diagnosis to be made, which, it may be recalled, consists in measuring a certain capacity or ability. This measurement can obviously only be made by referring the results obtained by the subject to a standard. This standard must be selected, and will be a different one in the case of vocational selection from that needed for vocational guidance.

To take first vocational selection. Suppose, as an example, that from a dozen candidates the four best have to be selected for four vacancies. The candidates might merely be arranged in order of their results, and the four at the head of the list might be selected. The inadequacy of this method, however, hardly needs to be pointed out. There is nothing to prove that the four best of twelve persons will be good absolutely as well as relatively. For the purposes of the work to be done, even the four best applicants may be quite unsatisfactory workers.

An objective standard (objective minimum norm) is therefore necessary to determine the minimum performance which is required of a candidate in the tests before he is admitted to the occupation in question. Similarly an average standard can be established, and a standard for workers meriting the description excellent. For example, an engineer, dentist, engraver, or watchmaker requires a minimum visual acuity of 1 in one eye and 0.5 in the other. Well chosen and tested tests are a necessary preliminary to the fixing of these standards. This will involve a great amount of work, but without these standards vocational selection will not achieve its full significance.

The problem may now be considered in regard to vocational guidance. In selection the starting point is, as it were, the occupation. In vocational guidance the scales of measurement are fixed from the point of view of the child or individual to be

advised. Suppose that a youth seeking an occupation is brought to the adviser, who carries out, for example, a memory test. The result of this test must be expressed in some fashion, and the best way of indicating the degree of the subject's memory must be found. If his memory had been tested by the 15-word test, the observer might merely note how many words of the 15 he remembered. It is not of much value, however, to know that the boy remembered 6 or 9 words out of 15. This information is only of use if the average number of words remembered by boys of the same age is also known. It will then be possible to find whether the child under consideration is about the average, or above or below it. This estimate, useful though it may be, is still very rough. It should be possible to say not only whether a person is above or below the average, but how far he is from it. In other words, it is desired to know if the person in question, when classified among a number of other persons in respect of memory ability, would rank with the first, with the last, or in what grade exactly.

The measurement of an ability thus implies an idea of grade, and the degree of an ability possessed can only be established by means of grading (40). Since the publication of Galton's work it has been customary, when grading individuals, to imagine a group of 100 and to find what grade the person to be classified would obtain among these hundred persons, the first of whom shows the minimum degree of ability and the hundredth the maximum. The degrees of ability corresponding to the intermediate grades are determined by experiment. These hundred theoretical individuals thus form a scale divided into 100 parts, and this scale of measurement is applied to the ability of the person to be advised or selected. To repeat, diagnosis of the degree of ability possessed can only mean indicating the grade of an individual in respect of this ability.

The hundred divisions of the scale thus described are known as percentiles. The measurement of an ability thus implies finding the percentile corresponding to the results of the test. An example will explain the procedure better than a lengthy explanation. Take again the determination of direct verbal memory. It is desired to determine the degree of verbal memory ability of a child of 12. He is given the 15-word test, and succeeds in repeating 10 words. In order to find the percentile corresponding to this figure, it is obviously necessary previously to have found by a number of experiments the performance of boys of 12 in this 15-word memory test. Experience shows that, if the 15-word test

(40) Claparède : *Profils psychologiques gradués d'après l'ordination des sujets*, in *Arch. de Psych.*, Vol. XVI, 1916, p. 73.

is given to 100 boys of 12 who are then graded according to their performance, those boys rank first who remember 13 words and those last who remember only one, the intermediate grades corresponding to intermediate numbers of words. A scale can thus be drawn up showing what grade or percentile corresponds to a given number of words.

Percentile	Number of words remembered
100	13 or more
90	10
80	9
70	8
60	7
50	7
40	6
30	6
20	5
10	4
1	2 or less

A glance at this scale or percentile table shows that a memory for 10 words corresponds to the 90th percentile. This shows that the boy taken as an example ranks quite high as regards memory, and in practice the figure 90 may be taken as representing the degree of his immediate verbal memory ability.

If similar scales are drawn up for all ability tests, the result of any of them may be converted into percentiles. This method has the great advantage of referring results to a single unit of measurement — the percentile — which means the same whatever the test under consideration. It is thus possible to compare two abilities of a single individual and ascertain which of them is the greater. Suppose that this boy of 12 was found to have a writing speed of 120 letters a minute and a speed of calculation of 4 divisions a minute ([41]). These various abilities would thus give the following percentiles: verbal memory 90, writing speed 75, calculation 20. The interpretation of these data would be that his dominant ability is verbal memory, while he is much below the average in calculation.

When a number of tests have been given to the same individual, the best method of presenting the total result is to construct from the data obtained a psychological graph according to the suggestion of Rossolimo of Moscow ([42]). The various tests are represented by the abscissae and the results obtained in each test by the ordinates. It has been proposed ([43]) to construct these graphs from percentiles, though

(41) Claparède : *Tests d'aptitude*. p. 316. Geneva. Kundig. 1920 (reprinted from *Arch. de Psych.*, Vol. XVII).

(42) Rossolimo : *Die psycholog. Profile*, in the *Klinik f. psych. und nerv. Krankheiten*, Vol. VI, 1911.

(43) Claparède : *Profils psycholog. gradués d'après l'ordination des sujets*, in *Arch. de Psych.*, Vol. XVI.

Rossolimo used arbitrary scales, so that his different tests were not comparable. This modification has been generally accepted by German and American practical psychologists (44).

The advantage presented by percentile scales over other arbitrarily constructed scales may be emphasised. In addition to the advantage already mentioned of making it possible to compare different abilities, it also expresses a fact in a form readily grasped. It is not of much significance to us that a certain ability measured by an objective and arbitrary scale equals 30 or 75, even if the maximum of the scale is known to be 100. On the other hand, to say that a person graded for this ability reached the 30th or the 75th grade out of 100 expresses a perfectly clear idea. It means that of 100 persons there are 70 who surpass him in this ability, if he is the thirtieth (the first percentile usually corresponds to the lowest degree of the ability under consideration, and the hundredth to the highest).

The measurement of abilities in percentiles does not obviate the need for the vocational counsellor to take into account the objective requirements of occupations. A subject may have one pre-eminent ability which stands out over his other abilities, but this does not necessarily mean that this chief ability is adequate to the needs of a given occupation. In each particular case the objective minimum norm already mentioned (45) must be taken into consideration.

Percentile tables have also the advantage of giving a definite meaning to the terms 'very good', 'good', 'adequate', 'most inadequate', as they are commonly used in ordinary language. It may be decided, for example, to describe as very good abilities corresponding to percentiles from 90 to 100; as good those from 75 to 90; as adequate those from 25 to 75; as inadequate those from 10 to 25; and as nil or most inadequate those from 1 to 10. Such terminology, however, is quite arbitrary. Some writers, as for example Lipmann, only apply the term 'very good' to abilities from the 95th to the 100th percentile. It will possibly be necessary to come to an agreement on this question of terminology at a future International Conference on Practical Psychology. It is also possible that this terminology cannot be fixed on uniform lines, as the adequacy of an ability is not an absolute characteristic of the ability, but a relative conception depending on the level of the objective minimum norm. A good degree of

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(44) Lipmann : *Die Berufseignung der Schriftsetzer*, in *Ztschr. f. angew. Psych.*, Vol. XIII, 1917, p. 117. Giese : *Psychotechnische Eignungsprüfungen*, p. 312. Langensalza. 1921. Kohnstamm : *Ueber die Eichung von Tests*, in *Ztschr. f. angew. Psych.*, Vol. XIX, 1921. p. 287. C. H. Town : *Analytical Study of a Group of Five and Six Year Old Children*, p. 35. University of Iowa Studies, 1921.

(45) See above, p. 56.

arithmetical ability, for example, will be described as adequate or not according to the trade in question.

It is thus clear that the detection and measurement of an ability presupposes the existence for each ability of a scale or percentile table, showing how this ability varies within a given community or group. The establishment of these scales requires a great deal of research, on which psychologists are at present engaged. In order to draw up a percentile table the test to be rated must have been given to a very large number of persons. The larger this number the more accurate will be the scale. In practice it is often difficult to extend these investigations to as large a number of persons as might be wished. In any case it is desirable that this number should be not less than 30 or 40, which is, however, only a minimum, to be exceeded wherever possible.

It has now to be decided what persons should be the subjects of these preliminary experiments for fixing the scale, whether these persons should be selected, and if so how. It must be definitely stated that they should not be selected. As a rule, the percentile table should represent the distribution of abilities throughout the whole community, and this implies that the persons observed for the purpose should be selected at random. They should, moreover, be sufficiently numerous to afford a probability of finding among them the various types in the same proportion as they occur in the community at large. If in the group chosen there were, for example, a larger number of very efficient or incapable persons than in the whole of the community, the scale would be wrong. In the first case it would give too high an estimate, and the candidates rated by the scale would be graded too low; in the second case the scale would give too low an estimate, and would thus overrate ability.

But it may well be asked whether the group chosen can be taken as representing the community adequately, and forming, as it were, a miniature of it. To make certain of this it is only necessary to plot graphically the results obtained from the representatives of this group according to the procedure laid down by Galton. If an ogival curve is thus obtained, this shows that the group is representative of the population, as observation has shown that the normal frequency curve of natural phenomena is ogival ([16]). If the curve shows too large a proportion of higher or lower degrees of ability, it will be necessary to increase the number of cases taken as a basis for the scale.

Some limitation is necessary on the rule given above, by which persons used as a basis for percentile scales should not

[16] Galton : *Enquiries into Human Faculties*. London, 1883. See also Claparède : *Psychol. de l'Enfant*, p. 344, and preface, p. xix. Eighth edition, Geneva, 1920.

be deliberately selected. If the scales are to have any real significance age must obviously be taken into account. An entirely false estimate would be obtained by measuring the abilities of a child on a scale constructed for adults. Different percentile scales should be fixed for different ages, at any rate up to 17 or 18, after which scales for adults can be used.

Sex must also be considered. It is infinitely preferable to grade a man on a scale drawn up for men and a woman on a scale drawn up for women. The significance of the percentile at which the subject is graded is thus more precise than if the scale were drawn up as the result of observations of both sexes, between which ability may vary considerably. Suppose that mechanical intelligence is more developed in man than in woman, and that in spite of this observations of both sexes are made the basis of a percentile scale for a mechanical intelligence test. The result will be that men will occupy all the high grades and women the low grades on the scale. This will involve the danger of perpetually overestimating the male and underestimating the female subjects.

In the case of scales for knowledge tests or tests of ability presupposing certain knowledge (such as mathematical ability), it will frequently be impossible to base them on representatives of all classes of the community. Obviously, in order to grade knowledge of languages, only those persons must be taken into account who have had an opportunity of learning a foreign language. Common sense will show in each individual case if it is necessary to make a choice of the persons to be used as a basis for the scale. A distinction must also be drawn between normal and abnormal persons, although this is sometimes difficult to achieve.

Diagnostic Value of Tests

Let it be assumed for the sake of argument that the scales and standards described have been drawn up on a sound basis. Take the case of an individual who wishes to pass a selection or guidance test. He takes the test — for example, the attention test — and obtains a certain result. It is then necessary to know what this result is worth and whether it really describes this individual's attention ability. In order to answer these questions another similar experiment should be made with the same subject. The result will not be exactly the same as in the first case, and repetition of the experiment will always give different results ([47]).

(47) Claparède, *De la constance des sujets à l'égard des tests d'aptitude*, in *Arch. de Psych.*, Vol. XVII, 1920.

Constancy of Subjects

No individual remains always the same. His abilities may vary from one moment to another, or various subsidiary factors (fatigue, excitement, etc.) may modify the expression of this ability. In other words, all individuals are more or less inconstant, and this fact complicates considerably the diagnosis of abilities. Occasionally very marked divergencies appear between the results of different applications of the same test to the same person. One of the first steps to be taken is, therefore, to study the extent of these divergencies and the methods of eliminating them.

It is first of all desirable to give several tests, not alike but equivalent. If the results vary considerably an effort should be made to find the cause of these variations. The results obtained under the best conditions should be taken, or, if such selection is impossible, the average of the various results. The fact that subjects are not constant and that abilities vary from one moment to another shows that each ability should be represented, not by exact figures, but by two figures representing the limits of its variations. The psychological graph should not consist of lines joining certain points but of bands defining areas of variation. This constancy of personality is in itself a characteristic of the individual and should be studied on its own merits. Some individuals are much more constant than others. For practical purposes the former are more reliable, as their performance can more safely be accepted.

Variation in the degree of an ability from one experiment to another is also affected by factors other than the constancy of the individual. Constancy may vary in a single person according to the test given.

Accuracy of Tests

If some tests give much more constant results than others in a single subject, this cannot be attributed to the personality of the individual, as a single cause cannot produce different results. It should first be determined whether some tests are not less reliable and their results more doubtful than others. This question has hardly been studied as yet. What is needed is an investigation to compare the constancy of different subjects in the same test and the accuracy of different tests of the same subject. Thus it will be possible to find how far the inconstancy of the results is due to the individual and how far to the test itself.

Permanence of Abilities

If it is demonstrated that the inconstancy is due to the test, and not to the individual, it must still be ascertained if the cause is the constitution of the test, the method of applying it, or the ability measured. Different abilities in a single individual are not equally constant. It is well known that, in general, emotional factors vary more than intellectual. The higher functions (attention, intelligence) vary more than the lower, purely sensory (visual acuity, etc.) or automatic capacities. In the emotional sphere the now classic investigations of Norsworthy ([48]) proved that when the chief traits in the character of an individual *X* are estimated by a number of judges, that is, by a number of persons who know *X* well, agreement is general on certain characteristics (e.g. authority, vanity, popularity), while other traits, such as honesty, tact, etc., are more variously estimated. This obviously suggests that some characteristics are more fixed, less fluid, than others. These problems are far from being solved and can only be mentioned here. The question whether inconstancy is due to the nature of the test or to the nature of the ability will be solved by applying different tests and methods to a single ability (e.g. visual memory), so determining what is attributable to the test and what to the ability.

Prognostic Value of Tests

Supposing that all the difficulties hitherto mentioned had been overcome, and that means had been found of eliminating errors arising from the inconstancy of the subjects, of the abilities, or of the tests — inconstancy caused by day-to-day or moment-to-moment variations in mental activity — even so a further difficulty would arise from the variation in abilities over a long period of time. This is a most important problem. The object of testing abilities for purposes of vocational selection, and even more of vocational guidance, is to discover not so much what the subject is at present as what he is capable of becoming. The diagnosis is in reality prognosis. The object is to discover not what his abilities are but to foresee what they will be, not to determine present capacity but to foretell future success. This problem raises two others, that of the stability of abilities and the modification of abilities by practice.

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(18) Norsworthy : *The Validity of Judgments of Character*, in *Essays in Honour of W. James*. London, 1908.

Stability of Abilities

This question mainly concerns vocational guidance, and is of special importance in advising a child or young person. Such questions arise as: Will this individual remain what he is today? Will he become more than he is at present, or will he lose what he already possesses? Will he gain or lose by contact with life? The majority of writers are conscious of this problem but do not seem to have realised its full importance. It is true that psychology is still very badly informed in this respect. It can readily be understood why this is so. The solution by observation and experiment of a problem of this nature must be spread over a whole generation. It is necessary to measure the abilities of young children and see if their development confirms or refutes the prognosis based on these first tests; but this, of course, requires time.

The crisis of adolescence often leads to profound changes in the individual. His inclinations and character are greatly modified. It has been justly asked if an estimate of ability made before this period has any value. The question arises in different forms in the case of general intelligence, special abilities, or temperament and character.

General intelligence is certainly a capacity which remains relatively the same throughout life, although it develops. A person who is backward as a child remains more or less below the average throughout his life, while the intelligent child has every chance of remaining intelligent when he becomes a man. Circumstances, however, make it very difficult to determine what precisely are the facts. The intelligence of children is most often estimated by their scholastic success, but this is not an accurate criterion of real intelligence. If future development does not justify the predictions made in childhood, it may be due to the fact that the ability has changed or that it has not encountered conditions favourable to its natural development. This, however, involves problems which are as yet unexplored.

Another difficulty in forcasting future intelligence is that intellectual output depends to a certain extent on character, interest, and will. The same individual will produce more if employed on work which interests him than in the opposite case. If he has high ideals and a resolute will his intelligence will produce the maximum. If, on the contrary, he is affected by scepticism and gives way to indifference or the poursuit of empty pleasures his intelligence will remain an unproductive force.

A beginning has been made with the systematic study of precocious children ([19]). It does not appear that precocity

([19]) Dolbear: *Precocious Children*, in the *Pedagogic Seminary*, Vol. XIX, 1912 (bibliography).

is a symptom of genius. Although some geniuses have been most precocious, as for example Pascal, Goethe, and Lord Kelvin, there are others who seem to have been entirely ordinary children, such as Darwin, Newton, and Rousseau. Children hailed some twenty or thirty years ago as veritable prodigies seem to have done nothing extraordinary and nothing more has been heard of them. As an example, little Otto Pöhler may be mentioned. He was born in 1892 and studied by Professor Stumpf, the eminent Berlin psychologist. He learned to read unassisted at the age of fifteen months and soon evinced an extraordinary amount of knowledge ([50]).

In the case of special abilities, most of all of special gifts, precocity is of more significance. It is characteristic of musical ability that it appears in childhood ([51]). Mozart began to compose at the age of seven and wrote his first opera at the age of eleven. Handel also was eleven when he composed his first works, while Beethoven was twelve. At the Paris Congress of 1900 Richet introduced a young pianist of 3 years 7 months ([52]).

Next to musical ability, mathematical ability appears earliest. Professor Fehr's investigation showed that, of 93 mathematicians consulted, mathematical ability appeared in 35 cases before the age of ten, in 43 between eleven and fifteen, in 11 between sixteen and eighteen, and in 3 cases between nineteen and twenty, giving a total of 78 cases in which mathematical ability appeared before the age of sixteen ([53]). Literary and artistic ability develops later than mathematical ability, and scientific ability later still. All this, however, gives no definite information as to the extent to which marked ability observed on the eve of adolescence, about the age of fourteen or fifteen, is likely to persist.

The problem of stability of character is even more obscure. It is common knowledge that nothing is more changeable than mood and feeling. On one day a person may be cheerful, eager, and make plans; on the following day, for some reason or another, excitement has yielded to depression, activity to lethargy. Yet the most 'characteristic' traits of a personality are to be found in the sphere of character. There is great scope for research in the psychology of character. When an individual changes in the course of his life, for

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(50) Stumpf in the *Revue scientifique*, Vol. VIII, 1897, p. 336. Paris.

(51) Revesz: *Ueber das frühzeitige Auftreten der Begabung*, in *Ztschr. f. angew. Psych.*, Vol. XV, 1919; also *Ueber das musikalische Wunderkind*, in the *Ztschr. f. pädagog. Psychol.*, Vol. II, 1918.

(52) Richet: *Cas remarquable de précocité musicale*; in *Congrès de Psychologie de Paris*, 1900; also Stumpf: *Akustische Versuche mit Pepito Arriola*, in the *Ztschr. f. angew. Psych.*, Vol. II, 1908.

(53) Fehr: *Enquête sur la méthode de travail des mathématiciens*. Geneva, 1908.

example through religious conversion, which entirely modifies his attitude to persons and events (e. g. St. Paul, St. Francis, Tolstoi), something permanent must surely remain in his character. If the direction of his reactions is modified, their form remains the same to a great extent. The whole question, however, is one of great complexity.

All these difficulties would make any attempt at vocational guidance useless, at any rate at present, if the object was to make a definite and certain diagnosis or prognosis; but vocational guidance no more claims infallibility than medicine. A diagnosis of ability should provide an estimate of probability. When a child comes for advice, the adviser, after examination, however definite the results may have been, will never say : " You will certainly succeed in this occupation ", but rather : " You are more or less likely to succeed in it ". The decision of the vocational counsellor should always be expressed as a judgment of probability.

The object of practical psychology is to make this judgment of probability increasingly exact ([54]). Even if this judgment is expressed very vaguely (e. g. " You are more likely to succeed in this occupation than to fail "), even this is surely better than nothing and better than the mere chance which now determines the choice of a career. Whatever changes may appear in character and in the later development of an individual's life, a forecast of abilities is not therefore useless. An adolescent worker, enthusiastic, sober, with a good character, is far more likely to keep these qualities in adult life than a lazy, disorderly, or vicious adolescent is to acquire them. Psychology should provide, and by means of intelligent statistics will be able to do so, a figure indicating the inherent probabilities in each of these two cases.

The question of the stability of abilities has two forms, quantitative and qualitative. From the quantitative point of view, stability implies normal development. To say that the general intelligence or mathematical ability of a child of twelve is stable does not suggest that these qualities will remain the same in adult life. It merely means that they will follow a normal course of development and that the individual will be as much above or below the average when he is an adult as he is now in relation to the average for his age. From the qualitative point of view stability implies preservation of the mental physiognomy, stability of the relative proportions of the different elements of the psychological graph. The high and low points of this curve will

(54) H. D. Kitson (*Vocational Guidance and the Theory of Probability*, in the *School Review*, Feb. 1920, Chicago) showed how the results of an experiment in vocational selection can be valued in terms of probabilities.

remain in the same place. For example, if at the age of twelve motor abilities are greater than intellectual abilities, this difference will persist in adult life.

These two problems of the stability of abilities may be investigated by the usual methods of observation and experiment, especially by the use of psychological graphs and their graduation in percentiles. Only by such graduation can the graphs for children and adults be compared.

Stability is of much less importance in vocational selection or guidance of adults. Causes of change, especially inherent in adolescence and on entering practical life, are here greatly decreased. The forecast to be made covers only a short period, since the candidate will enter the occupation chosen immediately after the examination. Here, however, and also in connection with vocational guidance, another question arises. It may be asked whether the actual exercise of a trade is not likely to modify abilities so that the diagnosis made before entrance into the occupation loses its value. It may be possible for acquired abilities to conceal natural abilities ([55]).

Natural and Acquired Abilities

The mere fact that a candidate asks for vocational guidance or has to submit to a selection test presupposes that he has not hitherto followed the occupation to which he is to be assigned. The first question which then arises is whether the candidate, if he does not in the psychological examination show the abilities required for the occupation, may not later acquire them in the course of learning the trade. The same question may be asked in the case of entrance examinations to technical or vocational schools.

This question raises several others which will be considered later in connection with educability. Here only one need be

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(55) The enumeration of the conditions which must be fulfilled by a satisfactory test should not lead the reader to suppose that tests cannot produce reliable results. The first researches in controlling the predictive value of tests are most encouraging. The following is an extract from the report of Mr. P. Rudhardt, Director of the Industrial Association of Geneva, on the results of the tests given to candidates for admission to the school of Watchmaking by Dr. Heimis, of the Psychological Laboratory of Geneva University.

" In the case of 6 of the mechanics the grade indicated by psychological tests on admission to the School was exactly the same as that attained by the students after a year's work. An important fact to be noted is that the two prospective students who a year ago were ranked lowest in the tests have since had to leave the School through inability to profit by the instruction. In the case of the watchmakers, who were more numerous, the great majority of the results at the end of the course agree with the grading on admission, and, as in the case of the mechanics, the three students at the bottom of the list in the tests in 1921 have had to leave the school during the year through inability to profit by the instruction. " (*Journal de Genève*, 1 Sept. 1922.)

mentioned. There may be a possibility that an individual who evinced certain natural abilities in a test before beginning to learn a trade may be outstripped in this respect during training by others who showed a lesser degree of this ability in the initial test. To take an example, two candidates, A and B, pass tests for telegraphists. A has a much better motor reaction than B, who appears quite devoid of any special ability in this respect. It may be questioned whether B might not surpass A in this respect after a certain amount of practice. Or take another example, two young designers, of whom A draws better than B. Is it possible that after a certain period in a school of art B would overtake and outstrip A ?

The problem raised is that of the relation between natural abilities and those acquired by practice, and whether practice can create an ability which was apparently lacking before. This question is of such importance that it was placed on the agenda of the first Conference on Practical Psychology at Geneva, but no one was in a position to reply to it. It may be considered from three slightly different points of view :

(1) in connection with children and education in general; the function of heredity and education in the formation of abilities;

(2) in connection with apprentices and training in a particular trade; the possibility of training developing an ability which was apparently lacking;

(3) in connection with disablement and retraining; whether and to what extent entirely new and non-natural abilities can be acquired.

Experience shows that persons who appeared entirely without a certain ability have nevertheless acquired the missing ability by their own efforts, or at least have found means of compensating this defect by their own will-power. Adler, the Viennese psychologist, even goes so far as to state that the knowledge of inferiority in a certain respect stimulates one to work in this direction, as if unconsciously one were protesting against the inferiority ([56]). He states that it was because Demosthenes stuttered that he became a great orator. Many painters have defects of vision. Giese expresses a similar opinion.

> It has still to be proved that abilities noted have really been fostered by environment and that the struggle against external difficulties has not been of more value to them. Here we are walking in the dark, although the matter is of fundamental importance for the success of gifted persons ([57]).

(56) Adler : *Heilen und Bilden*, Munich, 1914.
(57) Giese in the *Ztschr. f. pädagog. Psychol.*, 1916, p. 518.

In support of Adler's theory, the case of the late Professor Nagel, the Berlin psychologist, may be quoted. He specialised in the psycho-physiology of colour, although himself entirely colour blind. Such facts, however, appear to be exceptional, and it cannot, of course, be stated as a general rule that the lack of natural ability is a necessary condition for the acquisition of this ability. This question cannot be discussed more fully, however, without a better definition of the term 'ability', which describes very different things.

It appears therefore that the problem of stability of abilities is still obscure. It is largely subordinate to that of educability, which is briefly touched on in the following section.

The Problem of Educability

General Considerations; the Measurement of Educability

It is impossible here to deal with the whole of this problem, which is very large, but it is desirable to mark its importance and bring it to the notice of practical psychologists, who have not yet fully realised its importance. The term educability is very vague. It no doubt covers very varying processes, such as memory, comprehension, apperception, automatism, adaptability, habit, changes in emotional attitude, etc. These cannot be considered in detail. For the purposes of the present study educability is the power of mental faculties, operations, and abilities to develop through practice, whatever form this practice takes (intelligent study or mere repetition, memorisation, habit formation, etc.).

Hitherto, both in vocational guidance and selection, it has been more or less tacitly accepted that, if A shows greater ability in a test than B, A will also be more likely to develop this ability by practice than B. In other words, the educability of an ability was regarded as an attribute of this ability and dependent on the degree of the ability. Although this idea is plausible, there is nothing to prove that it is correct. It might equally well be supposed that educability is a general attribute of the individual, independent of any of his abilities or of the degree of these abilities.

The question should be submitted to experiment. If the first theory is correct, if educability is an attribute of the degree of the ability (if a given ability includes a capacity of development proportionate to its degree), experience should show that the result of practice on individuals of different abilities is to increase their individual differences. If, on the other hand, individual differences decrease after the period of practice, this implies an inverse rather than direct relation between the degree of an ability and its susceptibility to

practice. The greater an ability the less would be its power of developing through practice, and the slighter an ability the more it would have this power.

If the other theory is the correct one and educability is a general attribute of the individual, there should be no constant relation between the degree of an ability and its capacity for development. Thus, if a number of individuals are tested before and after practice, and the curves of their respective progress are drawn, these curves may appear in one of the following ways :

(1) On the theory of educability as a direct attribute, the curves should diverge, as those individuals who had the greatest ability to begin with will also gain the most by practice.

(2) On the opposite theory of educability as an inverse attribute, the curves should converge or even cross in the form of an X (for reasons the opposite of those given above).

(3) On the theory of educability as an attribute of the individual, these curves should cross and recross, the slopes being determined not by the degree of initial ability but by the actual composition of the personality of the individual.

The facts in connection with this question are extremely contradictory, and, as it is impossible for truths to contradict one another, it must be concluded that the facts compared require to be more minutely analysed. In the opinion of Thurstone, an American writer, for example, the variability of a group increases with practice. The more learners progress, the more they differ between themselves (the particular case was that of telegraphist learners) ([58]). This statement is only true, however, if educability is measured in terms of output. If speed of work or the number of errors made forms the basis, exactly opposite results are obtained, as Peterson pointed out. While the curves of output of different persons diverge, those expressing time or errors converge ([59]).

This contradiction is not a new discovery. Long ago Whitley showed that the reply obtained to the question whether practice increases or decreases individual differences varies greatly according to the method of calculating the results of experiments ([60]). This is such an important matter that it warrants giving an example taken from Whitley. It is, of course a purely imaginary case. Let A, B, C, D.

(58) Thurstone : *Variability in Learning*, in the *Psycholog. Bulletin* 1918, p. 210. Princeton, N. J.

(59) Peterson in the *Psycholog. Bulletin*, 1918, p. 452.

(60) M. T. Whitley : *An Empirical Study of Certain Tests for Individual Differences*, in the *Archives of Psychol.*, 1911, New York.

and E be five workers. The figures show the volume of their output before and after practice and their speed of work in hundredths of seconds per unit of work.

Subject	Output		Speed	
	Before practice	After practice	Before practice	After practice
A	5	10	300	150
B	9	18	166	83
C	10	15	150	100
D	6	18	250	83
E	5	15	300	100

It is obvious that the ranking of these five persons will be entirely different according as educability is estimated by output or time, and in each case as it is estimated by absolute or the relative progress.

Subject	Progress in output		Progress in speed	
	Absolute	Percentage of initial output	Absolute	Percentage of initial speed
A	5	100	150	50
B	9	100	83	50
C	5	50	50	33.3
D	12	200	167	66.6
E	10	200	200	66.6

Thus on the first system (absolute output) D is the most educable, then E, then B, and last A and C together. On the second system (relative output) D and E are equal at the top, then A and B and C alone at the bottom. On the third system (absolute speed) E is at the top and then in turn D, A, B, and C. On the fourth system (relative speed) D and E are at the top, then A and B, and C at the bottom.

The results differ not only in the ranking of the various subjects but also in the estimate of the relative degree of their educability. On the first system E is twice as educable as A, and also twice as educable as C. On the second system an extraordinary change appears; E is still twice as educable as A, but has become four times as educable as C. On the third system E's educability is only 1.33 times that of A, but still four times that of C. On the fourth system it remains 1.33 times that of A, but is only twice that of C. This example illustrates the difficulty of the problem and the impossibility of finding a single solution for it. Everything depends on the basis on which progress is calculated.

Some general considerations may be advanced at this stage. The experiments made show in general that persons

whose initial ability is the lowest gain the most by practice. This is almost always the case if progress is calculated as a percentage of initial output, but it is also sometimes the case if progress is reckoned absolutely. This may be a general rule, but it is liable to a great many exceptions. It appears only to apply to the average grades of workers. Very good workers often keep their high rank and very bad workers their low rank even with practice.

Five possible cases may be distinguished :

(1) High initial ability, high educability.
(2) High initial ability, low educability.
(3) Low initial ability, high educability.
(4) Low initial ability, low educability.
(5) Average initial ability; average educability.

These five types (ignoring intermediate cases) were found in an experiment in typewriting made with 18 school boys aged 13 and 14, from a primary school in Geneva, who had never used a typewriter before. The time they took to type the alphabet was measured. The test was repeated five times in succession, and in most cases considerable progress was recorded. The following figures show some of the results for five subjects, each representing one of the five types given above :

Subject	Initial time seconds	Final time seconds	Initial rank	Final rank
A	50	57	1	15
B	56	31	3	3
C	81	34	7	6
D	95	28	10	2
E	227	130	18	18

It thus appears that A represents type 2 (high initial ability, no educability); B type 1 (high ability and educability); C type 5 (average ability and educability); D type 3 (low initial ability, high educability); and E type 4 (low ability and educability) ([61]). The results as a whole appear to conform to the rule just laid down. Those who were slowest to begin with gained most by practice; those who were quickest at the beginning gained least. Between these two classes there were a number of individuals who showed no very clear relation between initial and final ability.

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[61] Similar results will be found in ARGELANDER : *Beiträge zur Psychol. der Uebung*, in *Ztschr. f. angew. Psych.*, Vol. XIX, 1921 (experiment with a typewriter); also LINDLEY : *Arbeit und Ruhe*, in *Psycholog. Arbeiten*, Vol. III, 1901, p. 515 (experiment in addition).

Educable and non-Educable Abilities

The great problem of educability has merely been touched. In itself it raises a great many questions. It might first be asked whether a distinction should not be drawn between abilities according to their degree of educability. Mere observation would suggest that this is so. Sensation and the memory for things are practically ineducable, while the faculty of motor co-ordination is highly educable. It would be both interesting and valuable from a scientific point of view to determine the characteristics of an ability which make it ineducable. It has been suggested that the ineducable abilities are those corresponding to the simplest elementary faculties. Some practical psychologists who have realised the importance of the question of educability say that tests should refer mainly to the elementary and ineducable factors, but it has still to be ascertained that these elementary faculties are ineducable. An example of an ability apparently quite impervious to practice is the ability to revolve a curling iron rapidly, which was studied by Schulte in his investigation of the occupation of ladies' hairdresser. The time curve obtained by measurement with a chronoscope did not fall at all with practice ([62]).

Differences in Educability of Abilities

A further question to be answered is whether educable abilities all develop with the same rapidity and facility, or whether there are some which develop very slowly and others very quickly after a short period of practice. This question is of considerable practical importance, as on its solution depends the reliability of prognosis from tests. If an ability can be rapidly trained, it can be developed to such an extent after a short period of practice that even practice in the occupation would not carry it farther. Measurement of the ability after this period of practice would thus be of value for the future.

Attempts have been made to compare tests in respect of educability. Thus Hollingworth repeated seven different tests 175 times with 13 individuals and determined by the correlation method which tests were the most susceptible to practice. He found, for example, that the grading of the subjects in the letter cancellation test after the 25th repetition was very similar to that obtained after the 175th (correlation =0.75), whereas, to obtain this correlation of 0.75 in the tapping test, the test had to be repeated up to the 130th time ([63]). In other words, the longer the practice was continued

(62) Schulte : *Die Berufseignung des Damenfriseurs*, p. 64. Leipzig, 1921.

(63) Hollingworth : *Individual Differences before, during, and after Practice*, in the *Psycholog. Review*, 1914. Princeton, N. J.

the more the grading of the 13 subjects resembled that obtained for the 175th repetition (the final grading). From the practical point of view it is desirable to know at what stage of practice the subjects reach their final and stable grading. Chapman undertook an investigation of this question in connection with the educability of typists (64).

Determination of General Educability

Whatever the susceptibility to practice of any particular ability, it is very probable that some persons are generally more educable than others. Backward individuals and idiots are known to be more or less ineducable. It may be asked whether this educability is in itself a special ability or merely an expression of general intelligence.

In various quarters attempts are being made to establish tests of educability. Christiaens, for example, in Brussels, gave five successive tests of motor dexterity and noted the curve of progress. He even sees in the shape of this curve an instance of the reality of this ability. He says that—

> in the case of special ability progress is regular, and the figures show this clearly. It should be pointed out that all abilities are present in all subjects, but in very varying degree. The sole matter of importance is to discover the rapidity of adaptation to the tests given, which is the only indication of real natural tendency.

It appears further that educability is influenced by the will or by the desire to develop. Interesting experiments might be made to compare passive education with active and deliberate education (65).

The phenomena of cross-education should also be mentioned. The effect of exercising one ability is sometimes to exercise related abilities. This is a fact proved by experience, and whatever its explanation, which has been much discussed, the practical psychologist must not lose sight of it. Enough has been said under this heading to suggest the number of important questions calling for the attention of investigators.

The Relation of Tests and Educability; Plan of Research

The many theoretical questions which have been raised would have the effect of obscuring rather than illuminating ideas on the subject if they did not impel us also to study the

(64) Chapman : *The Learning Curve in Typewriting*, in the *Journal of Applied Psychol.*, Vol. III, 1919, p. 266. Worcester, Mass.

(65) Cf. Giese : *Psychotechnische Eignungsprüfungen*, p. 199. Langensalza, 1921.

practical problem in precise terms. It has been shown that tests are only of value if they make it possible to forecast before training success or failure in this training or in the occupation. If has also been shown that this training itself may possibly change the psycho-physiological personality in such a way that its condition after training has no resemblance to the description given by the tests before this period. This might appear an insurmountable difficulty, as if a photographer were asked to produce a portrait of the child before him not as he is today but as he will be on reaching manhood.

This question might be investigated by empirical methods. Disregarding for the moment the obscure and hidden processes of educability, some suggestions for experiment may be given. Two parallel questions here arise.

(1) Are the tests stable or unstable ? Thus, if a test be given to a number of individuals before training and the same test to the same individuals after two or three years' training or work in the trade, will the results be the same on the second occasion as on the first ? Will there be a very high correlation between the initial and final results ?

(2) Are the results of tests comparable to those of actual practice in the occupation ? If the individuals observed are ranked by the results obtained in the final test, will this grading coincide with that obtained by grading these individuals according to their ability in the trade as shown in practice ?

These questions are very different, as there is nothing to show that instruction in a trade will affect the elementary abilities, the existence of which is proved by the tests. As those two questions overlap, four possibilities arise, and experiment must decide between them.

(1) The test is stable and in the final test correlates with acquired occupational ability.

(2) The test is stable but in the final test does not correlate with occupational ability.

(3) The test is unstable but in the final test correlates with occupational ability.

(4) The test is unstable and in the final test does not correlate with occupational ability.

In order to give greater clarity to ideas on the subject, an imaginary example may be given of an experiment on five subjects A, B, C, D, and E. Before training they are given a test, for example of motor ability, and are ranked according to these results. They then become apprenticed to a trade, and two years later are given the same test, and are also

graded according to their practical success in the exercise of their trade. In the first of the cases mentioned above the three gradings (initial test, final test and grading by practical success) will coincide. In case 2 the results might be as follows:

		Two years later	
Rank	Initial test	Final test	Practical success
1	A	A	E
2	B	B	C
3	C	C	A
4	D	D	B
5	E	E	D

The coincidence between the two first columns proves that the test is stable, but the absence of coincidence between these two and the third column proves that the test has no prognostic value and no practical value for vocational guidance. In case 3, on the other hand, the results would be as follows:

		Two years later	
Rank	Initial test	Final test	Practical success
1	A	C	C
2	B	E	E
3	C	B	B
4	D	A	A
5	E	D	D

In other words the test did indicate practical ability but did so at a moment when it was of no further use, as the test should give its forecast before training. In case 4 all three columns would disagree.

This question must therefore be settled by experiment. The most important tests must be tested by giving them to a number of individuals both before training and one or two years afterwards. Then the correlation between the initial and final results of the test must be calculated in order to see whether the tests are or are not stable. The correlation between the final tests and the grading in practice must then be calculated to find if the tests adequately indicate practical ability. It is evident that the tests will be regarded as valid and of prognostic value only if they conform to case 1. Experience will probably show that there are tests conforming to case 1, others to case 2, and others again to cases 3 or 4. It is quite impossible to say *a priori* to which case any given test conforms. As the value of any prognosis depends on the solution of this question, it is clearly most important that it should be investigated by experiment on a large scale and without delay.

Conclusions

In conclusion it may be well to summ arisevery briefly the steps which should be taken to place vocational guidance on a firm foundation.

(1) Psychological analysis of occupations and their classification according to the abilities required.

(2) Determination of corresponding abilities in individuals and, as a preliminary, the testing of tests to decide their diagnostic, and even more their prognostic, value.

(3) Investigation of the process of training and educability.

(4) Determination of the importance of general intelligence in the various occupations.

(5) It should never be forgotten that a forecast of ability will never be a certainty, but only a probability. Statistics should be prepared to determine this probability.

(6) Efforts should be made to arrive at a uniform system of measurement so that psychographs or psychological diagrams may be comparable between different countries and between different vocational guidance offices. Grading by percentiles appears to be the most rational and least ambiguous method.

(7) It is in the social interests of the community that every man should be in the position for which he is best fitted. It is also desirable and increasingly in accordance with the spirit of modern democracy that the various social functions should be allotted according to merit and not in virtue of any privilege. The only means of attaining this ideal is by a sound system of vocational guidance. All those who have at heart the harmonious organisation of society, both employers' and workers' organisations, should therefore facilitate by all means in their power any investigation having for its object the establishment of industrial psychology upon a firmer foundation.

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