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AN INTRODUCTION TO INDUSTRIAL PSYCHOLOGY

To my Colleagues of the
Industrial Health Research Board
and the
London School of Hygiene
to whom I am greatly indebted

AN INTRODUCTION TO INDUSTRIAL PSYCHOLOGY

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CASSELL AND COMPANY LTD.

London, Toronto, Melbourne and Sydney

THIS BOOK IS PRODUCED IN COMPLETE CONFORMITY WITH THE AUTHORIZED ECONOMY STANDARDS

First Edition March 1943
Second Edition July 1943
Third Edition Oct. 1945
Fourth Edition Feb. 1948

Printed in Great Britain
by T. and A. CONSTABLE LTD., Hopetoun Street,
Printers to the University of Edinburgh
447

PREFACE

THIS little book is not intended to be a detailed chronicle of psychology from the industrial standpoint, but to provide an introduction to the subject for those who are in some way responsible for others, or who have to get on with others.

During the last 20 years much patient research has been undertaken to prove the effect of hours of work, of different environments, of selecting people for suitable work, of the cause and control of accidents, and various related problems.

Unfortunately too few people knew what had been learned or attempted, so the practical experimentation has lagged behind the research. The result has been unfortunate during these recent years. Leaving on one side all research since the end of the last war, a number of problems that have arisen in this war might have been, if not solved, at least minimized, by the application of the findings of the Health of Munition Workers' Committee.

The reason for this ignorance is to be attributed to several causes. Some people were ignorant because the publications concerned with the research were too technical in character. Others in a futile quest for security turned a deaf ear to all innovations, believing that the last word on all problems was said in the childhood of their parents, and others, having learned that certain knowledge was available, cast it on one side as merely common sense, a commodity the users of this phrase usually lack or cannot use.

Now that all the Forces and some enlightened industrial organizations are applying on a large scale the results of research into human problems of work, others may follow suit. Any scientific work however, even psychology, can be applied mechanically, so the following pages aim also at humanizing industrial psychology, which sounds absurd, but which is necessary.

It is perhaps significant that organizations where more than lip service to the human aspect of industry has been paid, have weathered the succession of slumps and depressions that

have characterized the between-the-war period; thus demonstrating that there is no inevitable connection between bankruptcy and psychology.

Tests and studies are, however, not ends in themselves, but means to an end, and that end should be a fuller and happier life for all those who work, no matter what may be the work.

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Chapter I

PIONEER WORK

The term Industrial Psychology belongs to the 20th century, but there is a past to everything, and in relation to any particular branch of science it is always interesting to seek its forerunners, and to enquire why it became recognized as a separate field of research just at the time that it did. Every generation knows where its own shoe pinches, and in the endeavour to solve its own problems asks different questions of nature. Sometimes no answer is forthcoming. The times may be unpropitious, and although some speculative genius may furnish a theoretical solution, the means or the knowledge are lacking to give it practical effect. Thus the problems of flying and of bacteriological disease had to wait until the requisite materials, instruments, machines, and research could be brought into service. Sometimes, however, these are available when new problems are presented, in which case man can enter without delay into a new field of work.

During the past century and a half the rapid development of industry, first in England and then gradually throughout the world, has changed the lives of millions who have gone to work in factory or mine, and so set up a host of new problems, while at the same time a social conscience has been shaping which has made the sensitive increasingly alive to what is happening not only to people's bodies but to their minds. The general recognition of a psychological aspect in industrial affairs is something new in history, although, as we shall see, individual thinkers in the past have been aware of its importance, and have made pertinent suggestions concerning some of its problems. It was no fault of theirs that these had to wait for future ages to develop. "The slow issue of general ideas into practical consequences is not only due to the inefficiency of human character. There is a problem to be solved, and its complexity is habitually ignored by impetuous seekers."

For practical purposes industrial psychology may be defined

as the study of the conduct of those who exchange the work of their hands and brains for the means to live. This includes a large part of the population, excluding only the unfit and those too young to be given a paid job, and the very small minority who are endowed with the means to work or not as they wish. So far as this study is concerned, no distinction will be made between working at a job or a post, for wages or for salary, with one's hands or not, except in so far as the better condition may be held to entail a greater margin of security.[1] More research, however, has been devoted to the work of those whose direct instrument of work is the hand, but there is need for the extension of research to others.

Clearly, industrial psychology has much in common with the work of general psychology, the distinction between them lying in the fact that the former strictly limits its scope to the material and social environment to which the worker adapts himself while he is at work, and by which he is therefore modified. Some of the more important topics prominent in the study of industrial psychology, as it has developed during the present century, are vocational guidance and selection, time and motion study, hours of work and arrangement of such hours, and the relation of sickness and of accidents to the material and psychological environment. Every one of these topics has been recognized by some outstanding thinkers of a bygone age, though for reasons connected with the particular period in which they lived, their work was not followed up. Nevertheless they made their contributions, and these may well have helped to make smoother the path of present-day research.

Vocational Guidance and Selection

In the 16th century John Huarte wrote a book in Spanish concerning what we should now refer to as vocational guidance and selection. It was translated into Italian, and from this version an English translation was made under the title of "The Tryal of Wits", which, translated into modern speech, means the testing of intelligence. He maintained that it is

[1] The word "staff" is used in some firms as a comprehensive word for the whole of the organization, whatever may be the nature of the work; in others, it means all those not working at the bench—the latter are called workers.

nature which enables a man of ability to learn, and that it is quite superfluous for good teachers to try to teach any particular subject to a child who has not the disposition or the ability required for it. Each person, unless he is a dolt, has some predominant quality which will enable him to excel in some way, and there is a branch of study which will fit this quality. Having found out the most suitable branch of study, the next thing is to see if the person is inclined to the practical or the theoretical aspect—for the author holds that these are opposed.

The well-ordered commonwealth, he maintained, should have men of great wisdom and knowledge who might discover each person's intelligence at an early age, so that he might learn the most suitable subjects. The real age of a man is not a true measure, for "in some childhood ends at 12, some at 14, some at 18"—an early recognition of a mental age.

He also realized that there are great individual differences which he classified as follows:

(1) Some have a disposition for the clear and easy parts, but cannot understand the obscure and difficult.

(2) Some are pliant and easy, able to learn all the rules, but no good at argument.

(3) Some need no teachers, they take no pleasure in the plains but seek dangerous and high places and walk alone, follow no beaten track; these must fare forthwith, unquiet, seeking to know and understand new matters.

The subjects of learning he analysed according to the mental processes primarily concerned, and he boldly attacked the problem of the qualifications required for the professions, law, medicine, the army, and the ruler of a commonwealth, who, since he has to manage people, should have "a perfect memory of things past, a great imagination to see what is to come, and a great understanding, to distinguish, infer, argue, judge, and make choice". One cannot but regret that this part of his work did not receive the attention it deserved, but the 17th century had something else to consider, and, caught by the exciting drama of the rapid advances in chemistry and mechanics, paid little heed to the suggestions of a writer whose interest was in men's minds.

Not till the 20th century did the problem force itself into prominence. According to Münsterberg,[1] the earliest practical effort began in Boston, when a certain Mr. Parsons collected together the boys of his neighbourhood who were to leave the elementary schools at the end of the year. He discovered in the course of conversation that the boys knew practically nothing about the occupations they wished to enter, and never considered the problem of whether they had the necessary qualifications. The two were really bound up together. In order to help them he opened in 1908 a little office, and his efforts proved extremely successful, largely because of the personality of the organizer. He, however, realized that his methods were not adequate. He urged (1) that expert knowledge was needed about all the requirements and conditions of the possible occupations; (2) that the schools should be interested, so that the teachers would observe the individual characteristics of the pupils in order to furnish the preparatory materials for judgment; and (3) that the personal qualities might be tested by methods permitting of much greater exactitude.

Other cities copied, and although far from reaching Parson's requirements, they did collect reliable data connected with the economic and hygienic conditions of the occupations, the demand and supply, and the scale of wages. The psychological requirements had to wait till the laboratories developed tests of a practical nature.

Movement Study

The problem of motion has attracted thinkers throughout the ages, although until modern times it was considered mainly from the standpoint of philosophy. At intervals, however, there appeared individual researchers who realized that movements could be measured, and that such measurement was of practical value.

In the 16th century Galileo tried to measure the pulse by means of the oscillations of a pendulum. Then Borelli, influenced by him, considered the actual movements effected by different muscles and the changes brought about by a muscular movement. He studied the problems involved in

[1] *Psychology and Industrial Efficiency*, 1913.

standing, walking, running, jumping, flying, swimming, and other methods of locomotion. His observations formed the basis of muscular mechanics, although he himself did not extend these mechanical principles to all physiological processes as did some of his followers.

The story is continued in the 18th century with the work of Coulomb, who tried to measure the amount of work involved in occupations which were notably fatiguing, and then with that of Lavoisier on oxygen. In the 19th century came Marey,[1] who made a scientific study of walking and tried to reproduce human movements in photographs like those of the early cinematograph. From 1910 to 1920 flowed a veritable spate of articles and books on motion study. The work of Taylor will be considered later in detail; it originated from a purely industrial problem and was in no way influenced by previous scientific research.

The Health of Workers

For one section of the population at least, health problems have long been the concern of those in authority and have not been left to the attention of individual thinkers. The historical prototype of the modern industrial medical officer, now so important a member of the factory staff, is the army surgeon, for most armies have had their doctors since the days of Homer.

Galen,[2] the medical dictator, as Professor Greenwood calls him, rose to be medical adviser to the famous Stoic emperor, Marcus Aurelius, and was at one time physician to the gladiators, and so he might be regarded as an industrial doctor. Galen was a most interesting person, but he belongs to the history of medicine rather than to that of industrial psychology, and so his story cannot find a place here. Nevertheless his doctrine of temperament reigned undisputed until our own time, and cannot be left without description or comment.

His doctrine of temperament forms part of a general theory of disease causation, and also attempts to provide an explanation of individual differences of behaviour and emotion. He described 9 temperamental types: a perfectly balanced one

[1] *Movement*, tr. Eric Pritchard, 1895.

[2] Part of "Galen on Temperament", tr. in "The Nervous Temperament", *Brit. Journ. Med. Psych.*, X, 1930.

which acted as the standard, and 8 of varying degrees of lack of balance. Actually only 4 received any recognition, and they are enshrined in our general as well as medical literature, namely the Sanguine, the Choleric, the Phlegmatic, and the Melancholic.

The first writer to make a systematic study of industrial conditions as they affect the worker was Ramazzini, who in 1700 published a book called *Diseases of Tradesmen.*[1] He was a Professor of Medicine of Modena, where it was the custom to clear out the town's cesspools once every three years. The miserable appearance of the workmen engaged on this job moved him to enter into conversation with them, and this experience led him to study other occupations, the diseases specially associated with them, and possible methods of cure. In his most interesting and often entertaining book he described the diseases of laundresses and washerwomen, of those who work upon minute things which strain the eyes, of metal-diggers, the posture of workers, of potters, glass-makers and grinders, workers in flax, hemp and silk, of printers and those liable to writer's cramp, and of learned men. "Hoping that men of letters will not take it ill to find themselves ranked in the class of tradesmen, considering that, as other tradesmen gain by their trades, so they purchase to themselves by the pursuit of letters, if not great estates like those of the merchants, at least a livelihood and many comfortable conveniences; learned men are as slothful and ill in their body as they are active and busy in their mind and brain: so they have weak stomachs, weakness of sight, and become melancholic and heavy." Put into modern words, we have here the disabilities common to many clerical workers, teachers, and people in authority: gastritis, eye-strain, and nervous breakdown. "Secretaries to great men become melancholic" (i.e. neurotic) "owing to the strain of correcting their masters' work and living in the uncertainty of not knowing how it will be received." So shrewd a comment reveals rare insight and poses a problem which forces itself on our attention today.

About the same time a physician of genius in another

[1] Probably the first monograph devoted to an occupational disease was by Paracelsus, On Miners' Sickness and Other Miners' Diseases, published in 1567. It does not, however, recognize any mental aspect. Ramazzini's book was translated by Dr. James in 1746.

country was pursuing a parallel path of enquiry. G. E. Stahl,[1] born in 1660 and educated during a period of rapid scientific development, qualified as a doctor, with, however, a great interest in science, particularly chemistry. As a physician, however, he was constantly faced with human problems, and the more he pondered them, the less satisfactory did the contemporary doctrines of the scientists appear to him. Science, he complained, was forgetting the individual in the study of his component parts. "Chemistry has furtively insinuated itself into the medical art, and tries to be of the house and to rule as its supreme mistress."

Considered only as a structure the human body is a machine, but when that same body is studied in relation to the different lesions it may experience, their healing and integration, the wonderful theories of the mechanists seem to pass life by. Not only should the doctor study the physiological processes of the body, but also the personality of the human being. The questions we must now ask, wrote Stahl, are why some people are liable to one particular disease and others succumb to any; why some enjoy perfect health for years and then go down with what appears to be a trifling disorder; why some should be specially subject to fatigue, and so on. He even forestalled the doctrine of a very modern physician when he said that we ought to study the "estimated reason" of a symptom, i.e. what the symptom means to the patient.

As the body is ill or well so is the mind weary or alert, but it is no one-way traffic, for the mind can affect the vital actions. "Sudden joy, fright, anger affect the mind, disturbing reason, and this the medical schools would admit, but they overlook that they can disturb the circulation and other bodily functions."

Accidents are violent things affecting the organisms; they are influenced by cold, heat, unpure air, too much or too little sleep, and by emotions such as anger and fear which involve excessive action in vital movements.

Stahl's writings reveal a psychological insight far in advance of his day. His descriptions of the different temperamental types remained unique until the work of Jung in our own day.

[1] Further details of his writings will be found in "Some Pioneers of Medical Psychology" by Greenwood and Smith, *Brit. Journ. Med. Psych.*, XIV, 2, 1934.

Hours of Labour

We are still engaged in the prolonged struggle to secure reasonable hours of labour. In the rapid expansion of industry during the early 19th century, the labour not only of adults but even of very young children was ruthlessly exploited in England. People who have grown up in the last thirty years or so have often little knowledge of the great changes in factory conditions as well as in the provision of general amenities, so that it is perhaps worth while to recall now and again what things were like in the not so distant past.

A report[1] on factory children's labour produced in 1832 quotes evidence of the appalling conditions under which young children were forced to work. Here is an extract of the evidence of the father of the girls, himself unemployed:

At what time in the morning in the brisk time did those girls go to the mills?

In the brisk time, for about six weeks, they have gone at 3 o'clock in the morning, and ended at 10, or nearly half-past at night.

What intervals were allowed for rest and refreshment during those 19 hours of labour?

Breakfast a quarter of an hour, and dinner half an hour, and drinking a quarter of an hour. Sometimes almost the whole of the rest time was taken up with cleaning the machinery.

Had you not great difficulty in awakening your children to this excessive labour?

Yes, in the early time we had to take them up asleep and shake them, when we got them on the floor to dress them, before we could get them off to work: but not so in the common hours.

What was the length of time they could be in bed during those long hours?

It was near 11 o'clock before we could get them into bed after getting them a little victuals, and in general me or my mistress got up at 2 o'clock to dress them.

So that they had not above four hours' sleep at the time?

No, they had not.

Had your children any opportunity of sitting during those long hours of labour?

No, they were in general, whether there was work for them to do or not, to move backwards and forwards till something came to their hands.

And these disgraceful hours are only a part of the inhuman story.

[1] *Report of Committee on Factory Children's Labour*, 1831-32.

For over a century the struggle for reasonable hours has gone on, reasonable in the sense that life should have something else to offer besides toil, that enough energy should remain to enjoy some chosen task or recreation. Proper conditions within the factory had first to be fought for, safety precautions, lighting, heating and ventilation, as well as the limitation of hours, and while the fight is not yet over, it is well on the way to victory. Looking back over the past century, we can see that nothing less than a revolution has been accomplished.

The claims of machinery rather than of men, governed industrial developments in the 19th century. The enormous number of machines invented and improved upon during the century, the progress made in the natural sciences, and the growing knowledge of the mechanism of the human body, all tended to focus interest on man's likeness to a machine. The attitude was akin to that of the 17th century and was the product of similar forces, for in that earlier time, as in the later, enthusiasm for the wonders of recent scientific discovery blinded men's eyes so that they gave but a limited interpretation to human life. Some of the medical treatises of the 17th century, owing to a narrow application of Borelli's theories, resembled nothing so much as text-books in geometry. A working hypothesis, then as later, hardened into a rigid creed and produced disastrous effects. The phrase "the human machine" was invented by La Mettrie in the 18th century; rightly interpreted, it refers to part of the bodily structure, but it became, rather by implication than design, synonymous with man himself. How far the author's intention was removed from this may be judged from the fact that he also wrote a book called *The Human Plant.* This metaphor, however, failed to attract any of the attention given to the other. Where any effort at all was made to study the worker of the machine, the tendency was in the direction of emphasizing the likeness of one worker to another, and the likeness of all to machines.

The first challenge to these assumptions came from their failure under the hard test of war. The European War of 1914-18 called for a supply of munitions on a hitherto undreamed-of scale, and industrial operations were at first based on the simple but unjustified application of elementary

arithmetical rules. It was assumed that if a man completes 1 unit of work in 1 hour he will complete 8 units in 8 hours, or 12 units in 12 hours. On this basis it was easy to calculate what could be done by 1000 men working 12 hours a day, 7 days in the week. Up to a point, of course, it is true that the more hours one works the more will one accomplish, so incredibly long hours were worked in the munition factories, 90 hours a week being common and 100 hours not unknown. The results were disconcerting. Output went down and down, and absence from sickness and other causes went up and up. Where 1 unit of work was completed in 1 hour, the product of 90 hours' work a week was very far from reaching 90 units.

Something clearly had to be done, and in 1915 the Health of Munition Workers' Committee was set up to study the problem. After producing several interim reports, in which among other things it was shown that the 12-hour working day, except for short periods of emergency, was a wasteful and extravagant arrangement, the Committee were able in 1918 to publish their final report, addressed to the Minister of Munitions, the Rt. Hon. Winston Churchill. Since then a very considerable volume of research has been accomplished, yet the 1918 Report is still worthy of study and of practical application.[1]

The terms of reference given to the Committee in 1915 were: "To consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and efficiency of workers in munition factories and workshops".[2] The Committee recognized at the outset that they were confronted with a problem of great extent and complexity, since "it had to do with the environment of the worker, and with the worker himself, with immediate as well as remote problems; its issues had to be viewed in relation to present exceptional and ephemeral conditions and circumstances, also to what could be practicable and permanent after the war; it involved the consideration of the health not only of the munition worker in the narrow sense, but of all

[1] An analysis of this report is given in some detail as it is difficult to obtain.

[2] *Health of Munition Workers' Committee*, London, 1918.

industrial labour—for all branches of labour are interdependent—and of many health problems which lie outside the factory and workplace; and lastly it raised far-reaching social and even moral questions which are not commonly thought of as appertaining to health".

The central and foremost problem was the question of fatigue, and, as so often happens in this connection, the Report enters upon a somewhat difficult and irrelevant discussion as to the nature of fatigue and its physiological mechanism. Then, noting the important fact that continuous human activity is associated with a gradually diminishing capacity, it laid down the principle that the only direct test of fatigue was output, and that this should be recorded for each individual and for each unit group. (This optimistic requirement has not yet been fulfilled.) It was known that the ordinary restriction on hours of work had been widely relaxed, and that Sunday labour, previously forbidden for women and children, and except in a few continuous processes practically unknown for men, had become a common practice. Then, as now, the most highly skilled men, tool- and gauge-makers, tool-setters, etc., were the most difficult to get, and so were the very people who were most overworked. In short, there was a return in 1915 and 1916 to some of the worst mistakes of the early 19th century.

The Committee used two methods of getting their facts: (1) taking evidence from people in direct contact with munition workers, and (2) initiating *ad hoc* investigations. The first enabled them to get immediate information, the second needed time.

The volume and pertinence of the findings cannot fail to impress anyone who reads through the evidence. It is abundantly shown that the excessive hours imposed so severe a strain upon the workers that their rate of production tended to decrease, sick leave and broken time to increase, while some sought refuge in alcohol because they were too tired to eat.[1] There was evidence, too, of the almost intolerable strain on the Management. At first the full effect of the long hours was not manifest, because increased pay provided better food, and because a sense of patriotism stimulated

[1] Alcoholism has not been a problem in this war.

effort, but later the resulting depletion of the workers' reserves of energy was plain to any observer. The evidence, however, though overwhelming, was not quantitative, and witnesses differed widely as to what limits they considered reasonable. The Committee therefore felt bound to call attention to the almost complete absence of any scientific data.

The appointment of Dr. Vernon and other scientific investigators was intended to make good this deficiency. As a result, Dr. Vernon was able to show by output figures that the 12-hour day was a costly and useless arrangement which defeated its own end and produced less than the 10-hour day: "Misguided efforts to stimulate workers to feverish activity in the supposed interests of the country are likely to be as damaging to the desired result as the cheers of partisans would be if they encouraged a long-distance runner to a futile sprint early in the race." And again: "The country cannot afford the extravagance of paying for work done during incapacity from fatigue, just because so many hours have been spent upon it."

Hours and Output.—The problems of output are not quite the same during peace-time and war-time. During war the primary object of the work must be maximum production, and the obvious way of so doing is to increase the number of hours worked. No one would deny that in 8 hours more work could be done than in 2 hours by the same person or number of persons, assuming the will to work, but is this true of 12 hours?

Two calculations are necessary, namely the average amount done per hour, and the total amount done during the given period. Suppose 100 men can do 2 units of work each per hour, then in 8 hours they should do $8 \times 2 \times 100 = 1600$ units; in 12 hours they should do $12 \times 2 \times 100 = 2400$ units. This gives the total amount in the two periods considered as an arithmetical problem. The average amount done per hour is 200.

Now it has been often observed that with increased hours leading to conditions of fatigue the average amount done per hour decreases. Suppose that the average of 200 units per hour is reduced to 150 units with the 12-hour day; then the

total output would be $12 \times 150 = 1800$ units. This is not equal to the 2400 units that were expected, but it is greater than the 1600 units possible on the 8-hour day. Suppose, however, that the average output falls to 100 units per hour, which is 1200 in 12 hours, i.e. the total output is less than the total output of the 8-hour day.

The problem is therefore to see where the average hourly decrease neutralizes the effect of the longer working day, that is, at what stage the longer hours cease to be productive.

During the 1914-18 war the 12-hour day was shown to be less productive than the 10-hour. The exact number of hours where the longer day is unproductive will be dependent on the kind of work.

In addition to hours of work the importance of general environmental conditions was recognized, and the Committee therefore considered in detail the problems of cleanliness, the provision and equipment of canteens, protective clothing, etc., and made recommendations in regard to better housing and more rapid means of transport. In 1916 they suggested that a welfare supervisor should be appointed wherever women were employed; prior to the war few firms had realized the need.

The questions raised in connection with particular environmental conditions aroused interest, and in consequence of the dangerous nature of some of the materials handled by munition workers, ventilation ceased to be exclusively a problem of engineering, and under the aegis of Sir Leonard Hill the physiological aspects received practical development.

Time lost through lateness, broken time, sickness absence, or just sheer absence, was soon seen to constitute a formidable problem, though it is doubtful whether the Committee ever realized just how formidable its measurement was to be. The causes of lost time were classified into two main groups: those largely inherent in the nature of events and those that might be controlled. In the first group were included such causes as the employment of people of inferior physique, the inadequate housing and transport facilities, the inequalities of food supply, wintry weather, darkened streets—though there was nothing approaching the present black-out—the domestic duties of married women, the war preoccupations and exigencies of all workers, and sickness and disease caused

by conditions outside the factory. The second group listed such causes as fatigue, sickness and accidents originating in the factory, insufficient wage-incentive, faulty internal organization, indifference, slackness, laziness, discontent, prolonged hours, insufficient rest periods or holidays, and excessive consumption of alcoholic beverages.

The Committee reached the conclusion that absence through sickness was considerably under-estimated, and pointed out that if there is an undue proportion of sickness in any group of workers, there will probably also be lessened vigour and activity among those who remain at work. They noted the lack of adequate records, due partly to difficulty in regard to medical certificates and partly to the fact that minor illnesses were not recorded.

By law accidents had to be reported, so it was possible to make a statistical investigation into these, and Dr. Vernon undertook to enquire into the factors concerned. He showed the essential factor in accident causation to be excessive speed of production, the others being connected partly with environmental conditions such as lighting or temperature and partly with personal matters. The Committee decided that, however well equipped a factory might be, accidents were bound to happen and proper provision must be made for treatment. This led to a detailed account of the necessary measures.

With regard to incentives, the Committee began, not with a discussion of wages and hours, but with the statement that the first incentive is the health and physical fitness of the workers. Although they limited their report to the factory conditions contributing to this end, the field covered was very wide, including lighting, ventilation, heating, rest rooms, canteens, protection from poisoning and dangerous fumes, and the proper organization of a factory. Only after all this had been dealt with did they come to the question of wages, which "must be well-adjusted, equitable, and clearly understood". From this they went on to the problem of monotonous work, for which they felt some special monetary incentive was required; for such work they urged that piece rates of pay would produce better results than time rates. Where time rates were already in force they should not be left as a flat rate but supplemented with a bonus.

The Committee declared that what was needed "was not a cast-iron system of employment, but a sympathetic and correct understanding of the physical and mental capacities of each worker, and their most satisfactory and economical application", and pointed out that "it has been clearly shown that false ideas of economic gain, blind to physiological law, must lead as they led through the 19th century to vast national loss and suffering."

Another section of their report is devoted to what are described as problems of wider issue. These are:

(1) Problems connected with shorter hours in relation to health, political and economic conditions.
(2) The far-reaching issue of the social and economic conditions of women's labour.
(3) The solidarity of industrial society, the interdependence of employer and workman.
(4) The title of the worker to an effective voice regarding the conditions under which he works.

Reading through these reports in their entirety one is struck by the clear recognition that all the problems are dependent on one another. Purely psychological questions are suggested rather than expressed. First things must come first. People must work in the conditions in which they can keep alive, before the real suitability of their work calls for consideration. If the Committee's work had only been carried into full effect, many of the industrial difficulties confronting us in the present war might have been avoided. After the war was formed the Industrial Fatigue (later Health) Research Board, whose province was the study of human problems in industry as distinct from the material problems, the province of the Department of Scientific and Industrial Research. In 1919 the National Institute of Industrial Psychology was founded, an independent non-profit-making organization.

Though much has been accomplished, it is well to remind ourselves with Professor Whitehead that "a great idea is not to be conceived as merely waiting for enough good men to carry it into practical effect, nor does the final introduction of a reform necessarily prove the moral superiority of the reforming generation".

We have surveyed, even though only in a sketchy outline, the work of some who have asked questions and propounded solutions to problems that are of interest to us today, and thus have rendered possible the attitude of mind which admits of the study of these and other problems on an effective scale.

St. Augustine lamented "men go abroad to wonder at the heights of mountains, the lofty billows of the sea, the long courses of rivers, the vast compass of the ocean and the circular motion of the stars, and yet pass themselves by". His lament is perhaps a little less true today.

Chapter II

FATIGUE IN INDUSTRY

If a drug were available which proved to be the perfect antidote to fatigue, so that we could work without rest, would it be acceptable? We know that there are drugs that have a temporary effect in preventing the expression of fatigue, e.g. opium, but they have serious drawbacks.[1]

Fatigue is sometimes spoken of as if it were an unmitigated evil, but surely the unit of experience is not the period causing the fatigue alone, but in addition that which succeeds it, a period of rest. Fatigue and rest form one whole, and fatigue is only an evil when it is not relieved by rest.

Renan wrote: "A people have usually many words for what interests them. Thus in Hebrew there are 25 synonyms for the observance of the law. In Arabic the lion has 500 names, the camel 5,744, the sword 1,000. The Lapp whose language is so poor has more than 30 to designate the reindeer, the animal indispensable to his life." [2]

On this finding, we as a nation must be intensely interested in the more negative aspects of work, e.g. weary, tired, bored, blasé, jaded, exhausted, prostrate, spent, worn, droop, strained, fatigued, all symbols of our personal feelings; we can, however, attach the symbol to the outside thing, and so we have: monotonous, prosy, stale, flat, irksome, tiresome, dull, trying, humdrum, etc. I have not subjected any other language to such an analysis, nor even counted the more positive opposites. We certainly have an array of symbols for a number of rather subtly distinguished states. No one can complain that there is any lack of literature on the subject of fatigue; there are countless articles of very varying merits. When, during the last war, the human problem of industry began to attract attention, it was the subject of fatigue that

[1] W. McDougall and May Smith, "Effects of Alcohol and Other Drugs during Normal and Fatigued Conditions", *Med. Res. Coun. Spec. Rep.*, No. 56.

[2] Quoted by Ribot in *Evolution of General Ideas*, 1899.

formed the connecting link between this new application of science and the older, more theoretical researches, the experimental side of which came from physiological and psychological laboratories.

During the last twenty years fatigue in industry has been of relatively little importance; its detrimental effects have been ousted by the increasing number of repetitive jobs, associated with the mental state of boredom. The Industrial Fatigue Research Board became the Industrial Health Research Board in 1926.

There are many questions that can be asked about the state we call "fatigue", some relevant to industrial application and some not, some of direct and immediate importance and some not, but the questions that have appealed to numerous researchers are: "What is the nature of fatigue?" "What takes place in the body when it is fatigued?"

The answers to these, though only partial, are interesting, but for industry it is more important as yet to ask, "How does fatigue show itself?" and "In what circumstances is it produced?"

Some Laboratory Experiments

The pioneer experimental work on fatigue was done by Mosso,[1] who invented an instrument called an ergograph, which measures and records the work done by a single or, at most, a few muscles of the body. It is therefore adapted for the study of relatively simple movements. There are various forms of it. The arm is placed in a fixed platform and fastened by means of cross-bars; the middle finger is free to move. This is inserted in a brass cap from the end of which a weight hangs sufficiently heavy to put some strain on the finger. The flexion of the free finger lifts the weight and the several lifts are recorded automatically on a rotating drum. If the movements are continued long enough, there comes a time when the individual is unable to lift the finger any more. Fatigue is said to have set in. In using the ergograph for a study of telegraphists' cramp some of the subjects were so surprised when their finger finally failed to act, that they

[1] A. Mosso, *Fatigue*, 1890.

thought the weight had been increased or that the machine had jammed. By means of the ergograph a number of interesting and suggestive results have been achieved relating to the fall in efficiency after a time, the advantage of rest pauses, and the disproportionate time for recovery, i.e. if the body after a certain amount of work requires a certain amount of rest in order to recover from the fatigue, then after twice the amount of that work it will need more than twice that amount of rest.

About all these experiments, however, there was the question of how fatigued the subject was; the fatigue was probably local.

A new approach was taken by Professor Wm. McDougall in his Oxford laboratory.[1] He argued that if one wished to measure the effects of fatigue in the human being, it was useless to take as one's measuring-rod some well-fixed habit or simple task; these were too stable to be easily affected except in extreme cases of fatigue. A process late in development, and therefore relatively unstable, and so more sensitive to change, should be selected; voluntary attention answered to these requirements. A test was therefore devised "to provide the subject with a task demanding for its execution a continued maximal voluntary concentration of attention". As the apparatus has been used considerably in more recent industrial investigations it will be described. "It is a mechanical device whereby a continuous band of paper tape about one inch wide is drawn behind an opening or window in the top of the desk by a weight-driven clockwork movement. The rate at which the tape travels can be adjusted, so that the subject works at his maximum speed. Along the width of the band small red circles are distributed in as irregular a manner as possible. The test consists in marking the circles with a stylographic pen as they pass the field of vision." [2] The task, being of the nature of a sprint, is too exciting to allow a subject to acquiesce in failure—unless he is the type that just drifts; should failure occur at any stage, the interest aroused prompts

[1] W. McDougall, "A New Way of Measuring Mental Fatigue", *Brit. Journ. Psychol.*, I, 4, 1905.

[2] May Smith, "A Contribution to the Study of Fatigue", *Brit. Journ. Psychol.*, VIII, 3, 1916.

to renewed effort. A professional man who had done much shooting of big game described it as "shooting tigers".

A modified version of this known as the "disc dotting machine" was designed later by Dr. Schuster and, being portable, was the form used in some of the industrial experiments, particularly for the accident work.

"An irregular row of small circles 2 mm. in diameter with their centres marked is printed spirally in red on a paper disc 326 mm. in diameter. The spiral makes altogether two complete turns. The interval between successive circles, in the direction of the motion of the spiral, is 5 mm.; the lateral deviation is never more than 7 mm. The circles are thus clustered irregularly about the 'true' line of the spiral. The paper disc is mounted on a plate fixed horizontally which rotates at a constant rate. A cover is supported above the plate in which a slot one inch wide is cut in such a position that as the disc rotates every point of the spiral row of circles presents itself to view through the slot. The subject rests his wrist on the cover and aims at the circles as they appear through the slot at one edge and are carried out of sight at the other. He starts at the inner end of the spiral and makes his way outward over it as its whole length presents itself point by point through the slot. At the inner end of the spiral an angular movement of 45° brings 6 circles out from under the edge of the slot; at the outer end of the spiral 24 circles. Thus the subject has to work at a gradually increasing rate." [1]

How does Fatigue show Itself?

A. In Quantity and Quality of Work

1. *Experimental Work: the Effect of Loss of Sleep.*—The writer was the subject of the following experiments. To ensure a fatigued condition the normal amount of sleep, i.e. about 8 hours a night, was curtailed for 3 successive nights; on the first night's vigil 1½ hours' sleep were taken, on the second 3½, and on the third 5½, i.e. for 3 nights less than half the normal amount of sleep was taken. A length of tape of 1,200 circles was the standard amount and the circles passed at a uniform

[1] Smith, Culpin and Farmer, *A Study of Telegraphists' Cramp*, Ind. Health Res. Board, No. 43.

rate of 5·8 a second. The test was always done at 3 p.m. Under normal conditions the number of errors lay between 70 and 90. As a result of the three vigils the immediate effect was either normal records or superior; after the third night the record was 53 errors, the lowest ever reached; as soon as extra sleep was taken to make up for the loss the errors rose, and continued to range between 110 and 202 for 16 days.

An equally striking effect was shown by a memory test which demanded for its success, concentrated attention to see the relationship between words, and ability to recall the word. In a list of 40 associated words the average number of errors in normal circumstances was 5 (extremes 4 and 7); the immediate effect of the vigils was to reduce the average to 3, followed by a range from 10 to 26, the normal of 6½ being reached on the 16th day.[1]

These and similar laboratory experiments have since been verified by industrial experience.

2. *Industrial Work.*—Assuming that a worker is unfatigued at the beginning of a period of work, and also that it is possible to measure the amount of work done at intervals, it is found that the standard cannot be maintained, unchanging, throughout the day. If the amount done is estimated for each hour of the working day the results can be expressed graphically, and for a number of processes there is the same general trend, viz. a gradual rise in output till a period of stability is reached, which lasts for a varying period, and then a decrease towards the end of the period of work.

Owing to the shape when graphed, the curve is known as the saddle-back curve. It is characteristic of both manual and mental work, if there is no other change except the passing of the hours. It has been described as showing "a sluggish start before the worker is warmed-up, a rise as he gets into his stride, a flagging, and a final falling off in the last hour".

A study of the variation in daily output at short intervals during the day has been made in a number of processes, heavy and light. A few examples, typical of many, are given:

(*a*) In the heavy work of charging blast furnaces by hand, Vernon recorded for three shifts the time in minutes required

[1] May Smith, "A Contribution to the Study of Fatigue", *op. cit.*

for each charge and the actual hours when each occurred. The results showed that (with the exception of the brief spell from 6 a.m. to 8 a.m.) the rate of charging fell off during the last period of each spell, showing an average decline of 14%; also that this effect became exaggerated during the morning and afternoon shifts of Sunday when the men worked a continuous shift of 16 hours (6 a.m. to 10 p.m.) in order to enable the shifts to change over. If the hourly output is represented by a graph, there is a low output to begin with, followed by a rise leading to a fall.[1]

The interpretation given is that the fall is due to the effect of fatigue.

A closely similar type was found by the American Committee of Industrial Fatigue to be characteristic of certain kinds of engineering work, both for an 8-hour and a 10-hour plant, though the variations were less pronounced in the shorter day.

(*b*) Weaving. Variation in hourly output over the working day have been shown by independent workers for silk, fine linen and cotton weaving.[2]

In the case of the weaving figures the looms were working up to the end of the day, so that no loss in mechanical efficiency occurred. Elton in the silk-weaving investigation thinks that the longer time required to deal with the manual operations was due to fatigue.

It can be argued that the fall-off at the end of the day was merely due to conscious limitation; if this were so, one would expect an abrupt fall at the time when the worker decided to slow down. If, however, fatigue were the primary cause of the fall-off, a gradual fall would be more probable. Some evidence that the effect of the working hours was not an abrupt rise concentrated in the early part of the morning, with an equally abrupt fall in the evening, was shown in cotton-weaving. Wyatt took observations every quarter of

[1] H. M. Vernon, *Fatigue and Efficiency in the Iron and Steel Industry*, Ind. Health Res. Board, No. 5, 1920.

[2] Vernon, *op. cit.*; P. M. Elton, *A Study of Output in Silk Weaving*, Ind. Health Res. Board, No. 9, 1920; P. M. Elton, *An Analysis of the Individual Differences in the Output of Silk Weavers*, Ind. Health Res. Board, No. 17, 1922; H. C. Weston, *A Study of Efficiency in Fine Linen Weaving*, Ind. Health Res. Board, No. 20, 1922.

an hour for the early part of the morning and the latter part of the afternoon, and found that the rise and fall occurred gradually during the whole of the first and last hour.[1]

The personal expression of the absence of conscious limitation was given by a hand-ironer, who assured me that no matter how many hours she worked, her work never slowed down; when I timed her, her afternoon record became gradually lower after about 3 o'clock.[2] It was not necessary to destroy her illusion, but it serves to indicate that personal views may quite honestly be wrong. Whenever possible, investigators take precautions to balance the personal view with the objective view, since it is possible for the latter also to be wrong; if the investigator is not told the various local factors that may affect work, which he could not discover for himself, a decline in output might be due to quite other causes; for example, the output during the last period might decline because workers wishing not to leave something unfinished went more slowly on the last article to fill up the time.

(*c*) A composite figure for eleven laundries was worked out for the important process of calendering, i.e. passing wet sheets or table linen through steam-heated rollers in order to iron them.

There was not much variation during the morning, but there was an increase in the time taken during the last hour. It was not a process where individual variations could show much.

The heavier the work, the longer the hours, and the greater the part played by the worker compared with the machine, then the greater is the final decrease.

Variations during the Week.—The variation in output during the week is of use, since if the workers become gradually more tired, so that the night's rest is not adequate, we should expect a considerable decrease in output at the end of the week.

The results of a number of industries show that:

(1) Output is nearly always low on Monday and at the end of the week.

[1] S. Wyatt, *Variations in Efficiency in Cotton Weaving*, Ind. Health Res. Board, No. 22, 1923.

[2] May Smith, *Some Studies in the Laundry Trade*, Ind. Health Res. Board, No. 22, 1922.

(2) The general shape of the curves is consistent with output being affected by two opposing factors: (*a*) increased efficiency due to practice which causes a rise in output; and (*b*) fatigue effects which accumulate during the course of the week and tend to cause a fall in output.

(3) These opposing factors vary in strength according to the length of each working day, the kind of work and the experience of the worker. Output may reach its maximum on the second, third, or fourth day of the working week.

The output is often affected on a particular day by pay day, or "booking up". In cotton-weaving the time of "booking up" was generally preceded by one of increased efficiency, followed by one of reduced efficiency. An analogous effect is shown in the increased output during the weeks preceding the annual holidays; a similar spurt has been noticed before the Easter and Whitsuntide holiday. And in one factory an investigator was disconcerted to find that on a Friday afternoon, a period in that factory almost sacred to reduced output, the thought of the fancy-dress dance in the evening had the effect of producing the highest output on record.

Comparison of the 10*-hour and* 9*-hour day.*—During one period it was possible in the laundry trade to compare the time lost between finishing one article and beginning another for the 10-hour and 9-hour day. In calendering, folding, and hand-ironing there was a definite slowing down during the last hour or two of the 10-hour period, involving a reduction of output varying from 11% to 36%.

Studies with a Psychological Test in a Factory.[1]—This was the tape dotting machine test which has already been described. As it involves continuous attention, the better the attention the fewer errors will there be, and as attention is easily disturbed by fatigue, it is an indirect test of fatigue. A length of the tape on which 400 small circles were printed was the standard amount; each circle had to be dotted as it passed. Each performance kept the girl away from her work just

[1] *Op. cit.*, Ind. Health Res. Board, No. 22, 1922.

under 5 minutes in all. As the problem was to see the effect of a day's work, only as many people could be tested as could be got into in an hour; 15 was found to be the most convenient number. Each girl came and did the test between 9 a.m. and 10 a.m., and again between 5 p.m. and 6 p.m. As far as possible, 5 weeks' daily records were obtained from each.

For the purpose of the experiment, the machine was placed in a quiet corner of the factory. Theoretically it might be assumed that a test requiring attention should be done in the quietness of a secluded room, but in many a factory no such room exists, and even if it did, it seemed desirable from a practical point of view that the test should be done under factory conditions; also much less time was spent in coming and going. The machine was, however, sufficiently isolated to prevent anyone from observing the actual process or overhearing any conversation between the subject and the experimenter.

It is probably a safe assumption that if, in the case of a given worker, there is a considerable and consistent diminution of accuracy during the last hour of work compared with the morning, the differences represent the effect of the intervening hours, part of which is the effect of the work. It might be argued, as it has been with output, that if a worker wished to prove his work fatiguing he would consciously do his best in the morning and try to do it badly in the evening. This is a possibility, but one which did not seem to be the case at least in these experiments. The subjects of the experiments did not know how many mistakes they had made on a given occasion, and it is characteristic of the test that people often think they are doing it well when they are not, and vice versa.

The following example gives the results of the test on two groups of workers: 7 calender workers and 7 packers and sorters. The daily records for a month were averaged for each group, the early morning being kept separate from the late afternoon.

The calender workers, whose work is heavier but less responsible than that of the packers and sorters, showed in the afternoon an increase in errors of nearly 14%, and the packers and sorters an increase of 24%. The periods when the

experiments were being done were during the ordinary 9-hour day and when there was no special rush of work.

In another factory the same experiment was done on a larger number, namely 15 calender girls, 6 packers and sorters, and 4 ironers. In each group there was an increase in the errors for the afternoon period, namely 10·6%, 18·7%, and 20·4%. In no case was any effect shown on the morning of the following day.

The hourly variation, which it was possible to obtain in this factory, showed that the first hour was not as good as the succeeding one, and that there was an increase in errors in the period from 4 o'clock.

A weekly arrangement of the records of the same workers showed that Tuesday and Wednesday were the best days and that there was a general tendency to fall off on Thursday and Friday. These results show the same tendency as the output variation. This tendency is, however, only a group tendency, i.e. if a number of people are tested or measured the group records have certain features which stand out as the most representative; it is most important, however, to realize that the individual variations are very great and some will be directly opposite to the main trend. It was possible to get information about each worker's general attitude to the hourly happenings, when she came to be tested.

In doing tests, whether we use output or a psychological test, we have to assume that the background remains constant throughout the day and that the only change is the passing of time. Actually this is not so, for even if nothing else did change, a person's thoughts about it might change. There are emotional changes which vary irregularly and affect differently different individuals, e.g. some may be stimulated by anger, others exhausted; and we have also to realize that there are fluctuations in physical health which, while not sufficiently great to cause definite illness, may yet be sufficient to make a normally easy task a very difficult one. Hence one might get on some occasions a striking apparent fatigue effect at 6 o'clock, which, however, might only be a fatigue effect under these conditions.

The personal conditions which in individual cases reduced the dotting efficiency were: worrying days (i.e. when things

in general went wrong), slight accidents, headaches, periods of rush, worry about the work, a grievance, boredom.

B. *Increase of Accidents*

Although accidents have several causes, yet there is evidence that a state of fatigue due to too long hours and insufficient rest causes an increase in the number of accidents.

During a period of the 1914-18 war when a 12-hour day (75-hour week) was being worked, the accidents incurred by women workers were two and a half times more numerous than in the subsequent period when the daily hours were reduced to 10.[1]

C. *Organic Changes*

In addition, there are organic changes, sometimes expressed in some digestive disturbance, the "too tired to eat" condition, in eye-strain, headache, and various minor disorders.

D. *Psychological Changes*

Some of these have been demonstrated experimentally in the laboratory, and some are present to the consciousness of the fatigued person or to an observer.

Intellectual Functions.—There is diminution in the power of concentration, in memory, in ability to see the connection between ideas, all of which are important for efficiency. The fatigued person criticizes uncritically because emotionally. Often, too, there is a loss of humour, for few of us are able to see the amusing side of things when fatigued.

Greater Emotional Susceptibility.—When fatigued, most people are more easily moved to tears or laughter, less balanced emotionally, more likely to suffer from wounded self-esteem, with easier yielding to fear or irrational stubbornness, and a tendency to irritability which may vent itself on the wrong person, of which the following is an example:

Towards the end of a long day during the Christmas rush a woman came to the ribbon department of a large store and asked for some ribbon to match the pattern she produced.

[1] H. M. Vernon, *Health of Munition Workers' Committee Report*, 1918.

It was a shade not belonging to the current year, and scrutiny of the accessible stock failed to satisfy her requirements. Eventually consultation with a higher authority led, after much trouble, to the production of another shade. This proved exactly right. Whereupon the customer said, "I'll have a quarter of a yard, it's for a golliwog's waistcoat". The shop assistant, already fatigued, relating the story said, "I could have murdered her, but I snapped out at my assistant". Most of us know that state of mind.

These do not exhaust the expressions of fatigue, but they are those of practical importance. Which of them is of the greatest importance will depend partly on the kind of work one is doing. The diminished output, increased accidents and errors would affect the worker using his hands; theoretically, at least, he might feel emotionally unstable or be irritable, but if these in themselves did not interfere with his actions they would not matter to his work. The work of the manager, teacher, doctor, or any person whose decisions are the important feature of his work, might be unaffected if the muscular inefficiency were the sole evidence of fatigue; he might, however, make an inferior or even harmful decision, or cause trouble and unhappiness to his colleagues or subordinates by "letting off steam" on them, who in their turn might pass on the irritability, with disastrous consequences to the morale of an organization.

If such an investigation were possible, it would be interesting to know how many faulty decisions of people in authority were associated with fatigue. Most people have a consciousness of virtue when carrying on with their work when they are fatigued, and this perhaps more than compensates for the associated feelings. The late Professor Pembrey once remarked at a discussion on fatigue that most of us liked being intoxicated with the products of fatigue. If this be so, it might be in the interests of humanity if those in authority restrained this indulgence and found out at what stage their decisions were valueless. People who assert that they can work indefinitely are usually those whose assertions can never be challenged. Many a person in authority believes, as did my hand-ironer, that his work is equally good in all circumstances; he likes the feeling of being a martyr and is often

ignorant of the fact that his subordinates are paying the price of his fatigue, which, even if his work cannot be measured directly, is nevertheless exhibited in irritability and less balanced judgment.

After this digression we have next to consider the important question of "In what industrial circumstances are the fatigue symptoms produced?"

(1) *Long Hours Encroaching on the Hours of Sleep*

With normal work and a reasonable number of hours of sleep there should be complete recovery from the results of a day's activities. When this is not so the sufferer starts tired, so although by an effort of will he can force himself to be efficient, the efficiency cannot be maintained; the difference therefore between his best output and the natural fall-off at the end of the day is increased. In war-time the possibility of an adequate night's rest is affected by the longer hours worked leaving little time for rest, involving as they do for many people very early rising to get to their work.

This condition has been somewhat mitigated in this war by the provision of hostels for munition workers, but only a relatively small part of the population are accommodated in these. There are still many who have at least an hour's journey by train or bus both morning and night. When in addition the 7-day week is worked, it is not surprising that absenteeism increases. A foreman, in 1917, said that Sunday work gave six days' output for seven days' work on eight days' pay. Even if the worker gets his normal number of hours of sleep, the long hours involve fatigue which is not compensated for by normal rest.

The output of munition workers after the loss of Dunkirk, in 1940, illustrated again the findings of the last war and research experiments.[1] Since man is not a machine he can rise above himself when necessary and make himself work and endure in circumstances that would be impossible in normal circumstances. Therefore the output during the first few weeks showed the effects of this willed effort, and also the tempor-

[1] Emergency Report No. 2, Ind. Health Res. Board. *Hours of Work, Lost Time and Labour Wastage*, 1942.

arily stimulating effect of excessive fatigue. This was followed by the inevitable decrease, since it is impossible to remain at that level. Where output remained high it was due to improvements in organization in regard to supply and machinery, or to the appointment of more workers. If it had been possible to have had detailed personal output records of individual workers over a period embracing before Dunkirk and after Dunkirk for 6 months we should have been able to measure the progress of recovery. Excessive fatigue acts on the organism almost as an infection, and a period of convalescence follows the acute stage.

Some typical remarks made after Dunkirk were: [1]

"We are getting run down and bad-tempered and shall be in bed most of the winter if we don't get some rest."

"We are just tired out and need some fresh air and a rest. They could get the same production if they closed down on Sundays."

"We manage to keep going, but it needs all the will power we've got and we shall have to pinch time off if we don't get it. Most of us are taking tonics, and in my own case it costs almost 10s. a week."

Actually the need for a systematic curtailment of working hours was officially recognized on 25th July 1940, and the reduction which followed was reflected in better time-keeping. It is unfortunate that the curtailment was not enforced for all.

Those with experience of fatigue conditions and the circumstances leading to them knew what to expect, so were not surprised. What was surprising was that people ignorant of the exhausting nature of sustained effort should have thought that exhortation could neutralize fatigue. There has been a failure to realize that, for an extended period, work at a pace that can be maintained is of more value than spurts followed by breakdown

(2) *Inadequate Lighting, Heating, and Ventilation*

Some of the symptoms of fatigue may be present in consequence of inadequate lighting, or temperatures that are too high or too low, or of the air being very stagnant.

[1] Report No. 2, *op. cit.*

This aspect will be studied in detail in a special chapter. The fatigue results are not spectacular, but they are present.

(3) *Faulty Machine Design*

It should be obvious that a machine ought to be constructed with some regard for the probable physiological requirements of the worker, and not necessitate awkward or painful movements. Some machine designers do consider the human worker, but many do not. Of recent years there has been a considerable improvement in this respect, though much yet remains to be done. Investigations have shown that badly planned machines can cause quite unnecessary fatigue, which, though in some cases local in character, ultimately become serious. To take a trivial example: if a writer had to use a pen that was of considerable weight instead of the usual kind, then in the first hour he might protect himself and do less writing, or keep to his standard amount and fight against the initial discomfort, eventually becoming pain, in his hand and arm. If he persisted in the enforced effort he would end by being unable to hold the pen at all.

Some industrial machines throw a quite unnecessary strain on those who work them, involving either stooping or overreaching, throwing the full weight of the body on to the foot in pedal movements, or demanding rapid jerky movements.

The bicycle is an example of a machine which has been successively modified, first mechanically so as to obtain high efficiency, then psychologically so as to reduce the risk of falling and difficulty of balance, and finally physiologically, so as to reduce vibration and enable the force exerted by the rider to be more efficiently applied.

As it had the advantage of being tested in races, its effect as a fatigue-producing machine has consequently been subjected to more severe trials than occurs in the case of machines that are used for industrial purposes.[1]

Faulty Posture

Closely connected with machine design is posture. Many processes can be done either sitting or standing, and it is desirable that alternation of posture should be encouraged

[1] Legros and Weston, *On the Design of Machinery in Relation to the Operator*, Ind. Health Res. Board, No. 36, 1926.

wherever possible, particularly for young people. Either sitting or standing for long periods produces more fatigue than when the same number of hours are worked alternately sitting and standing.[1] Often the sole reason for not arranging for an alternation is simply "the foreman says it never has been". In a factory where it was possible for a group of workers to do two jobs, one necessitating sitting, the other standing, for 9 hours a day, the custom had always been for some to sit all day and some to stand all day. As an experiment the workers agreed to alternate; output was a little difficult to measure, but it certainly did not go down, and the result of using a psychological test to measure fatigue showed that there was less fall-off at the end of the day.

No posture that obstructs respiration or circulation or free movement should be stereotyped. The seats used where sitting is possible should make a good posture easier to maintain than a bad one.

Rhythmic movements are less fatiguing than jerky or stiff ones. A rhythmic movement in which the hand moved in curves instead of in a straight line, when taught to beginners reduced considerably the period of learning in one industrial process studied in detail.[2]

Personal Factors

So far, some of the external conditions likely to induce fatigue have been considered, but it has been tacitly assumed that all the individuals who have been subjected to these circumstances will be affected in the same way, and that each individual remains unchanged. Such assumptions could only hold for extreme circumstances; it is possible to subject people to such a strain that no living being could withstand the effects, although in the light of war-time experience human beings of all sorts of shapes and sizes, physically, mentally, or morally, seem to be tougher than one would have thought in 1939. Even with that proviso, we must only interpret the circumstances known to be associated with fatigue symptoms

[1] Bedale and Vernon, *Effects of Posture and Rest in Muscular Work*, Ind. Health Res. Board, No. 29, 1924.

[2] E. Farmer, *Time and Motion Study*, Ind. Health Res. Board, No. 14, 1921.

as true of a group as a whole, i.e. as representing the influence of the majority. There are various individual differences that would produce exceptions.

Variations in the Same Person.—Suppose that you are a shop assistant in sale-time, in the best of health, that you have worked hard, and that things have gone well. On reaching home you will be fatigued, but pleasantly so. And let us suppose that we could measure the degree of fatigue—a much-desired measure—and that you had 20 degrees. Now suppose the circumstances were exactly as above, but that instead of being in the best of health you were convalescent from influenza. Even though things went well you would probably feel worn-out. By our imaginary measure you might have 50 degrees of fatigue. The same result would probably apply to any other set of circumstances of a fatiguing nature, and although we only have indirect evidence of other people we know that it is true of ourselves.

Now let us alter the *circumstances*. As before, you are in the best of health and prepared to enjoy a day's work, but you have a sequence of tiresome customers, and you think the manager has been unjust to you. At the end of the day, in spite of your health, you are more fatigued, perhaps to 35 degrees.

If the sequence of tiresome customers and the unjust manager occur during your convalescence period the result would be more nearly 100 degrees.

A person full of vitality will carry on successfully much longer than the same person wearied by overwork, though the work and conditions remain the same; and that same person will flag sooner on very strenuous work than on lighter, and on work for which he could see no use than on work which he considered valuable.

These illustrations, though imaginary, do represent real situations, and they are given in order to bring out the relativity of fatigue. The degree of fatigue experienced by any one of us is the final answer to a division sum whose divisor and dividend are the fatigue conditions and the amount of energy available.[1]

[1] W. McDougall, *Outline of Abnormal Psychology*, 1926.

$$X = \frac{\text{fatigue conditions}}{\text{available energy}}.$$

Whatever, therefore, decreases the amount of available energy at any human being's disposal will increase his fatigue; and the same amount of energy will not last as long when demands are above normal. If the available energy is small, then relatively insignificant fatigue conditions will produce observable symptoms of fatigue; if the available energy is great, fatigue conditions may be present in a high degree without producing symptoms.

We accept the effect of illness or continued strain in reducing our energy, but there are mental conditions that also have this effect. If during a day of ordinary work we are worried all the time about something we have left undone, something we have said, the fate of someone we love, the possibility of losing one's job, and so on, energy is being used up in the conflict between the work and the worry.

The worry instead of being of the nature of current stress may be quite irrational, i.e. neurotic, and yet have the same results: the people who fear they will be sacked, though they know they have security of tenure; those who are upset if they have to interview someone in authority, though they know there is nothing wrong; those forced to attempt an impossible perfection—these are all using up in their conflicts energy which is in consequence not freely available for normal activities.

So we get an almost inescapable cycle; for example, the work continued too long may have depleted one's capital energy, and this in turn is not available for the work, and this sets up worry which uses up uselessly still more energy.

Adjustment to a Particular Kind of Fatigue

Most of us, however, have discovered that we can get accustomed even to lack of sleep. The seemingly never-ending hours of one's first fire-watching period gradually became of quite reasonable duration, and the weariness that afflicted us the next day became considerably reduced. There seems to be a mental as well as a physical adjustment; perhaps without defining one's terms too rigidly, a certain immunity is set up.

Experimental work in a laboratory showed the same phenomenon. The cutting down of sleep described earlier and the measurement of its effects by psychological tests was repeated at intervals, 5 times in a number of years. The result was a less exaggerated stimulating effect during the period of limited hours of sleep and a quicker return to normal.

Most of the experimental work both in the laboratories and in the factory has necessarily concerned itself with muscular and intellectual work. Now, it is a truism that a happy person is more able to withstand the rigours of circumstances than the unhappy. We mentioned above that the worrier was using energy to no purpose; worry is a mild fear, and fear is an emotion, and observations would suggest that emotional fatigue plays a considerable part in the very complex causes of fatigue. It is of course impossible to experiment on emotional fatigue. It is recorded that Leonardo da Vinci, in order to see the lines of the face which expressed fear, pretended to be on fire and thereby terrified his housekeeper, whose face immediately registered fear, which the painter noted accordingly. The psychologist is much more handicapped. Even a short period of emotional excitement is fatiguing, though in emergencies emotion can release for a time enormous energies. In war-time we have here an added cause of fatigue symptoms.

Another individual difference often observed is that people differ in their resistance to fatigue, that is, as some people are more liable to illness or accident in certain circumstances than others, so some are more liable to experience fatigue. On what this difference depends we cannot as yet answer, nor can much be done about it. It has to be accepted.

Some of the physiological and psychological symptoms of fatigue, for example the gastric disorders and headaches, irritability and lack of concentration, are also associated with some diseases. It is therefore not difficult for a fatigued person to think he is ill, and the step to being ill is not a long one. Consequently sickness absence increases, which in its turn still further reduces the output, since the worker is no longer present to produce even a diminished output. He may or may not go to a doctor. If he does, there will probably be a diagnosis of neurasthenia, or gastritis, according to the

symptom of which the sufferer is most conscious. If he does not have a doctor's certificate he will probably buy his favourite tonic and absent himself for a day or two, giving some vague reason if questioned.

The remedy for fatigue is rest, and if the work done during the day has been reasonable a night's rest should restore normal energy. Where the fatigued state has been prolonged, the return to normal is slow.

"Fatigue so closes the avenues of approach within, that education does not educate, amusement does not amuse, nor recreation recreate." [1] It can be therefore a dangerous condition.

[1] J. Goldmark, *Fatigue and Efficiency*, New York, 1912.

Chapter III

THE ENVIRONMENT

Unconsciously we all take for granted a certain background to our lives. We assume that tomorrow will be in essentials as today, that we can within certain limits plan for the future, for next week, or next year, and so on; that the future of the country, of our social groups, of our work and home environment, is at least in thought predictable.

The entirely unexpected does, it is true, happen sometimes, both to individuals—for example, sudden death, sudden increase or loss of fortune—and to groups, e.g. a mine explosion, an earthquake; such events, however, are looked upon as exceptions, and apart from the generally expected order of events. War breaks this stable background. Nothing then can be taken for granted. The careers of men and of women are interrupted, there is the possibility of sudden death in dramatic circumstances, for large numbers of people the uncertainty with regard to income and career, both in the present and after the war—all of which means that, even where the actual details of daily life have not been radically changed, the background against which they take place has no longer the same security.

The result is a feeling of uncertainty, to which people react differently. Some have broken down under it and have sought a specious security in physical or mental illness; some have become querulous, taking as a personal grievance the shattering events now impinging on their stability; some have been stimulated to greater effort; some consciously acquiesce in the change; no one, however, remains the same.

The factory, in itself a community, is part of the wider community of the country and is therefore necessarily affected, since it is against this background of social uncertainty that the daily routine has to be carried on. Hence all the problems that beset workers in ordinary times, whether as subordinates or as people in authority, will be present

and in some cases intensified. These relate to work, to the environment both material and psychological, and to the make-up of individuals.

No human being can be considered apart from his environment, and no human being is independent of his environment; for good or ill each of us is affected by conditions external to our bodies, and then to our minds. The air we breathe, its temperature, light and darkness, noise and quietness, these we know affect the body, and through it the mind. The body in its turn is an environment to the mind, so its condition, its changes, whether from within or without, modify the mind, and these are in turn modified; part of the mind can be environment to another: we can judge ourselves, approve ourselves, love, hate, or despise ourselves. The social groups to which we belong either by choice or necessity are part of our environment and exercise a moulding influence on our mental development.

The environment in which we earn our living can stimulate or depress, help or thwart us, determining in some way to what we shall react. Contrast the effect of bringing up a child in a social group that thought everything he did was perfect, with the effect of bringing him up in a group where everything he did was adversely criticized. It is certain that the results would be very different. "Man is an organism, a vast complex of physical, biological and mental events, constantly influenced by and reacting upon the physical, biological and mental events of the environment in which he lives." [1]

Though the environment is extremely important, we are not merely passive to the world of physics outside us; in our turn by our activities we alter it to try to reach conditions that are "comfortable", i.e. of such a nature that we do not need to give conscious attention to them.

This absence of conscious attention to some features in the environment is important in another connection. We are all familiar with the effect when the clock stops. Up to the moment when it stopped we were not aware that it was ticking. When it stopped we noticed the difference, therefore we must have been aware of it; we were, however,

[1] W. McDougall, *Energies of Man*, London, 1932.

not attending to it. Psychologists use the word subconscious for such conditions. Another familiar example is the awareness of the "feel" of our clothes if our attention is drawn to it, but normally we are unaware of the contact of our clothes with the surface of the body. Our mental life is essentially practical in aim, and normally we do not waste voluntary attention, required for other things, unless there is need to *do* something. But it is sometimes argued that to lose awareness of noises with which we are familiar is detrimental, though the evil effects of suppression are not attributed to the same process in the other senses.

THE MATERIAL ENVIRONMENT

The work of all of us has to be done in an environment where light, temperature, air, noise, play an important part. There may be innumerable other conditions of the existence of which we are so far ignorant, but the above have been proved to influence work and mental well-being in a measurable degree.

Lighting.[1]—No one doubts the extreme importance of light, but if anyone had had a tendency to be indifferent to it, the experiences of these war years, with the need for rigid black-out, would have altered that attitude of mind. To be able to do away with the black-out, to be able to enjoy the lighted streets, is the conscious desire of the majority of people. Extreme conditions often have the effect of throwing into relief conditions that may be always operating though to a less noticeable degree.

The ideal lighting is daylight, but unfortunately in these northern lands there is too little of it during the winter months. When there is need for night work, or the work is carried on underground, daylight is never available and the black-out still further encroaches on daylight.

In these circumstances some substitute has to be found, and that is artificial lighting, of which the essentials are:[1]

(1) Enough light to make everything that it is necessary to

[1] The subject-matter of this section no lighting is largely taken from "Industrial Lighting in Wartime" and "Industrial Lighting in Reconstructions", H. C. Weston, *Transactions of the Illuminating Engineering Society*, January 1941 and December 1941.

see bright enough to be seen *quickly* and *accurately*, at least by individuals possessing "normal" vision and with a margin of safety for subnormal eyes.

(2) Controlled distribution of light, to make the many different brightnesses in the field of vision form a picture comfortable to the eye.

The Ministry of Labour and National Service is empowered by the Factories Act to fix standards of lighting and to make regulations. Regulations have been made which apply to factories where processes are carried on for more than 48 hours a week, or in shifts. It is required that the illumination in the horizontal plane 3 feet from the floor shall be not less than 6 foot-candles,[1] and it is expressly said that this requirement is without prejudice to any additional lighting required by the nature of the work. For other illumination standards there are no legal demands in this country, but desirable figures are given in the Illuminating Engineering Society's code, namely:

1. Precision work to a high degree of accuracy: tasks requiring rapid discrimination: displays . . Above 50 foot-candles.
2. Severe and prolonged visual tasks, such as fine engraving: discrimination or inspection of fine details of low contrasts. 25-50 foot-candles.
3. Prolonged critical visual tasks such as drawing, fine assembling, fine machine work, proof-reading, sewing on dark goods and type-setting . . . . . 15-25 foot-candles.
4. Visual tasks such as skilled bench work, sustained reading and sewing on light goods . . . 10-15 foot-candles.
5. Less exacting visual tasks, such as casual reading and large assembly work . . . . . 6-10 foot-candles.

It was noted early in the course of the present war that apart from the physiological effects due to the exclusion of daylight, "there occurred in some blacked-out factories an increase of nervous irritability among workers and supervisory staff, with consequent friction". Part of this irritability seems to be associated with a feeling of being denied something that is one's right. An authority on problems of factory

[1] The foot-candle is the unit of measurement of illumination in this country. An illumination of one foot-candle is produced by a standard candle at any point on a surface of one foot distant, and so placed that rays from the light source meet the surface at right angles.

lighting makes the plea for the admission of some daylight—useless, perhaps as an aid to work—because it gives a visible assurance of daytime and is as it were a "daylight token". Another important point is that "good lighting should facilitate seeing without being ostentatious". In the factory, as so often in other fields, a means becomes an end and the sources of light are too obtrusive, attracting attention to themselves, reminding everyone that this is no natural lighting, but the creation of man.

There are complaints from workers even when actually the lighting is up to the required official standard, because, owing to the method of lighting adopted, it fails to give a cheerful and satisfying appearance. In one factory where, owing to quite unimaginative black-out conditions, the interior was described as "dingy and dismal", the whole establishment was referred to as the "dump". The consequent depression led to an increase of lost time. Lighting that gives "good visibility *of* the work is not necessarily good enough *for* the work". It has been argued that people get accustomed to anything in time. This is partly true, but where a "dingy and dismal dump" leads to emotional depression it "cannot be assessed merely in terms of quantity and quality of work done, even if that did remain the same; it has a significant influence on the whole life of the individual and the community, for the sufferer takes his gloom or his irritability into the home and so extends the influence of the factory condition to the home".

The illumination in factories even for rough work is often inadequate, so that although the workers can see their work they are producing less than they might do. Prior to the outbreak of this war, in a factory doing the rough work of tile pressing, for which little more than half a foot-candle was provided, the output has been shown to improve progressively with increases of illumination up to 20 times this value. Yet with 3-4 foot-candles they could *see the work* adequately. The increase of illumination gave a more cheerful appearance.

That light has an effect on the mind has been known for ages. Anyone would understand what was meant by the remarks, "What a depressing colour!", "Isn't the room

cheerful with the sunlight coming in!" Actually a colour in itself cannot be depressing, any more than the room can be cheerful. It is the minds of the observers that are depressed or cheerful. But although we know from our own experience that that is so, yet a very large proportion of factories have so far failed to find people in authority with sufficient foresight to act on it. If one factor in cheerfulness is light, then common sense would suggest that advantage should be taken of it.

From the lighting point of view the total exclusion of daylight, due to the necessity for black-out, amounted to total night in some places, and this had to be the lot of thousands of workers hitherto accustomed only to a limited number of hours without ordinary daylight.

Wherever the walls, floor, and roofs of factories are clean and light in colour, and general lighting is installed, the appearance of the factory is improved. The effect of obscuring windows by means of black paint might be equally as well described as "blacking-in" as "blacking-out". Even factories that normally have adequate natural lighting fail to be attractive by night, or when blacked-out, if lighted artificially on conventional lines.

One of the most noticeable features is the contrast of the black top above the sources of light. "With direct general lighting in a large workshop a forest of bright patches is seen set in a dark 'sky' so unlike anything natural that to become oblivious of the means of lighting is impossible. This defect is not noticeable when fittings with partly open tops are used. Further improvement can be effected, without adding greatly to the total lighting load, by arranging a few units to illuminate the roof."

The general effect of a cheerful light is best obtained through general lighting, but in addition supplementary local lighting is required for some work. For very fine work adjustability of local lighting units is desirable, not only to permit change of direction of light, but to allow individual choice of illumination.

Where the work involves handling and inspecting polished articles, direct lighting with high brightness sources can cause an appreciable reduction of output. Some workers engaged in examining cartridge cases stated that "the electric light

produced a disturbing dazzle on the brass caps of the cases which makes the work more difficult and fatiguing."

Investigation showed that not only did they suffer from the dazzle or glare, but the cases were less uniformly illuminated than in ordinary daylight, and so it became increasingly difficult to see the defects.

It was found by noting the hourly output records that during the period of artificial light the fall in output for the two workers studied was 6·7% and 5·6% respectively. Both the colour and brightness of the background were unsuitable and "failed to provide the restful contrast which is essential to comfort and efficiency".[1] It requires little imagination to realize that if, not only during the afternoon period but throughout the whole day and perhaps the night, the work has to be done in artificial light, then a fruitful source of lowered output is to hand. Machines are usually painted black or battleship-grey, so there is often too little brightness or colour contrast between the work and parts of the machines forming the background. If these parts are finished with light-coloured paint, contrast is improved, and it is much easier to see the work. In addition, the illumination of the work itself may be improved by light reflected from machine surfaces. The whole machine may be painted a uniform colour, or a different, but pale, colour can be used for parts not in close proximity to the work. The general brightness of a machine shop is heightened, and where high machines such as heavy presses are used, more light is reflected to adjacent machines and troublesome shadows may thus be avoided. Both in this country and in America experiments have taken place to discover the most satisfactory colours. In America light buff was the best, then aluminium and light grey. Yellow was found to be tiring. In this country the advantages of painting machines a light colour were recognized by the Departmental Committee in Factory Lighting; in a report published in 1940 this was recommended, and where trials have been made they have proved very satisfactory.

In a recent discussion by illuminating engineers several speakers mentioned the "eye-strain and headaches resulting

[1] H. C. Weston, *Effects of Conditions of Artificial Lighting on Performance of Worsted Weavers*, Ind. Health Res. Board, No. 81, 1938 *passim*.

in nervous irritability and psychological upsets", due to inadequate lighting. As a contrast is the following description of a factory.

"The appearance of the interior is excellent and very natural. On entering the building on a bright sunny day one is conscious only of the expected change of brightness level, but not of any qualitative change, and the light sources are not obtrusive. Looking across the factory, it is impossible to see the lamps at all in distant bays, where it is difficult to believe that daylight is not being admitted. The most striking testimony to the acceptability of the installation was given involuntarily by a visitor who, having been conducted through the building, was asked by the manager, 'How did you like the lighting?' and replied, 'What lighting?' He had to be taken back to be convinced that the factory was, in fact, entirely dependent on artificial lighting." [1]

This case is a good example of the truth that the more thoroughly an industrial lighting installation does its job the less notice will it attract. In fact, the highest art conceals the art.

"Lighting, even in factories, serves other ends besides the mere revealing of work, and while this is here its prime function, those who plan it should never forget that only in thought, and not in fact, is the work-man an isolate from the whole-man." [2]

The Influence of Temperature

That a temperature too high or too low may be dangerous to health and that the amount of work that can be done may be affected is well known. In industries such as iron and steel, tinplate and glass manufacture, the output is least in the hot summer weather and greatest in the colder months. Even in the lighter work of the textile industry, although increased temperature and increased humidity are both favourable to the weaving process, yet when the increases are pushed to an uncomfortable degree the increasingly unfavourable physiological effects more than counterbalance the favourable condition.

[1] H. C. Weston, *Industrial Lighting in Wartime, op. cit.* [2] *Ibid.*

On the other hand, any process dependent upon manual skill is affected by temperatures that are uncomfortably cold. It has also been established that accidents increase when temperatures are above or below a range of 65° to 69° F.

Recently more detailed enquiries have taken place in an attempt to find out what constitutes a "comfort zone" for the worker in sedentary and light industrial work.[1] Within certain limits it is possible to say what would constitute a dangerous degree of chemical impurity in the air, or what is a workable temperature. As with light, though, there are psychological problems. Comfort is the expression in consciousness of certain satisfactory conditions and is dependent on individual judgments. If a particular temperature makes me feel uncomfortable, I shall be less able to attend to my work, and this in spite of it being a perfectly satisfactory and healthy one for others. Any physical or mental condition that attracts attention unnecessarily interferes with the smooth working of the human being.

It is necessary to make a distinction here between a sensation of warmth and a sensation of stuffiness or freshness; a warm room may be either stuffy or fresh, as also may a cold room, though as a matter of experience a warm room is more likely than a cold room to be stuffy.

The enquiry attempted to find out within what limits workers considered themselves comfortable in regard to conditions of warmth or cold. There are, it is known, considerable individual differences of opinion about what is a comfortable condition of warmth. Every place where even a few people are gathered together is sure to have the person over-sensitive to cold or heat; but although it is impossible to organize for them even in a private house, it is desirable to know within what limits the majority of people consider the conditions comfortable for particular kinds of work. A wide range of industries was studied, including factories devoted to aircraft, radio valves, wireless receivers and components, paper bags, ladies' dresses, and furniture. The methods by which the factory buildings were warmed and ventilated were as varied as the processes they housed, and

[1] T. Bedford, *The Warmth Factor in Comfort at Work*, Ind. Health Res. Board, No. 76, 1936 *passim*.

the buildings themselves were a fair sample of English factories, ranging from the oldest to the newest, from one storey to multi-storey structures.

Each worker was asked to say whether the room was too warm or too cool, and care was taken in asking the question to distinguish the person over-anxious not to appear dissatisfied and who therefore could find everything perfect, and the opposite type who would always be disgruntled.

It proved possible to classify the replies into seven groups, namely, much too warm, too warm, comfortably warm, comfortable, comfortably cool, too cool, much too cool.

The feeling of warmth experienced by any person is not dependent only on the warmth of his environment. Differences in clothing, in muscular activity, age and general body-build, condition of health, and not least in acclimatization, all tend to influence feelings of warmth experienced by different people in the same environment. Reid (1844) recorded that on a certain occasion in the House of Commons one member complained of suffocating warmth while another was shivering with cold. Conversation elicited that some members demanded a temperature as low as 52° F. while others required one of 71° F. Morin (1863) mentioned an amusing squabble about the temperature at the Théâtre Lyrique in Paris. During a warm week in May when the temperature on the stage was about 70° to 73° F. the manager and the prima donna complained of the high temperature, while the director of the opera grumbled that he was cold. Morin bemoaned "these prejudices and interested oppositions" and said that "the only way of overcoming such obstacles lay in the strict observance of well-made regulations".

The problem is on what evidence are the "regulations" to be "well-made".

In the actual enquiry from the above-mentioned factories very wide differences in estimates of comfort were noted. Over a temperature range of from 64° to 66° F.—the most popular temperatures—some persons were too hot while others were too cold; somebody was comfortable and uncomfortable at each recorded temperature from 54° F. to 76° F.

There is general agreement that for light work 65° F. is a suitable air temperature, and the above enquiry supported

this opinion, but it also showed that temperatures differing considerably from that are tolerated and even found comfortable.

In addition to the actual temperature, a room is uncomfortable if the air is stagnant. Two rooms may be equally warm, but one will seem fresh and the other stuffy. It is therefore important to see that the speed of the air movement is adequate. In summer weather a much higher air velocity is necessary than in winter. Satisfactory air movements will generally be secured in rooms ventilated by suitably placed windows if these are used properly.

Other factors such as radiant heat and humidity also play a part in "comfort", but the details of assessment are too technical for discussion here.

In the Emergency Report No. 1 of the Industrial Health Research Board, 1940, the chief requirements for satisfactory heating and ventilation are given as follows:

(1) The temperature should be suitable for the work that is to be performed.

(i) In winter suitable temperatures are:
for very light work, 65° F.;
for active yet light work, 60° F. to 65° F.;
for work involving more muscular exertion, 55° F. to 60° F.; overheating should be avoided.

(ii) In hot weather the temperature should be kept as low as possible by thorough ventilation.

(2) The supply of fresh air should not be less than about 1000 cubic feet per person per hour and should preferably be greater.

(3) Adequate air movement should be ensured. In winter the rate of movement should be about 20 to 40 feet per minute, and in warm weather higher velocities are desirable.

(4) The relative humidity should not generally exceed 70% and should preferably be distinctly less. Proper ventilation will generally ensure that the air is not unduly moist.

From the psychological point of view, apart from the physiological, adequate comfort is necessary lest energy be

wasted in attention to the discomfort. Also any environmental factor that is unpleasant can form the focus for grievances. Many "brain" workers record as a fact of observation that their efficiency is affected by temperatures that are uncomfortable.

Noise

Noise has been defined as unpleasant sound. The important word, however, is "unpleasant"; unpleasant to whom and under what circumstances?

No one can avoid knowing how much some people dislike noise. Before the war at regular intervals a spate of letters appeared in the Press emphasizing with lurid detail the appalling effects of being subjected to the noise of machinery, of our streets, and railway stations. If the writer was physiologically minded, he explained exactly what he thought was the effect on the brain and nerves, and usually concluded with a dissertation on the increase of nervous disorders (not very clearly defined) due to noise, particularly of the kind of noise most distasteful to himself. If he was commercially minded and desirous of making financial shudders run down our spines, he told us exactly how many millions of money were lost through preventible noise. One writer, unfortunately he does not give the details of the calculation, thought it could be over one million pounds a week.

Others describe a "golden age", usually any period other than their own, when noise was unknown. This belief in the quietness of preceding periods is certainly not borne out by such contemporary references as we have, for references to noises are common. A writer in *The Times* some years ago says that before the days of motor cars, "when all the traffic was drawn with iron tires running on either stone setts or macadam, it was impossible to talk as one went along Piccadilly". According to Schopenhauer, referring to the cracking of whips by tradesmen and carters, "the sudden, sharp crack which paralyses the brain, destroys all meditation and murders thought, must cause pain to anyone who has anything like an idea in his head". To each age its own noises and its complaints.

About the so-called "effects" of noise we know almost

nothing. It is perfectly reasonable to object to being wakened by the noise of some passing car driven by an irresponsible person, but, as was pointed out some years ago by Dr. Culpin in the *Nineteenth Century*, "if every pop should mean a shilling in my bank balance I could sleep happily beside a continued procession of motor cycles, and only wake up when the row ceased"—and many people would be of the same mind.

When one comes to study the subject one finds no agreement about what constitutes a noise; what is noise to one is music to another, and a noise disliked intensely by numbers of people, namely the road drill, is liked by some.

There are so many individual reactions to specific noises that an objective criterion is hard to come by; e.g. the crying of a baby, but not motor traffic, was noise to one person; the sound of a typewriter, but not of machinery, to another; while the rustling of papers in a quiet room drove one woman back to a noisy room to do responsible written work. Some people definitely prefer to do their work in a noise. Equally personal is the kind of work that can be done in a noise. Obviously there are some noises, e.g. a tyre bursting near by, of such a nature as to distract anyone for the moment; but to noises forming part of one's daily routine most people become habituated. The definition of noise as unpleasant sound means unpleasant to the speaker. A noise is not a noise if made by ourselves; it is generally other people who make noises. This is an obvious difficulty from the point of view of investigations.

It is a curious observation that the literature on noise is infinitely more emotional in character than that on temperature or illumination.

What is known apart from Emotional Dislike?—It has long been recognized that people subjected to continued excessive noise in an enclosed space are liable to permanent damage leading to hardness of hearing. To this domain belongs the well-known boilermaker's deafness, and sheet-iron smiths, coppersmiths, blacksmiths and coopers were liable to a perversion of hearing, shown by increased perception of high notes or loss of perception of low notes. There is also in these occupations the complication of the effects of vibration. These,

however, are exceptional, and the noises of ordinary life and of the factory are not of this nature.

Several researches have been made with the object of studying noise, of which the following are examples; the first was done in a laboratory [1] and the other in a factory [2]:

(1) Undergraduates were asked to perform certain tests ranging from tests of manual performance alone, through tests demanding partly motor and partly mental activity, to tests almost entirely of a mental type. The conditions under which they were applied differed from varying degrees of noisy surroundings to almost complete quiet.

The results showed that noise did produce a slight diminution in efficiency at the beginning of the tests, but that this initial effect soon wore off and adaptation to the noise took place rapidly. The effect of the noise on the mental tests showed a retardation of the speed of the work and a diminution in the amount done, but again adaptation took place. Discontinuous low mechanical noise was more disturbing than continuous low mechanical noise. Mere loudness was not important, for "soft" gramophone noises proved almost as distracting.

This diminution, even if slight, is worth consideration, and attempts should be made to reduce the noise if possible. The popular accounts, however, given of the effects of noise, e.g. fatigue, headaches, nervous irritability and strain, are all vague, and these symptoms are assigned quite as frequently to several other environmental conditions.

Not all the subjects could become accustomed to all the noises. One man reported that he could work to the strains of classical music but not to jazz. Another that he could to jazz but "not to Beethoven or anything interesting".

Laboratory experiments are bound to differ from factory work; nevertheless, because they can be controlled, they throw light on conditions that might be overlooked in the more complex environment of the factory. (2) A factory enquiry studied the effects of noise on weaving.[3] As it was

[1] K. G. Pollock and F. C. Bartlett, *Two Studies in the Psychological Effects of Noise*, Ind. Health Res. Board, No. 65, 1932.

[2] H. C. Weston and S. Adams, *Effects of Noise on the Performance of Weavers*, Ind. Health Res. Board, No. 65, 1932.

[3] Weston and Adams, *op. cit.*

impossible to reduce the noise of the looms, the workers had to be rendered for part of the time insensitive to noise; for this purpose ear-defenders were used of such a nature that conversation could be carried on but the general noise was reduced for the wearer.

The output of each loom for every hour of the working day was recorded, and throughout the experiment each worker wove the same kind of cloth and worked the same loom. The ear-defenders were worn during alternate weeks and had the effect of subduing the noise. The noise in a weaving shed is a continuous roar and clatter, the resultant of a number of sounds of considerable intensity due to various parts of a large number of looms. Two groups of equally proficient weavers were selected in the same weaving shed. The output of the looms was measured in picks (i.e. weft threads woven) by "pick" recorders. There were two experiments, one lasting for 24 weeks and the other for 52 weeks. The effect of the noise normally associated with weaving was to lower the output by about 3% of that obtainable when the noise was subdued. In terms of personal efficiency, that is, allowing for the part under the control of the worker, as against the machine, this is equivalent to an increase of about $7\frac{1}{2}$% with subdued noise. In a purely manual process a $7\frac{1}{2}$% increase in output would indicate that noise is an important factor.

It cannot be maintained that what was true in these particular circumstances would apply in different circumstances. There is no reason to suppose that reductions from relatively low intensities to still lower ones, or even to complete silence, would necessarily give similar results. Much more research is needed for the effects of different intensity levels and of continuous versus intermittent noise.

Excessive noise is to the human organism very much as excessive friction is to the machine; it wastes energy.

A study of the phraseology used by people susceptible to noise suggests that one factor in the mental effect is resentment, the noise being regarded as an assault on their right to quietness.

Opinions of Workers.—In three factories where there was considerable noise, namely chocolate-shaping, tin-stamping,

and printing, the workers were asked about the noise, and the opinion of the majority was that they got used to it. In each case, however, it was the manager who objected, and in one factory the manager was trying to get noiseless machines invented. The explanation was, I think, that the workers were helping to make it, while the manager was forced to hear it but was powerless to prevent it.

In a laundry a worker on one machine said that she got used to the noise, but that when it stopped she realized the peace, and that it "got on her nerves for a bit" when it started again. Another comment was that the noise of machinery was much more irritating when heard from a distance, e.g. in the canteen when eating. A worker on a rather noisy machine did not object to the noise, as she looked upon it as characteristic of the machine, but when an irregular click developed, which in no way affected the working of the machine, she found that extremely annoying.

Office workers often object to the noise of the factory and say it affects them if they are run down.

There seems to be a considerable habituation to a noise which has "meaning", but annoyance is felt at a noise which is not necessary.

People of a "nervous" temperament are much more susceptible to noise than those who are more balanced; they therefore serve as an index of something wrong, even though the well-balanced people may be indifferent to it.

(3) *Clerical Work.*—There are frequent complaints of the noise of typewriters, and a defence of the noiseless machine is that it reduces the irritation attached to the combined effect of several machines. If this is so, then one would expect the result to be shown in some measurable way, i.e. in output, in reduced absence for sickness, or in better work from the people near the noise but not making it.

An opportunity to test this occurred a few years ago.[1] From the staff of a large organization two special groups were formed comparable as far as possible in regard to age and typing experience. The output for each typist for the preceding 6 months was available. One group was equipped with

[1] *Effect of Noiseless Typewriters*, Ind. Health Res. Board, Annual Report, No. 19, 1938.

new noiseless typewriters, one with new standard machines, while a third was available as a control group which was unchanged. Each typist's average output for each day was recorded for 12 months, and month by month the group with the noiseless machines had an output considerably superior to the other two groups. Had the investigation stopped at the end of the year it would have seemed reasonable to conclude that, other conditions being equal, the noiseless machines did permit of a significant increase in output. The point is whether "other" conditions were equal; every effort was made to have the experimental groups as equal as possible, but absolute equality is more than improbable. It was therefore decided to change the machines, so that the group which began with the noiseless should have the standard machines and vice versa; the control group remained as before. In this way the same typists could be compared with each type of machine.

Those who during the first year had used the noiseless machines still kept up with the standard machines an output superior to the other groups, but out of the 9 months of the second year's experiment 6 showed a very slight balance in favour of the noiseless and 3 months were in favour of the standard. The other group showed a very slight but consistent balance in favour of the noiseless, although the output never equalled that of the other group.

The main difference between the groups, a difference that became clearer as the experiment progressed, lay in the temperament of the supervisors in charge of each group. The effect of one of these on her group was to increase within a month not only the average output of her group but the output of each member of the group; another increased the average of the group but not of each individual; a third increased it, but to a lesser amount; and the fourth decreased it. Whatever was the effect of the machines, it was modified by the influence of the people in command.

The sickness absence remained practically the same for each group whether the noiseless or the standard machines were being used, namely 4·9 days and 5·2 days per person for the same period.

The third way in which the effect might be measured was

in the work of those who worked in the room but did not actually do the typing.

Part of the work of the supervisors was to check the work, which meant that one person read while another compared the script. For the purpose of the experiment three of them were able to keep daily records of the amount checked and the number of hours so spent. They were unanimous that it was much more comfortable both to read and to listen in a room where the noiseless machines were in use.

One of the supervisors, the one who increased each person's output, showed a slight improvement only in 3 out of the 9 months when she worked in a room with the noiseless machines. She was, however, a very exceptional person, and would be likely to accept a challenge and prove that no machine could interfere with her. Another had a considerable amount of sick leave during the period; she definitely preferred to work in the noiseless room, but there is nothing in her output to show that. The third supervisor was uniformly better when checking in the noiseless room. Taken in conjunction with other researches, all admittedly of a tentative character, it is fair to say that while diminution of noise will not result in any striking increase of output, yet it is worth while in the interests of general comfort and efficiency.

More detailed knowledge of the kind of people particularly susceptible to noise was obtained in the course of a study of the nervous temperament.[1] The following groups worked in a noise, and each person was interviewed from the point of view of nervousness:

(1) A group of 30 girls working at or near a very noisy process called "stamping", and a group of 19 typists working ordinary machines in one room.

(2) A group of 19 men students who worked under fairly quiet conditions, disturbed at intervals by traffic.

(3) A group of 156 men whose work was sometimes done to the accompaniment of much noise.

Each person was asked incidentally to the main enquiry

[1] Millais Culpin and May Smith, *The Nervous Temperament*, Ind. Health Res. Board, No. 61, 1930.

how he or she worked in a noise. The answers could be classified roughly into three categories, namely: (1) those indicating indifference to unavoidable noise, (2) those indicating slight dislike, and (3) those indicating serious susceptibility to noise so that physical symptoms or mental distress was set up.

In the first group of 49 girls, 17 were graded well-balanced emotionally; of these 17, 12=71% were not affected by noise and 3=18% were seriously affected; 32 had nervous symptoms to some degree, and of these only 5=16% were unaffected and 20=63% were seriously affected.

The group of men students contained an unusually high proportion of nervous subjects, but the 3 well-balanced ones were unaffected by noise, and of the 16 nervous ones 10=62·5% were affected and 6=37·5% were not affected.

The group of 156 men gave a similar result. Of the 51 who were free from symptoms 42=82% were unaffected by noise; of 79 with severe nervous symptoms only 32=42% were unaffected.

One factor in serious susceptibility to "noise" is the emotional make-up.

Hours: the Number Worked

The relation of hours to output during the 1914-18 war has been already mentioned. It was shown then that there comes a time when, with the best will in the world, the pace cannot be maintained. If the work is of such a nature that the machine is the instrument of the worker, then variations in human well-being show clearly in a gradually diminishing output; if the human being is rather an appendage to the machine, then the actual output per hour varies less. Output can be reduced in two ways:

(1) The workers, while remaining at work, may be physically and mentally unable to continue at a high level of production because of fatigue. This will show in a reduction in the average hourly output.

(2) A large number of workers may absent themselves for varying periods of time. For example, during one month of the war when the average number of hours that could be

worked was 69 the average number worked was 51, but when the possible hours were 63 the number worked was 54.

If, however, large numbers of additional workers are taken on, the production will naturally increase, and unless that production is considered in relation to the number employed it is difficult to have an idea of what actually is happening to the workers. During a war, from the point of view of the country it is primarily important to know that the production is increasing; from the scientific point of view it is necessary to know what is happening to individual workers.

It has been extremely difficult during this war to get accurate output records in relation to hours, because established operations have been gradually and sometimes suddenly extended and new processes introduced, while the transference and replacement of workers has proceeded at an increasing pace and some firms are doing work entirely different from what they did previously.

A number of factories concerned with war production in some form have been studied, and while the differences between one organization and another are considerable, yet certain general trends can be seen.

After Dunkirk the national emergency led to a sudden increase in the number of hours worked. In most munition works the official hours were from 70 to 75 a week. It was realized that nothing mattered but the greatest possible increase in munitions and other war requirements. The result was an increased average hourly rate and an increased weekly rate. Unfortunately all the authorities concerned did not take to heart the lessons of the 1914-18 war and the long hours were kept on past the emergency period, with the same result, namely a diminished speed of production and an increased amount of lost time due to sickness and other causes.

Managers reported that the outbreaks of energy and patriotic enthusiasm which characterized the first phase of the emergency period were weakening under the strain of the long hours. Later the hours in many factories were shortened and holidays were arranged, both of which had favourable effects.

Enemy action and transport difficulties interfered at times

with the activity of some particular factory, but taking them on the whole the evidence points to a connection between the time lost and the weekly hours of work. It was reasonably low when the hours of work were less than 60 a week, but was higher and in some cases excessive when the hours were from 65 to 75 a week.[1]

Arrangement of Hours

A. *Rest Pauses.*—The usual arrangement of an ordinary working day is 4 hours or 4½ in the morning, and after an hour for dinner another 4 hours or 4½ in the afternoon, but it is not reasonable to expect people to remain at a machine doing routine work for 4 or more hours without a break. Those engaged on individual interesting work are usually a law unto themselves and are, after all, relatively few in number.

As a matter of actual fact it rarely happens that any work can go on absolutely uninterruptedly for 4 or 5 hours on end without anything happening to disturb the flow of work. Something goes wrong with the machine or there occurs a stoppage in the flow of the work, or a failure in the material, and such hindrances may either occur fairly frequently or at long intervals. In such cases the workers on the particular machine have to stop work; whether that can be called a rest is another matter. Many workers are intensely irritated at such stoppages, and irritation is hardly restful; the other type, that welcomes any chance to cease work, would in all probability find opportunities on many occasions. The majority of workers decidedly prefer a regular period which is recognized as their own to a doubtfully occurring time dependent on circumstances over which they have no control. Firms doing the same kind of work vary considerably in the number of these irregular stoppages.

Arrangement of Rest Pauses.—It is generally recognized that a regular effort can be maintained for 2 or 2½ hours, and that the knowledge that a rest will occur within a relatively short period induces a good maximum effort from the beginning.

[1] *Hours of Work, Lost Time and Labour Wastage*, Emergency Report, Ind. Health Res. Board, No. 2, 1942.

The human being is self-protective, and observation of a number of workers in factories and offices suggests that when the prospect is 4 or 5 hours' unbroken work the workers almost automatically adjust to it and put out less effort. This is a statement difficult to prove, because the conditions for a perfect experiment do not exist, but a number of independent observers have noted it as a matter of observation.

The most frequent arrangement of the break is to allow 10 minutes or a quarter of an hour in the middle of each long spell, during which period the workers can go to the canteen if there is one, or make their own arrangements for refreshment. When there is a garden many of them like to sit there. In some processes where the work is extremely mechanical, particularly on the moving belt system, a break of 5 minutes every hour is recommended.

How is the Output affected?—Assuming that each worker works to maximum capacity for 9 hours a day, then if only 8½ hours are worked there will be a reduction of output. Can such an assumption be made? It is the experience of most people who have timed processes that it cannot. The chances are therefore that, if a definite period is allowed and the organization is sufficiently good so that no delay takes place in returning to work, the output will be improved, or at least will not go down.

Some firms do not allow a definite rest pause but connive at tea-making, which often involves a quite considerable expenditure of time.

From the point of view of the loss in output it will depend on whether the process is almost entirely dependent on the machine or whether the worker's skill is an important factor. In the former case the output is in all probability reduced, but whether to such an amount as to jeopardize the factory seriously if otherwise efficiently conducted is very doubtful. Where the output is largely dependent on the worker the rest pause is a decided advantage.

In heavy work it is physically impossible to continue for long periods without a break. Such workers take rests at frequent intervals, and these may amount to anything from

10 to 20 minutes an hour.[1] The problem really arises in connection with the light industrial processes, where the work is not so much physically exacting as boring.

Evidence for or against the organized rest pause must be studied with workers who have been doing the work for a sufficiently long period to have become experts, the environmental conditions must be the same, and the hours of work must have been fairly steady for some time.

Examples of Investigations.

(1) A group of 17 girls who were labelling small packages were on a 48-hour week, the usual hours of work being from 8 a.m. to 12.30 p.m. and from 1.30 to 6 p.m. At 10.30 all work stopped for 10 minutes. Output records were available for 8 months, during the last 4 of which the rest was in force. During the last 6 weeks the average hourly rate of production was 13% greater than in the previous period. The improvement did not take place immediately.

(2) Another group consisted of 6 girls engaged in pressing grooves in rectangular pieces of cardboard, which were to be bent to form boxes. If their output for the 9 weeks preceding the introduction of the rest period is estimated as 100 per working hour after the introduction of the rest period, it averaged 105 in the last 16 weeks.

(3) An improvement of 8% occurred with a group engaged in a packing operation.

(4) In a factory where handkerchiefs were being manufactured each of 4 groups of workers showed a slight reduction in output during the first few weeks of the rest pause, followed by a gradual rise. Although the increase was never great, yet it was a definite improvement compared with the earlier period.

The writers of the report on these experiments emphasize that improvement is not likely to be evident at once and that at least a 3 months' trial ought to be allowed before deciding to give it up. The slowness of the adaptation is thought to

[1] Vernon and Bedford, *Rest Pauses in Heavy and Moderately Heavy Industrial Work*, Ind. Health Res. Board, No. 41, 1927.

be due to the fact that, as a rule, it is brought about unconsciously.[1]

Elton Mayo, discussing this problem in connection with the Hawthorne Works of the Western Electric Company in Chicago, holds that, for light work, two rest periods, one of 15 minutes in the middle of the morning, and one of 10 minutes in the middle of the afternoon, are more effective than 6 breaks of 5 minutes each distributed through the working day.

Individual Variations.—A rest pause, like any other environmental condition, does not affect all workers to the same extent. For example, the 17 labellers mentioned above were divided into 3 classes according to their output preceding the change, and in taking the averages the following results were obtained:

The 5 quickest workers, with an initial output of 112, improved 8·2% and the 6 medium workers, with an initial output of 101, improved 12·8%, while the 6 slowest workers improved 17%.[2]

A similar result was obtained in other groups, the slowest workers improving most.

Quite apart from the effect on output, the rest pauses help to improve goodwill, as they are popular with the workers. A foreman at one factory said to an investigator that the introduction of the rest pause was "the best thing the employers had ever done for their workpeople". They undoubtedly serve to relieve the monotony of repetitive work, with the result that there is usually less lost time.

Much more research is needed. The actual output curves for work of different types need further study, as well as the best position and duration of rests for the different classes of work, the advantages weighed against the disadvantages of the effect on rhythmic processes, the possibilities of alternating work, and the difference according to the amount of fatigue or of boredom generated. For example, it might be that the middle of the spells was not the best place in all processes. Even within the narrow limits of our knowledge

[1] Vernon, Bedford and Wyatt, *Two Studies in Rest Pauses in Industry*, Ind. Health Res. Board, No. 25, 1924. [2] Vernon and Bedford, *op. cit.*

of the subject the evidence seems to show that at the worst the production would not be seriously reduced, and in many cases could be materially improved.

B. *Short Time.*—Reduction of hours from 12 to 10 results eventually in an improved output, and the 8-hour day gives a very satisfactory output for many processes. Rest pauses also have been shown to have a beneficial effect. In these cases, however, there is the implication that there is plenty of work to be done. When the reduction in the working week is due to a shortage of work there is a serious reduction in output. One would naturally expect that a 4-day week would produce less total output than a 5½-day week, but it is not obvious that the average hourly output should fall. Yet this is what happened in several groups of which the following are examples:

A group of weavers were put on a 4-day week instead of their usual 5½-day week for 9 weeks, the reason being a shortage of work. Naturally the total amount of output was reduced, but it was found that their hourly output fell by 6%. The reason may have been a desire to spin out what work there was for as long as possible, but in addition the knowledge that work was slack may have depressed them and so lowered the output.[1]

A study of box-makers whose hours varied between 36 and 48 hours per week over a period of 2½ years gave the following interesting result. The 40-hour week provided the highest average hourly output, but the 48-hour week the highest weekly output: the 36-hour week was not satisfactory from either point of view.[2]

Hours worked.	Number of weeks.	Weekly output.	Hourly output.
36	27	29,926	831
40	61	34,737	868
44	31	36,920	839
48	5	38,100	794

[1] Vernon and Bedford, "Influence of Short Time in Speed of Production", *Journ. of Nat. Inst. of Indust. Psychol.*, II, 4, 1924.

[2] Miles and Angles, "Influence of Short Time in Speed of Production *ibid.*, II, 7, 1925.

If short time is prolonged there is loss of wages and dissatisfaction and discontent.

Habit has accustomed the workers to a certain pace. When a factory has settled down to a "normal" period of moderate length, for example 40 or 44 hours, any alteration of the week to longer hours will tend to reduce the hourly speed of production until such time as the working pace has been adjusted and a new norm established.

The above table has sometimes been quoted as evidence of the effectiveness of the particular length of the working week. Actually it is only relevant in the particular circumstances, namely during a period of slack trade.

Time off when other people are working is also unsatisfactory. A day off at the week-end is preferable to one when the majority are at work. There is "more to it", more opportunity for a social life.

THE PSYCHOLOGICAL ENVIRONMENT

So far we have considered the environmental conditions of a material nature which play a part in human efficiency and well-being. Nevertheless popular speech recognizes a less obvious, though no less important, environment in the phrase "mental atmosphere"; "the atmosphere was decidedly chilly" we might say of a not too cordial welcome. The mental atmosphere is as real and as important in industrial life as is the physical atmosphere. Unlike the latter, though, it cannot be measured by any instrument, and it is only by observation, guided and trained by experience, that it is detected. Some people seem unable to sense it, just as there are some people who never know when they are not wanted.

It is impossible in the present state of our ignorance to analyse all the factors that go to the formation of the mental atmosphere. A sketchy survey is attempted here in the hope that others will venture into a little known field.

The Group

Each person, in addition to being an individual, is a member of one or more groups, and there is little doubt that a group thinks, feels, and acts differently from the individual. Groups

have individuality, a personality of their own, and if we knew enough we might be able to grade them as we grade individual people.

In any organization worthy of the name, numbers of individuals will necessarily be grouped in order that for some purposes they can be treated as one, and the head of each group will represent the many in another group, and so on in the fairly typical form of hierarchical organization. Such an organization can be represented on paper in the form of a neat diagram, and this is all that the final authorities generally know; only a few at the director level, and these are of the very elect, can sense or even believe in other groupings by which subordinates consciously and sometimes unconsciously organize themselves.

A group once formed tends to back itself against other groups, to get common ideas, feelings and purposes, to develop leaders—too often those who are glib of tongue, though there are exceptions—and support its members against what it thinks injustice on the part of organized authority. Conventions develop; what "is not done" in one group may be the accepted mode of behaviour in another. Belonging to a group is a source of satisfaction to the majority of people. As a member of the group one loses some self-consciousness and the sense of responsibility is diminished. In large organizations curious hierarchies are formed. Each department or group of similar departments has its status. In a large store, department A would be considered the superior department, with B and C at the bottom. A student who was getting experience spent a short time in "ladies' hose" and then was transferred by way of contrast to "cooked foods". She had been a success with the "ladies' hose" group, and when they heard of the transfer they considered she was going down in the world. To show, however, that they were not snobbish, in spite of their disapproval, they used to come over to visit her in her new department. "Instructions to Staff" required the same conventions from all departments; there were nevertheless considerable differences in the interpretations put upon them.

Selling was regarded as inferior by the office staff, but the saleswomen prided themselves on being "in business". Factory and laundry workers in connection with the same organization

were looked down upon by both "Selling" and "Administration". As far as an outsider was concerned, the individual differences between groups were no greater than the difference between the individuals of any group.

Another organization might conceivably have developed quite different forms of grouping.

The "old school tie" is an attitude of mind not confined to public schools.

The informal groupings can sometimes actually neutralize or even nullify the policy of those in high authority. It was the declared policy of one firm that no one was to be dismissed except for flagrant inefficiency. This did not prevent one group at least from acting as if the contrary were true. A shop assistant found that she had lost her check-book. She was convincd without any reason that when the loss was reported she would be sacked. The charge hand also took this line, saying " I haven't authority to save your skin. You'll have to go before the Staff Manager and the head of the Counting House ", with the unspoken implication that the worst was to happen. Ultimately, after much anxiety, she saw the Staff Manager, who took it quite calmly. The fact was that no one would have been dismissed for such a thing, but the department, believing the opposite, had been upset for some hours. The culprit took a violent emotional view, annoyance influenced the charge hand, and ultimately every member of that group firmly believed in her impending dismissal.[1]

There also develops loyalty to the departmental head, with resentment if he or she is criticized by another group, even though he may not be popular.

An American enquiry reported that in an organization where the management thought that all departments were being treated fairly, and had that aim as a definite policy, 93% of one department and only 11% of another agreed that this actually was the case.

When one reads of "security" as a post-war aim it is difficult for those not familiar with different groups of people to realize that the effects of not believing in security, even if it is an objective fact, can be very great. Part of it is a legacy in the case of many firms from a very murky past, transmitted

[1] Margaret Leiper, "A Student as Shop Assistant", *J. Inst. Lab. Man.*, 1935.

by tradition. Part is a love of the dramatic; many reactions of human beings in groups are pure drama, unrehearsed.

The spread of rumour is, as in most groups, rapid but incalculable, and since nobody knows where a rumour starts, nobody is responsible; even if it is false it is extremely difficult to get emotional conviction for its falsity. "Oh yes, Mr. X *says* so and so, but still, well, you never know", and the story survives. A dramatic fiction often has more life than an undramatic fact.

The only remedy that could be effective depends on the actual responsible head of the organization, who should at intervals talk to each department and himself at times explain his policy. If he is known to the staff, even though he cannot know them all personally, and can show that he is human, there is much less chance of futile rumours circulating.

In wartime particularly it is difficult to believe that a rumour is not necessarily true because it is disquieting. It is equally difficult to remember that we are most suggestible where we are most ignorant. Lurid stories of death rays do not agitate the physicist, and the airman who has just made a safe landing at his base would be left unruffled by a story that his machine had come down in flames. Any large concourse of people facilitates the spread of rumour, and the best way of debunking it is to ask, Who told you? Who told him? Does he know?

During one of the many slumps that occurred in the period between the two wars, the workers in one organization, without any evidence, decided that the wages of all ranks were to be cut. The Managing Director, on learning of the rumour, took the first opportunity of addressing the staff, beginning with "The first person's salary to be cut will be mine: when it comes to the lower-paid ranks being cut, well, this organization will have failed. We are going through difficult times, but if we work hard together we shall pull through."

That got across and the rumour died. Events proved the rightness of the policy.

Dr. Wyatt found considerable variations in the rate of working throughout the working day, variations that were practically independent of the type of work and which he was sure could only be due to the suggestive influence of the group

upon the individuals composing it. He writes: "As a rule the workers were not aware of this collective influence which formed an intangible background and determined the general nature of the reactions to the conditions of work". He also notes the disturbing effect of a domineering assertive worker, who when bored attempted to disturb the whole group. On some occasions during the day an industrious attitude would prevail; at other times the group as a whole would show signs of slackness or indifference. "These general tendencies completely neutralized any variations in the rate of working which might have been caused by differences in the type of work." [1]

At the Hawthorne plant of the Western Electric Company, Chicago, from 1927 to 1932 a large-scale investigation was made and about 20,000 employees from all parts of the plant were interviewed, to determine their points of view about their work and its environment. In addition, detailed studies were made of several specialized groups doing different work, with particular reference to working conditions.[2]

The investigators noted among groups of workers "a uniformity of behaviour which expressed itself not only in the output of these groups but also in the attitude of the workmen towards each other". It showed itself in "straight line" output (i.e. no operator attempted to exceed a certain fixed amount) as well as in criticism of the wages system, promotion system, etc.

One interviewer reported that they firmly believed that they would not be satisfactorily remunerated for any additional work they did, or that rates would be reduced, whereas actually this had never happened. With themselves they were a happy and congenial group. Even though they were paid on a group-piece rate they prevented any individual from doing more than was the fashion.

It was clear that these human situations were unsatisfactory to both workers and management; they represent conflicting forces. The investigators pointed out that:

(1) There were in the company many human inter-relations

[1] Wyatt, *Incentives in Repetitive Work*, Ind. Health Res. Board, No. 69, 1934.
[2] Röthlisberger and Dickson, *Management and the Worker*, Harvard, 1939.

of which the company officially knew nothing, and that some groups gave allegiance to a member as leader who held no such position formally.

(2) The relation of supervisor to employee worked out differently from what it was supposed to do in theory, and that the group piece-work system was not functioning as it was supposed to do.

The writers distinguish between the "technical organization", i.e. the way management logically and technically represents its organization to be, and "social organization", meaning the *actual* human situation existing among the employees. To note this distinction is not to imply that the organization was bad; it is merely made for practical purposes to emphasize that misunderstandings may easily arise. The organization concerned did its best to give a fair deal, and in the study of complaints there were none against the company in general.

Management frequently takes the view that economic gain is the sole motivating force, whereas after a certain necessary minimum it is only one of many.

In a recently published enquiry in America Dr. Robinson [1] comments on the effect of social contacts, often unavoidable, which are accompanied by emotional strain leading to an interference with the possibility of effective collaboration, a decline in individual efficiency, and an incapacity for work.

As a result of the detailed study the investigators came to the conclusion that "Many of the actions of the workers were mechanisms to resist too rapid changes. This opposition to change not only was reflected in all their tactics to keep output constant, but also implied in the reasons they gave in justification of their actions." Unconsciously the principle was that if they exceeded their output management might *do* something, interfere in some way with their ways of work and personal relations.

Now the technical organization depends for its success in large part on changing, machines are re-designed, the tech-

[1] *Fatigue of Workers and its Relation to Industrial Production*, Nat. Res. Council, New York, 1941.

nical lay-out of the job altered, piece-rates reset.. This may seem natural to the management, but to the subordinate it is as if he were always in a position of having to accommodate himself to changes he does not initiate nor understand, though actually they may be to his advantage; and secondly, his established routines of work, personal inter-relations, are at the mercy of technical specialists.

The writers conclude that "successful management of any human enterprise depends largely on the ability to introduce more efficient methods without disrupting in the process the social foundations on which collaboration is based", and Elton Mayo makes the interesting comment that the more intelligent is a company's policy, the more necessary is it that there shall be a method of communicating understanding 'down the line'".[1]

As a member of an organized group each individual has to adjust to his superiors, equals and subordinates. Perhaps it would be more correct to say that most people have, since there is the final authority responsible to no one theoretically but God, and the most junior of juniors with no subordinates. Each has also to adjust to his work and its conditions.

In interviewing people, as an opening question of a supposedly neutral character each was asked, "How do you like your work?" Later the answers given by about 1000 workers were tabulated into four categories: those who liked their work (+), those who actively disliked it (−), those who neither liked nor disliked it (o), and those who liked the work but disliked some particular condition (+−).[2]

In making the classification, "mere contentment" or the negative "not disliking" was classified as o, not as "liking", and a person who said he liked it now but hoped to do something better in time, was classified as liking it.

A comparison as above of two clerical groups doing the same kind of work and of the same general background, and a factory, gave a very different distribution. The numbers in each group were expressed as a percentage of the total number.

[1] Elton Mayo, *The Human Problems of an Industrial Civilization*, New York, 1933.

[2] Millais Culpin and May Smith, *op. cit.*

	Number.	+	o	+−	−	
Clerical Group A .	95	39	25	16	20	100
,, ,, B .	42	55	24	19	2	100
Factory . .	211	76	7	14	3	100

In group A, 20% actively disliked their work and saw no way out. Both groups A and B had virtual security of tenure, group A contractual security. As groups they differed in many respects. Group B belonged to an organization which was very much alive, the general atmosphere was friendly, there were recognized chances for promotion, and the discipline was human; the other clerical group A had a very rigid organization, with promotion in practice, if not in theory, by seniority. It was not 100% so, but the workers certainly believed it was only "dead men's shoes" and it would have required a lot of evidence to the contrary to convince them. The actual work was in both cases routine clerical work.

The factory had over 75% who liked their work and only 3% actively disliking it. Although on the whole people who work with real things seem to find a greater satisfaction with their work over the years than the clerical workers, yet whatever the reasons, and they were complex, that predisposed to these differences, the mental atmosphere was very different.

An important consequence is that an entrant coming to a firm where the majority are happy in their work stands a much better chance of being happy and of learning to form good relations than he would in a firm where discontent reigns. The object of organization is to facilitate the activities of each member so that the general idea governing the whole should receive adequate expression. Some organizations have the family with a Victorian parent in charge as an ideal—they are too paternal; others are too casual, so there is little security, not merely of keeping a job—there may be security of tenure —but no security of judgment about the work; others are too rigid, so that the means have become the end and workers feel they are of no account. There is more discontent where there

is an arbitrary standard of work, a rigid machinery allowing little scope for the individual and few prospects of promotion.

Monotonous or Stimulating Atmosphere

If an observer looks at most factory or office operations he will probably be struck by the sameness of the work and call it monotonous.

Literally, "monotonous" means "one tone"; it suggests absence of change, a flat wash, a dead level, an environment that provides for the person no stimulus or change. If the observer were to spend some time in the factory he would notice many differences where at first he saw only similarity. A worker may be repeating a particular sequence of movements, but his life at any one moment is more than that sequence. The repetitive movements have a setting, they are in an environment which includes at least the varying amount of work done as the time goes by, the opinion of fellow-workers and of the head about that work, physiological changes with regard to meals or fatigue, emotional changes connected with the group, or recollection of past events, anticipations of the future, the latest gossip or film. The consciousness of one or other factor of the composite situation varies from person to person and from hour to hour in the same person. Many industrial processes appear to the observer to be extremely monotonous; when, however, the views of the people working are sought other aspects are revealed.

The person who fails to see where the "monotony" lies is generally very scornful of the "monotony" finder. It is no uncommon thing to hear a worker on one process say of another, "I could never stick that", when to an observer there was nothing to choose between them. The writer once had to spend some time in two factories doing the same repetitive work, in the same neighbourhood; in the one were many complaints of the monotony of the work, in the other none; in the one the majority of faces expressed a dull acquiescence in existence, in the other the general "aliveness" of all was obvious. The work was the same, but the psychological environment was very different, the one stimulating, the other depressing. And I have been pitied by workers on repetitive work for what they thought was the monotony of my work.

"They've fair got you" one hand-ironer said after I'd done some hours of timing output.

The repetitive work is one thread in a total pattern, but not the total pattern.

The worker has an audience, so that even a tyrannical foreman does not exert an unmodified influence. Suppose the foreman has criticized a subordinate unjustly, the resentment aroused will be mitigated by the feeling of support from his fellow-workers, in allying with them against the superior, while to certain characters the joy of having a grievance is almost worth the grievance. Similarly, there is an audience for any successful work, and a person in authority whose praise is valued can by it encourage a worker's or a group's self-respect, acknowledging publicly that the work is worth while.[1]

Still, repetitive work exists, and even life itself has been described as "one damned thing after another"; such work in the majority of organizations tends to have a mental effect, generally called boredom. Boredom is the result of too little mental stimulation, due to absence of change or to the work making too few demands so that there is a feeling of being wasted. For the realization of change two conditions are necessary: (*a*) an actual change, (*b*) a person who can be affected by it; there are some people who are always bored and no environment can stimulate them.

The external symptoms of boredom are hardly distinguishable from those of fatigue. There is a reduction in output, an increase in mistakes, a feeling of weariness, an appearance of listlessness.

The problem of boredom has been studied among operatives engaged in simple types of repetitive work.[2] [3] Output records were kept and the worker's personal experiences obtained. 355 workers were graded according to a 5 point scale for boredom. It is worthy of note that we can be unconsciously fatigued, but we cannot be unconsciously bored. The most exciting changes would fail to be appreciated by certain

[1] May Smith, *Problems confronting an Investigator*, Ind. Health Res. Board, Annual Report, No. 4.

[2] Wyatt and Fraser, *The Comparative Effects of Variety and Uniformity in Work*, Ind. Health Res. Board, No. 52, 1929.

[3] Wyatt and Fraser, *Effects of Monotony in Work*, Ind. Health Res. Board, No. 56, 1929 *passim*.

types. In popular speech there is a recognition of differences in boredom, e.g. "the born tired" and the "Weary Willy" type. The classic description of the bored person is expressed in Walter Raleigh's lines:

I wish I loved the human race,
I wish I loved its silly face,
I wish I liked the way it walks,
I wish I liked the way it talks.
And when I'm introduced to one,
I wish I thought, What jolly fun!

The investigators found that some people, about 3%, did not suffer from boredom—today was another day, and that was excitement in itself—about 3% were always bored, between these extremes 33%, 38%, and 23% experienced boredom in varying degrees. Since those who do experience it are vastly in the majority, it is for these that some amelioration is necessary.

Boredom was found to have a direct effect on the output, preventing the worker from exercising his skill and interfering with learning.[1] When hourly dotting records were being obtained, one of the workers, a young hand-ironer, gave such extraordinary variations as to challenge investigation. In the course of conversation it appeared that her work varied from hour to hour, and that she liked doing some things very much more than others. Some work, particularly handkerchiefs, she disliked intensely; other work, such as lace and dainty things, she liked. From what she said it was possible to grade the work she had been doing into three classes: work which interested her, work which bored her, and work she neither liked nor disliked. During boring work she sank into a state of mental lethargy, which was reflected in the dotting by a inability to focus attention; when her mind had been really occupied by interesting work she was more alert and better able to concentrate. Her average number of mistakes after interesting work was 42 (extremes 27-58); after neutral work, 61 (extremes 47-72); after boring work, 74 (extremes 52-98).

Wyatt compared the output when the same repetitive process was done all day and when changes of work took place at intervals; it was found that the latter gave a better

[1] Wyatt and Fraser, *The Comparative Effects of Variety in Work*, *op. cit.*

output, provided that the alternating processes differed considerably. On unvaried days the output was much lower at the beginning and end of the spell than on varied days. Also the workers worked better when they knew that there was to be a change in work.

An experiment under carefully controlled conditions varied the work of cigarette making with cutting as follows:

(1) Making and cutting alternately according to the worker's inclination.
(2) Making 1 hour, then cutting, and so on.
(3) „ 1½ hours, „ „
(4) „ 3 „ „ „
(5) „ all day.

The highest average output was obtained under the 3rd condition and the lowest under the 5th.

Typical comments of the workers were: "Making all day almost puts me out"; "The days seem doubly long". In another process, namely bicycle-chain making, an alternation of work increased the output of each of 4 workers by from 2·4% to 5·0%. The alternative work must not resemble the first kind too closely or there is no improvement. This was shown in handkerchief folding done in two different ways.

The variation in output is much more irregular from hour to hour when there is boredom. The worker unable to find interest flags, then pulls himself together and forces himself to work for a time, then flags again. The boredom effect is less striking towards the end, probably because the thought of the approaching end acts as a stimulus. The most intense boredom is experienced during the middle of a work spell, with a consequent lower and more variable rate of working. Time crawls, so that there is an apparent increase in the length of time. 45% of the workers studied found the time pass more quickly in the last hour, some said it was because they knew the end was near, and others that they tried to make up for lost time and that gave a stimulus.[1]

Except for the always bored, it was found that there were individual preferences for certain types of work, and that

[1] Wyatt and Fraser, *Effects of Monotony in Work*, *op. cit.*

although to an observer there was little to choose, yet the personal interest did actually neutralize the boredom. In the filling of chocolate boxes some workers preferred the large ones to the medium or small, and their output varied accordingly.

The most intelligent workers suffered the most from boredom. Since there are plenty of people who have low or mediocre intelligence, it seems a pity to employ the intelligent on such work. Somebody should be on the look-out for intelligent workers in order to train them for higher work; there is no doubt that many are passed over. Occasionally one meets a highly intelligent person who likes routine work because, while it may be boring, it is not exhausting; by it a living can be earned and the leisure time can be spent in creative work. Still, there are too few to affect the main stream.

It is also possible on repetitive work to brood on troubles and discontents till the molehill becomes a mountain range. It also may lead to an attitude of mind that renders the possessor open to any propaganda that promises relief from the existing regime.

On one occasion, when interviewing a young worker doing routine comptometer work, it was found that she was suffering acutely because, in the absence of an interest in the work, she had taken to day-dreaming. Unfortunately her day-dreams gradually ceased to be pleasant and actually terrified her. She tried to switch her mind on to her work, but could not find enough interest, and so the conflict went on. At the time of the interview she complained that the "day-mares", as they seemed to be, were invading her life outside the office. Fortunately she had mathematical interests, and alternative work demanding active attention and intelligence was obtained.

Many workers day-dream quite cheerfully as a relief. "The occasions when my thoughts wandered were most pleasant and helped to prevent monotony."

The repression of intruding thoughts is an unpleasant feature of monotonous work, since the enforced effort involved in the continuation of the work is a wearying process. Boredom is a complex mental state, and is related both to the nature and conditions of the work as well as to the mental

make-up of the worker; day-dreaming is not always beneficial.

The severest boredom and strain is experienced in work that is semi-automatic, so that it requires too much attention at probably irregular intervals to permit of comfortable mind-wandering, but not enough for real interest. Where the attention is needed all the time, boredom—except with a very few—is not characteristic, nor where the work is so automatic that the mind can be free to attend to what it likes.

Some young cotton operatives used to astonish their evening-class mathematics teacher by their rapid progress; when asked, they said they could think about their mathematics while at work.

How can Boredom be mitigated

Since we have to accept repetitive work as essential, the movements themselves cannot be made interesting. There remains the environment in which they are done. That can be changed, i.e. interest is attached to something outside the work:

(1) By letting the worker feel that the work matters.

(2) By the system of payment having a personal interest. An investigation which had for its aim to compare three different systems, namely time-rate, piece-rate, and piece-rate plus a bonus, showed that the flat piece-rate gave the best output, reduced the lost time and was regarded as the fairest. The time-rate is too weak an incentive when the work is pure routine; its advantage was that it promoted friendly relation as there was no rivalry.

"The time-rate was all right because we could do as little work as possible and still get the same wage"; "I did not care for the time-rate because it was uninteresting. If I did a lot of work I didn't get more money. Time seemed to go slowly", represent some of the workers' views.

(3) By allowing adequate rest pauses. In some processes 5 minutes every hour is preferable to a longer break in the middle of each spell.

(4) By arranging the work in small units so that it does not seem like a never-ending stream.

(5) By allowing talking and singing when other people are not disturbed by it.

(6) By the use of music. The early investigation by Dr. Wyatt was done with gramophone music played about the middle of the spell when boredom was likely to be reducing the output; he found that the music prevented the fall-off, so that the daily output was increased by amounts varying from 2·6% to 6%. This is now done on a large scale by the B.B.C. in the familiar Music While You Work.[1]

There is always a tendency to discuss industrial problems in reference to "workers" in general without specifying the inevitable limitations, e.g. age, sex. All through this discussion it has been assumed that the groups considered were either ageless or all of the same age, and that the general conclusions were really true for all. There is more reason for this neglect of age in regard to women, because on the whole the majority of women in industry—war-time excepted—are under 25 years of age. Still, the older woman does exist, and though relatively fewer in number than the younger women, actually there are many of them.

Men and women of all ages, in professions as well as in factory work, experience boredom, but the boredom of middle-aged women who saw no way out either by marriage or promotion was in many cases intense. The clerical worker suffered more than the factory worker. In addition to the monotony of an environment which seemed unchanging was the feeling of being useless. The reason lies probably much deeper than the environment. The late Professor Keatinge used to describe late middle age as being "biologically dead". The accounts of themselves given by many, not only women, though they are more specific than men, do suggest that this useless or wasted feeling is the expression in consciousness of a biological condition. There is no reason whatever why anyone should be useless psychologically. It is very difficult at times to distinguish between boredom and fatigue in some people. It would, however, be worth considering the possibilities of changing one's occupation at about 40. It is nonsense to

[1] Wyatt and Langdon, *Fatigue and Boredom in Repetitive Work*, Ind. Health Res. Board, No. 77 *passim*.

believe that the power to learn something else has been completely lost by middle age. In a recent medical book the writer expresses the view that people break down through having to change their work in middle life. This may be true of some. There are numbers of middle-aged people who would welcome a change of work.

"I'm not tired, but I'm tired of this" is the expression of boredom. The remedy for boredom is change.

People in Authority and their Subordinates

The writer of Ecclesiasticus says that "as the judge of the people is himself, so are his officers: and what manner of man the ruler of a city is, such are they that dwell therein".

A modern psychologist says that "the personalities of the leaders of a nation probably play a more effective part than any other factor in the peaceful working of the nation". If these statements be true of the heads of cities and nations, they are just as true of industrial organizations. The problem of the person in authority forces itself upon an investigator—sometimes as a disconcerting interference to the main investigation—but in the nature of things proof is difficult to obtain. It is not possible, for example, to grade a number of people in authority according to their efficiency and to have a psychological enquiry as to their intelligence, temperament, and character. What has been learned has usually had to be by observation or by interview.

It is self-evident that a person in authority who was too ignorant or too unintelligent for the post would either ruin the business or become a mere figure-head. But granted the intellectual and technical equipment, is there any evidence to demonstrate that the temperamental make-up of the head matters?

The most impressive standard would naturally be output, but in many occupations it is extremely difficult to measure efficiency or to have any objective criterion of success.

(1) In the experiment with noiseless typewriters it was pointed out that the effect of one of the heads of a group was to increase the average output of each of her group within a short time of her taking charge, and that the effect of another

was to decrease it. The difference in the two was largely temperamental, one being extremely vital, emotionally well-balanced, while the other "enjoyed ill-health". In reply to this one frequently hears, "Well, we all know that". The only answer is, "If so, why don't we act on the knowledge more frequently?"

Another example, this time from a factory. The manager prided himself on increasing the output by his mere presence. He was temperamentally childish, so on entering a room he usually shouted, grumbled—in short, threw his weight about. The consequence was a temporarily feverish activity which subsided on his departure. The object of an investigation into the effect of hours of labour was frustrated because the effect of the work was cross-cut by the manager's irregular appearances. On his departure, when the workers felt humorously inclined, a dramatic representation of his behaviour was given; they did not dislike him but rather despised him.

In another organization the head of the department was young, well educated and inclined to be superior. In a detached, condescending way he treated his staff as automata. He was ambitious and anxious to get on, but his lack of imagination was patent in his lack of interest in his staff, and his treatment of them as a means to his end, and a rather troublesome one at that. There was never any concerted effort made by the department to please him, whereas there was to save his charge hand from a row with him. In general his orders were ostensibly obeyed, because the staff were frightened of his sarcastic tongue; but had he only known it, he was silently obstructed in many ways.

Literal obedience can be two-edged. A man who demands it may find it used against himself, when subordinates, knowing he has made a mistake, may deliberately carry out his order.

(2) It often happens that work cannot be measured quantitatively, but in some occupations, where circumstances permit of finding other work elsewhere, the labour wastage is a good measure of management. There are many reasons for a high labour wastage, i.e. when employees only remain a short time, but among them is the kind of person at the top.

Two factories situated in the same town, recruiting the same kind of labour, and doing the same kind of work, had a labour

wastage in one year of 15% and 55% respectively. The labour manager had gone into the various environmental possibilities without finding any material difference, nor did the hours vary. The only discoverable difference was that the latter was in charge of a head who bossed and bullied instead of leading, and the other was controlled by someone who knew how to rule.

(3) Where, however, there is contractual security, or the work is so highly specialized that other employment is unobtainable, it is found that absence because of sickness or other reasons varies according to differences in the temperamental make-up of the head. It is not suggested that this is the only, or even the chief, cause of a high sickness rate—the causes are many and difficult to disentangle—but it is one, and that not a negligible one.

The writer was at one time in daily contact with two groups of clerical workers over a period of several months. During a mild influenza epidemic on a certain Friday afternoon over 80% of the workers in one room were absent, while in the other very few. The latter was in charge of a well-balanced woman, while the other was a psycho-neurotic generally described as a "nagger". Of the latter a typist who seemed ill and somewhat distraught said, when asked if she were ill, "No, just 'er", pointing with her thumb.

The conclusion must not be drawn that the people were malingering. Of direct malingering there is little—probably most of us are not honest enough with ourselves to do that—but there is no hard-and-fast line between sickness and health, and a relatively slight condition may make all the difference between staying at home or going to work when the general circumstances make it easy to yield with honour.

In one factory the absenteeism for men was 6·7% compared with 13·1% in another comparable as far as work and general conditions were concerned, and 9·1 compared with 18·7% for women. In this case, the respective managers were the deciding factor.

(4) Sometimes it is the morale that suffers and a general attitude of grousing prevails.

The transport department of a large organization was

afflicted with this disease, and when things had become so bad as to make it a general nuisance a Director tried to find the reason. It turned out that the departmental head insisted on having the vehicles put into the garage in a particular way, which the drivers considered made extra work. When an explanation was required he gave an excellent and unanswerable reason. When asked if he had explained to the men why he did so, he replied, "No, why should I?" In that "why should I?" lies the key to the difficulty. That attitude is the cause of endless trouble in industrial and even other relations. In this connection a letter appeared in *The Times* of Monday, October 19th, 1942, about a Tyneside shipyard strike. The writer complained that numbers of the workers were not consulted about an increase in their hours of work, and that they were expected to work under conditions imposed by agreements made without their knowledge or consent.

Walter Bagehot remarks that "the leading statesmen in a free country have great momentary power. They settle the conversation of mankind." This to a considerable extent is also true of people in authority in industry. They form an important topic of conversation far down the scale of the hierarchy among people who, in the large organizations, can never have come into contact with them. "Remote authorities like the directors are regarded almost as gods. Their movements are followed with the same interest as that aroused by the Royal Family. Their private and domestic history is discussed in the same way." [1] On them lies a great responsibility, because their behaviour to their fellows is observed and it acts as a pattern to be followed by those a little lower in authority.

The above are merely examples which could be multiplied by anyone familiar with groups of people. Measured financially, reduced output, high labour turn-over, and high sickness absence are uneconomic; measured in terms of human unhappiness, the person in authority who is not suited as a human being to his work is a tragedy.

The following are general descriptions of different kinds of people in authority:

[1] Margaret Leiper, "A Student as Shop Assistant", *J. Inst. Lab. Man.*, 1935.

Some Individual Differences.

(1) The explosive person who reacts regardless of consequences not to the reality of the situation but to the particular emotion aroused in himself by the situation.

Mr. A. has plenty of physical energy, he blows into his works and every employee looks anxiously at him: "What's the boss like today?" The answer is soon given. In the tones of a drill sergeant one hears, "What's the meaning of this?" "Haven't I told you I never allow it?" "Am I running this place or are you?" and so on. Nobody is quite sure what it is all about. The chances are that yesterday he approved of the very things he now criticizes. His praise and blame are entirely dependent on his own feelings. When his mood is over he expects that others will also have recovered. One of these remarked after an entirely unjustified criticism of his office staff, "I can't think what's the matter with my staff; they *are* glum". When someone suggested that he'd been irrationally angry with them he said, "But I've forgotten all that". He could not see why they also had not forgotten. This type cannot bear anyone to have any power, for he is to be all-powerful, and what is more, not only must he have his own way but everyone must know that he has had it. Hence he tends to promote, in the absence of effective safeguards, weak rather than strong people, and then complains fretfully that nobody can take any responsibility. He also believes in the all-powerfulness of his wishes, so that when he gives an order he fails to envisage the means that often demand much work and time, with the result that he harasses his subordinates with fractious and querulous enquiries as to whether the work is done yet. If he feels kindly disposed he is equally irrationally pleased. From him balanced criticism and justice are rarely forthcoming. If he should have great organizing ability he may do well in industry, the very ruthlessness of his babyish make-up being an advantage, particularly if he rarely comes into contact with his subordinates, but above all if he has the wit or the luck to have some subordinate who can act as "emotional interpreter".

If his intellectual equipment is mediocre and he has no contractual security he drifts from post to post, never realizing what is the matter; if he is in a permanent post he makes the

lives of many of his subordinates miserable, unless they learn to manage him tactfully.

These people are emotional babies. Watch a child of under 3 years of age and you will have a very fair picture of many a grown-up person. Intellectually and practically he may be quite adult, but for some reason not available to consciousness he ceased to develop emotionally and so remains the permanent baby.

(2) Another kind of emotionally undeveloped person is older than the preceding: the pre-adolescent, the schoolboy or schoolgirl. One of his outstanding characteristics is liking to feel important and to have an audience to admire him. His attitude is like that of Jack Horner, "What a good boy am I!" Many a person in a position of authority seems unable to work without an audience and really relies on the expressed approval of subordinates. Because of his emotional immaturity he cannot take effective responsibility, so that subordinates often have the difficult task of having to take responsibility without power. Like the baby type, he tends to promote weak people and likes to dramatize himself as a great leader. One of this kind used to talk about himself as a captain of industry though actually he was in a minor post. Some of them look upon themselves as Peter Pans, and to subordinates say, "Let's all be boys (or girls) together". No subordinate is taken in, and they are, at the best, faintly amused. This type sometimes defends its attitude on the grounds that it does not believe in being remote.

(3) The adolescent. The temperamental adolescents are still older, but not grown-up. Among the characteristics of adolescents are a developing sense of other people and an interest in others, as well as a realization of their responsibilities to the group. They have learnt to play for the side, to be loyal to their school. As real adolescents they have not as yet much power, so usually find an outlet in talk; many so-called adults are at this level. They attach themselves to some political, religious, or literary group, or to their idea of some foreign country, and spend their time irrationally defending their choice and endeavouring to seek converts to their point of view, instead of doing something to demonstrate that their view is worth while. As authorities they like to dramatize

themselves as leaders, speculate on what would happen if it were not for them, enjoy pessimistically lamenting on the dreadful state of the world in general, but do nothing to improve that part of it for which they are responsible. To feel more sensitive than one's fellows but to be very little inconvenienced by it practically is to some people a most uplifting experience. To criticize them in any way or even to disapprove on minor points is to be disloyal; they talk much about loyalty, which means agreeing with them. They often identify themselves with their group and resent any criticism of it, but are blind to the loyalties due to other groups on higher principles.

These descriptions do not purport to be more than rough.[1] They have been arrived at as a result of many years' observation of people in varying degrees of responsibility. It is only occasionally that the clear-cut example is forthcoming. It must be emphasized that the reference in each of these examples of immaturity refers only to the emotional development. Each may be linked to intelligence of a high, low, or medium order, but none of these emotionally undeveloped people can look at a problem connected with people as it must appear to other people. They are blinded by their own emotional reactions.

In war-time the person in authority is of even greater importance, and in some instances in recent months people who have had a high reputation for leadership have been found wanting. The person in authority who in emergencies flutters about like a frightened hen giving contradictory orders is a menace and is in direct contrast to the person of whom subordinates say, "If X is in charge we feel safe". X can probably do no more than Y or Z, but his presence inspires confidence, and people by that are enabled to show their best instead of breaking down.

Psychologists may be able to diagnose the trouble, but it should be asked whether the emotionally undeveloped are fit to have charge of others. Although the emotional immaturity may be deep-seated, yet these immature adults might manage

[1] May Smith, *Emotional Development,* Ind. Health Res. Board, Annual Report, No. 18.

to modify their behaviour by some knowledge of themselves and by an adequate training. So often they are quite unaware of the effect they have on others, of their unfairness and weakness. It is probable that comparatively few of us are emotionally adult.

What are the Characteristics of a Good Head?—The question is not easy to answer. Observation of a number of people in authority would suggest:

(1) Good intelligence, enabling him to distinguish, to judge, to make a choice, and this intelligence must not find expression only in words; he must be able to understand complex situations involving the relationship of events and people.

(2) Imaginative insight to see beyond the obvious, both in regard to things and people, to see another picture not yet actualized.

(3) A well-balanced temperament so that, in the words of a 17th-century writer, "in the mutable haps and sudden chances of fickle fortune he is not lightly dismayed, nor brought to fear". The emotionally balanced person is neither too self-contained nor yet too dependent on others, he can adjust himself easily to superiors, equals and subordinates, is not over-anxious nor yet self-satisfied, neither feebly yielding nor tyrannical.

(4) A sense of justice that is more concerned with whether he is *being* just than whether he is *receiving* justice.

(5) Willingness to accept responsibility, which implies a considerable degree of self-reliance and an ability to pass from thinking to acting.

(6) *A sense of humour* preventing him from taking himself too seriously; and lastly, ability to rule without strain.

People in authority are often rather comic to the outsider. They have identified themselves so much with their office that they almost cease to be human.

Some Workers' Views on People in Authority.—Before the war, 118 workers, men and women, were asked individually to record the qualities they thought a person in authority ought

to have.[1] In the counting of the votes for collective examination descriptions that were approximately synonymous were grouped under a suitable common heading.

The following obtained the greatest number of votes: Consideration, Forcefulness, Sincerity, Justice, and bracketed equally Personality and Efficiency.

The Managing Director of a large organization in an unpublished contribution to a students' discussion gave the following: (1) Spirit of adventure; (2) the "hostile" or "incalculable" mind, i.e. he should not wear his mind on his sleeve to attract "yes-men"; (3) intuitive sympathy, with some psychological technique; (4) sense of justice, with an objective view towards life; (5) evenness of attitude.

A group of forewomen at a training class put tact as the most important quality for anyone in authority.

It is probable that all these requirements are founded as much on realization of the opposites as of experience of their embodiment. Still, one does come across people in authority with at least an approximation to these qualities expressed in personal dealings, and there are certain qualities common to the different assessments.

General Wavell, writing on the subject of the mental and moral qualities of leaders, says: "A leader must have character, which simply means that he knows what he wants, and has the courage and determination to get it. He should have a genuine interest in and knowledge of humanity, the raw material of his trade." And again, "a general may succeed for some time in persuading his superiors that he is a good commander; he will never persuade his army that he is one unless he has the real qualities of one."

Subordinates

As authorities vary, so also do subordinates. As there is an art of being an authority, so there is an art of being subordinate. Most of us have to be in positions of subordination to somebody, and many people who feel, rightly or wrongly, that they are fit to rule may never be in a position to do so.

[1] G. W. Goodall, "Some Workers' Mental Attitudes", *Occ. Psychol.*, XVI, 2, 1942.

Perhaps from the point of view of life at work the self-assertive instinct receives little chance of development, and the self-assertive person forced, either by faulty selection or lack of ability, to be for ever subordinate may be in a considerable state of conflict, which may be expressed:

(1) By over-truculence. He is extremely resentful of all criticism of his work and all orders, is generally described as "touchy", will throw up a good job at a moment's notice. He can always find a good reason for his truculence, but the real reason is that he resents the fact that he is in a position to receive orders at all. He is a difficult person to manage. If he is a very good workman at some specialized job, those above him put up with his drawbacks for the sake of his work; if he is of mediocre ability he is allowed to leave, and so he goes from job to job developing on the way a permanent grievance. A professional man of this type whose record I have seen had had 20 jobs in 21 years; in each job he had got up against his next in authority. There *are* bad authorities, but it is against all the laws of chance that he should have met so many. He opposed just because he could not see himself in perspective, mistaking opposition for intelligent criticism.

(2) At the other extreme is the person who had become so used to being subordinate that he has lost his individuality; he will never take any responsibility, is good at routine work and gives little trouble. On the other hand, as a human being he is a failure.

(3) A similar character, not unlike this one in outward behaviour but actually very different, makes up for not having what he would like in reality by having it in imagination. He works well, but his real life is a day-dream, his work a shadow-show. He is happy as long as he is undisturbed, but is apt to be irrationally annoyed at any alteration in his usual routine if the change involves attention. When asked if he finds his job monotonous, a look of pained surprise comes over his face and he says, "Some people might think it is, but I've always something to think about".

(4) The successful subordinate recognizes that in some things he has to be subordinate, but that does not mean giving up his personality; he finds what satisfaction he can in his

work and enlarges his scope in activities outside his work. And there are few people who are not in authority to someone; even the newest of new office boys can feel himself of importance in the presence of his friends who are still at school. To see oneself in perspective prevents much emotional waste.

In noting the conduct of people in the position of being subordinate we have to take into account not necessarily the actual position but what the particular person believes it to be.

The above types of behaviour are fairly stable, definite characteristics, and will take place in some form no matter what the person in authority is like.

When subordinates of any type have to adjust to one of the uncontrolled heads, even the most stable is likely to show some exaggerated reaction.

Some live in a constant state of "nerves", awaiting the next outburst and fearfully anxious to avert it, not realizing that an angel from heaven could not do so. The practical result is a series of minor complaints variously diagnosed as headaches, nervous dyspepsia, gastritis, etc.

An outspoken employee under a "baby" manager remarked, "The boss fair makes me feel churned up inside with his tantrums"—she suffered from constant dyspepsia—adding, "The doctor can't do me any good". The only cure for that dyspepsia was to learn to stand up to the boss or to get another job.

Others are completely indifferent and carry on regardless of the boss, while the mimic gives entertaining demonstrations to his fellows and thereby finds relief.

A writer in the *Journal of the Institution of British Launderers* speculates on what would happen to two factories, one of which was in charge of a blustering egotist, i.e. the baby, and the other of the "persuasive man who knows what he wants and draws out the best work that the people can do", if suddenly "by some freak of fortune the managers were changed round". Both will, the writer thinks, before very long be on the road to ruin. "In the first factory, as soon as discipline is relaxed there will be slacking, unpunctuality, slipshod work; in the latter there will be opposition, active or sullen". The speculation is a very interesting one. It is well known that a

change of head in a fairly stable group is often followed, temporarily at least, by considerable unrest, even assuming that he is equally efficient. A whole series of emotional habits are disturbed merely because he is different. Hence the advice usually given to a new-comer to go slowly in his changes.

The person in authority is part of the environment of the subordinates, and he can encourage by his own behaviour certain relations which become habitual.

Chapter IV

FINDING THE JOB FOR THE PERSON AND THE PERSON FOR THE JOB

Observation shows us that in all walks of life, in all occupations, some people are successful, others are failures, and there are all grades of variation between; this is true also whatever standard we take, whether that of personal happiness or objective efficiency. Why is it? Is it that the individual in one case has a special capacity that finds in a particular environment its adequate expression? Would the same person be successful in other environments? Can the requirements for success be discovered, and if so, can individuals be helped at an early stage, i.e. guided towards or warned off particular activities?

The problem is not a new one, and is important now. On the one hand there are people who are either beginning, or wishing to change, their work, and on the other hand work requiring a person to do it.

Vocational guidance sets out primarily with the problem of, given a person, find the suitable job. Vocational selection sets out with the problem of, given the job, find the suitable person.

Both have much common ground, though selection is a narrower problem. For example, after a due consideration of a person's intellectual and emotional make-up the psychologist might decide that he had the making of a doctor, and so would advise him taking up the medical profession. If, however, there was a job for a doctor in a remote part of Africa it would not be enough to look for someone with medical qualifications; it would be necessary to find out what peculiarities were connected with the particular place. He might have to be much alone, might have to deal with natives, be absent from his own country for some time, and so on. The doctor qualification would have to be modified by these circumstances. We should have to "select" somebody to fit

the job, having already "guided" somebody into the medical profession.

Theoretically we ought to know and to be able to measure all the powers and activities of a human being as well as have a complete knowledge of the requirements for all the possible jobs. In practice we have to be limited by a number of considerations, some general and some particular:

(1) It is possible that all of us are capable of activities that have never been stimulated by our environment, of the existence of which we are ignorant. It is equally possible that were we living in a different century the essential requirements for success might be different. Probably centuries to come will make still different demands.

Our measuring-rod can only be the standards of our period of historic time and our known civilization.

(2) We are further limited by economic considerations. Suppose it could be shown that a boy or girl of 14 had all the qualities for a successful barrister. If he had to earn a living as quickly as possible it would be useless to recommend the law—and even more useless for a girl. Also with children just leaving school the possibilities of the available work in the neighbourhood have to be considered.

(3) In theory, too, no one should hold any post or job for which he is not fitted, whether factory worker, typist, doctor, teacher, administrator, or politician; in practice, only a limited number of the population do seek an occupation because of known potential ability for it. Some take up an inherited occupation; some without evidence think they know what they can do—for example, very many people believe they can organize; some are prepared to take anything that comes; some just drift; and some, and they are lucky, really know what they can do, insist on doing it, and do it.

(4) Another limitation is that there are relatively few occupations in life whose requirements, apart from technical ones, are known.

For a number of activities it is known that in the absence of certain qualities or skills success is impossible, but we cannot argue that the possession of these qualities or skills will ensure

success. For example, without an interest in dress no one is likely to succeed as a dress designer, but this interest expressing itself in a liking for drawing fashion dresses is a quite inadequate, though by no means rare, reason for beginning to train as a dress designer. Or a boy might have all the measurable requirements for a successful engineer, but if he was not interested in engineering, or disliked active work, he would not succeed. The ability to do something does not necessarily involve the will to do it.

Vocational guidance, therefore, has for its practical object to advise within definite limitations: (*a*) at what work the beginner is likely to be reasonably successful, and then (*b*) what other qualities he may have which are capable of development and which he might advantageously develop for their own sake (i.e. not directly for earning a living). By so doing, the possible narrowing effect of many ways of earning a livelihood may be corrected; the urgency of the former very often obscures the advisability of the latter.

There are frequent complaints that young people at the present time, unlike those at the time of the speaker's youth, do not know what they want to do. Leaving on one side the genius who is no problem in one sense, since he is usually quite prepared to suffer in order to go his own way, the statement is literally true. If we could have asked 100 boys and 100 girls of middle and working class families in 1840 the question "What are you going to be?" the answer would probably have been much more definite than those from a corresponding contemporary group.

When we ask why, the answer is not the peculiar vagueness, lack of interest, or laziness of modern youth, but the different environment in which they live. In 1840 probably a majority of the boys would have assumed that they would follow in their father's footsteps because alternatives would be likely to occur only to the more rebellious; not only the family but the social environment would assume the inevitability of such a course. The possibilities for the most part would have been the army, navy, church, schoolmastering, certain forms of trade, or the factory or land work of the neighbourhood. The girls would have been still more limited. When a choice has to be made, as now, from a large number of possibilities, the

potentialities of which are unknown, it is unjust to blame the young.

Vocational guidance as generally conducted has evolved from the meeting of two streams:

I. The advice given by parents and teachers at the school-leaving age. This inevitably would vary very much according to the interest, ability, or information of the teacher or parent. This type of advice was considerably improved and widened in 1910 by the setting up of an Advisory Committee for Juvenile Employment. The committee represented the teaching profession, employers, and workpeople as well as other persons having special knowledge.

The primary duties of the committee were:

(1) To advise the Minister on the administration of the Juvenile Department of the Employment Exchanges to which they were attached.

(2) To give advice to juveniles (and their parents), particularly at the school-leaving age, on the choice of suitable employment and on matters incidental thereto.

(3) To assist boys and girls, as necessary, by finding them employment as nearly as possible in accordance with the advice given.

(4) To assist employers to obtain, whether from local or more distant sources, an adequate and suitable supply of juvenile labour.

II. The development of intelligence testing during the last few decades. That people differ in intelligence, i.e. inborn, general intellectual capacity, has been recognized for centuries, but how to measure these differences, apart from the obvious extremes, was not a practical possibility till Binet published his work about 1904.

The real impetus to intelligence testing was given when, during the 1914-18 war, the American psychologists tested nearly two million recruits. Since then thousands of school children and adults have been tested, the results critically analysed and interpreted, and now it may be fairly claimed that, within a very narrow margin of error, it is possible to test

for general intelligence, at least as expressed in our particular environment.

Critics of testing often attack it in ignorance of its possibilities and limitations. Every tester knows perfectly well that any human activity is affected by the total physical and mental condition at the moment as well as by the general environment.

We all know that there are days when we are particularly clumsy, and periods of the day when at any activity we are less successful. Even the most fluent speaker, or sports champion, knows that if his efforts were carefully tested at different hours of the day or on different days his standard of achievement would vary. But some people if tested frequently would give a high percentage of successful efforts and others a low. That the usually successful person is sometimes unsuccessful must be admitted.

The industrialist and the doctor sometimes assume that the rating given by a person on a particular occasion is to be interpreted as a fixed index of his intelligence on all occasions. We all recognize that distractions, ill-health, fatigue, anxiety, emotional excitement will have the effect of lowering the record. With these qualifications in mind, it remains true that if the same people do two intelligence tests (similar but not the same) with an interval of several months between, the place-positions will be practically the same. Where considerable divergence has occurred, some difference in conditions was usually discovered. An adult whose intelligence test on one occasion was brilliant and on a later occasion extremely poor, admitted that prior to doing the second test he had lunched much too well.

Intelligence tests may be given to groups, i.e. as many can be tested at once as can be adequately supervised. It is necessary to use this method when large numbers have to be tested in a short time. While it is obvious that this will not be as effective as an individual test, yet it does permit of a rough classification of large numbers into a few main groups, i.e. those with outstanding intelligence, those with a low degree, and the rest. Those with extremely good records can be accepted—the result is a hard fact; those with a low degree should be considered separately in order to distinguish those

whose intelligence is really low from those merely affected by extraneous circumstances.

Experience has shown that, if no other information is available, then the intelligence test is for practical purposes the most useful measure of a person one can have. If, however, we had to consider the problem of what to advise for a boy or girl leaving school we should like to know in addition:

(1) Educational attainment and school report.
(2) Family circumstances.
(3) Position in the family.
(4) Special interests.
(5) Results from aptitude and other tests.

The educational attainments alone are not adequate. Some children may be judged to be lazy or not intelligent when they have merely failed to adjust to their particular school or have had many changes, or been absent at critical periods. There are few interviewers who have not been surprised at an unexpectedly high intelligence rating from someone whose scholastic attainments have been mediocre. Some children, too, have aptitudes that do not happen to show themselves at school and whose significance is overlooked by parents. Tests of a different character may reveal unsuspected gifts.

What can we test?

(1) Intelligence.
(2) Mechanical ability, either with actual models or as a paper test by means of diagrams.
(3) Speed and accuracy of movement. There are many tests for these, ranging from the simplest activity to the very complex.
(4) Various mental qualities, e.g. memory, attention, perseveration.

For the details of these and other tests reference can be made to one of the numerous text-books on the subject.[1]

All the professions require intelligence, and most of us need to be able to understand and to explain by words; hence the great importance of the verbal intelligence test. Some people, however, either through natural endowment or lack of train-

[1] E. M. Earle, *Methods of Choosing a Career*, London, 1931.

ing, are slow to express their intelligence in words, preferring to use things. This has led to the development of the non-verbal test—for example, performance tests and those using symbols other than words.

Vocational guidance cannot, however, be isolated from selection, since for both a knowledge of the requirements for success in a given occupation are necessary. Unfortunately this knowledge is not always available, and there is an urgent need for extensive and detailed research. In some cases the requirements are obvious. Some occupations require primarily considerable muscular strength, others good health, though such departures from the normal as lameness or deafness need not be a handicap. Some obviously require superior intelligence, some average, and some a very low level. Others again require average intelligence, but in addition some special aptitude, e.g. delicate finger manipulation. Some require ability to learn a number of activities.

A certain amount of self-selection takes place, e.g. a feeble weedy man is unlikely to attempt to be a dock labourer, and a boy weak in arithmetic would not choose actuarial work. Leaving such as these on one side, there remains a large proportion of occupations where even our partial knowledge of requirements may be helpful.

The professions all require a high level of intelligence, and so do the higher executive posts in industry. A rough grading, involving a gradually diminishing amount of intelligence, is given below:[1]

I. Higher professional and administrative class.
II. Lower professional, technical, and executive work.
III. Clerical and highly skilled work.
IV. Skilled work.
V. Semi-skilled repetitive work.
VI. Unskilled repetitive work.
VII. Casual labour.
VIII. Unemployable.

It is as stupid to put a child of high intelligence to work requiring little as to put a child of inferior intelligence to work

[1] C. Burt and Others, *A Study of Vocational Guidance*, Ind. Health Res. Board, No. 33, 1926.

requiring much. The one is wasteful, the other futile; the one provokes discontent, the other worry. For example, a study of 52 men rejected from a Training Regiment R.A.C. as untrainable revealed that 96% of these were shown by an intelligence test to be of low grade. The estimations made by those responsible were based on some weeks' or months' experience. The tests, requiring about 30 minutes to do, given at an early stage would have saved much waste.[1]

The word selection suggests the enquiry: for what? A typist, a weaver, a mechanic? What are the requirements? If we had more detailed knowledge about the primary requirements for success the problem would be much nearer solution.

The most usual method of selection is by personal interview, certain minimum qualifications of experience or education being demanded before an applicant is considered. In a long-established stable business it is likely that those responsible will have learnt by experience the kind of employee they need, and in some cases the method works well. As there is, however, little check on the selection, far more people believe themselves to have an intuitive knowledge of people than is the fact.

In large organizations where the jobs vary considerably in the degree and kind of skill required, some more objective method is needed to supplement the personal method. To this end, research work has been conducted in most countries during the last twenty years.

It is relatively easy to watch the movements and note their sequence, less easy to know what special aptitude is demanded, i.e. from the observed movements deduce the mental and physical qualities required. The obvious answer would be to ask those who are doing a particular job or who are in charge of it. Experience, however, has shown that there are few who really do know, and even they have been known to leave out, because taken for granted, what proves to be the most essential. To obviate this, sometimes after considered consultation with those engaged in them, a list is drawn up containing what are thought to be the requirements for a number of occupations, and the head of a particular department is supposed to answer

[1] E. Farmer and E. G. Chambers, *The Prognostic Value of some Psychological Tests*, Ind. Health Res. Board, No. 74, 1936.

which in particular are required for his work. With characteristic thoroughness the Germans drew up a list of 148 items, ranging from the professions to hair-dressing. Quite apart from other drawbacks, including probable ignorance, the unfortunate person would become so wearied as to reduce considerably the value, if any, of his contribution. What is the usual method of finding them out?

(1) The psychologist would seek information from managers and workers if possible, observe the particular activity, note the movements adopted by the good and the poor workers, study the conditions leading to accidents, if accidents are likely, or the mistakes made.

(2) He would draw up a provisional list of the supposed aptitudes; for example, for a job in an engineering firm it was decided that the following were necessary for success: hand and eye co-ordination, mechanical ability, manual dexterity, visualizing, and these had to be expressed in very delicate small movements.

(3) Choose tests for these and then test a number of workers of varying degrees and capacity. Ask the head of the department to grade them according to their skill at work. Usually one has to be satisfied with a classification of best, worst, and the rest; if a 5-fold classification, i.e. the rest divided into best, worst, and the rest, so much the better. If some objective standard, e.g. piece-rate earnings or output (assuming there are no complications), is available, that is better still.

(4) Compare the grading obtained by each test and all combined with that obtained from the responsible head. If, as is improbable, the ranking based on the work is exactly the same as that based on the tests, there is considerable likelihood that the test or tests would select those who had the abilities for the work. In human measurement nothing so clear-cut ever happens; there is merely an arrangement which may approximate more or less to the standard taken.

The actual verification involves the use of statistical technique, and before passing from the experimental stage the tests would have to be applied to other groups of similar workers.

The devising of tests and applying them needs experience, and a merely casual attempt by inexperienced people is likely to prove unsuccessful. At the same time there is no mysterious secret about it, it requires ability, training, and experience.

In large organizations there is an opportunity to apply both guidance and selection. Problems of promotion sometimes fall under the first. Some of the large organizations are almost miniature industrial worlds, employing hundreds of people at widely differing jobs. The problem might be either, which part of the complex organization will be best for a particular person, or, given a vacancy, who can fill it?

Selection Research

At first sight it would seem easy to devise tests for various occupations, but as an actual fact what little has been achieved has only been done after great effort, and many of the early aspirations have proved to be ill-founded. Ever since the last war the Industrial Health Research Board and the National Institute of Industrial Psychology as well as individual firms have studied the possibilities of selection tests. Some have proved satisfactory, but frequently they cannot be used in any other than the original setting. There is such a thing as beginner's luck even in research work, and a problem might be solved for one organization but the same solution fail in another doing the same work. The probable reason is that an initial research is usually undertaken either because the problem has proved to be so urgent as to thrust itself upon the attention of those responsible, e.g. the "sorting" enquiry described later, or because a researcher asks to study a particular problem at a particular factory, in which case he must have realized that it would prove a likely field for investigation. When verification is sought in other groups this particular problem, even if present, may be overshadowed by some other set of circumstances.

Examples.—I. In occupations where a long period of training is necessary before proficiency is reached, it would mean considerable saving of time and experience for both the learner and his department if there were some means of finding out,

before he embarked on the course, whether he had the requisite qualities or aptitudes.

Before the war, investigators studied the possibilities of selection tests for the R.A.F. with special reference to signalling.[1] The tests used included:

(1) A linguistic intelligence test, consisting of an opposites test, an analogy test, a mixed sentence test, a completion test, and a reasoning test. It must be realized that an intelligence test is not a test of general knowledge. The object of the latter is to find out how much a person knows; the object of the former is to see how he can deal with what he knows. Intelligence is defined as "inborn, general, intellectual capacity". The test used was designed by Professor Cyril Burt for the National Institute of Industrial Psychology.

(2) The dotting test already described. The portable form was used.

(3) The form relation test. In this test drawings of squares and rectangles have pieces of differing shape and size missing from them. Under each set of squares and rectangles is a series of numbered drawings of different shapes, and the subject is required to pick out the pieces needed to complete the figure.

(4) The Morse Mimeometer, which consists of a device for producing buzzes of long and short duration comparable to the dots and dashes of the Morse code. This is a test resembling the actual work of a signaller.

(5) Dial Test. In this 7 black fingers rotate on a white screen. Each finger rotates at a different speed, some clockwise and some anti-clockwise, and each finger has an indicating letter. The subject is required to write down the order of speed from the fastest to the slowest.

(6) A pressure test. Seven unequally weighted levers are enclosed in a box with their ends projecting. The subject is required to press the ends of the levers with one finger and decide which had the heaviest weight attached, which the next heaviest, and so on.

There were some other tests, but they were not used for all

[1] E. Farmer and E. G. Chambers, *op. cit.*

the subjects. The results showed that the tests which agreed best with signalling proficiency were the first two on the list and the 4th and 5th. The other two did not select the best or worst signallers. The number of subjects tested in order to test the value of the tests was 2731.

In most published work there is a tendency to relate successes or apparent successes and omit the failures. This particular research is also important because of the unexpected failure of a test. Mr. Farmer writes: "This test (i.e. the pressure test) is an example of how a test can be carefully devised to measure a quality believed to be involved in an occupation and yet in practice prove a failure".

He points the moral against "the method sometimes adopted of selecting new entrants for an occupation by means of tests which have not been proved experimentally to measure qualities specially needed in the occupation. Before selection tests can be used for practical purposes, their validity must be established, although the temptation to omit this lengthy process is often a strong one. If it is omitted and tests are put into practice on the assumption that they measure some quality that appears to be involved in the occupation, there can be no certainty that the use of such tests will aid in selecting the best candidates."

These tests were also applied to a number of other groups of workers for skilled and unskilled trades, and the general tentative conclusions drawn are that tests of intelligence, mechanical aptitude and ability will on the whole select those best fitted for the skilled engineering trades and for semi-skilled occupations undertaken by those with an elementary education only. The tests were not useful for selecting men for unskilled trades.

Psychological tests are related more closely with occupational proficiency when maturity has been reached than with proficiency at the end of training. The tests therefore have permanent prognostic value.

II. The next example is an analysis of engineering by Max Tagg.[1] The trade was divided into nine main groups

[1] Max Tagg, "The Make-up of the Engineering Worker", *Journal Inst. of Indus. Psychol.*, I, 8, 1923.

with a number of sub-headings. Tagg classified the various groups into 5 divisions ranging from high to low in accordance with the intelligence required. As a result of this part of the work he found among the repetitive workers some with a grade of intelligence far higher than the work demanded. In some cases there were temperamental reasons for this, but not as a rule, and he holds that "to allow such a state of affairs is economically unsound and socially demoralizing".

The next step was to find out the particular abilities, in addition to the degree of intelligence, required for the various occupational groups. His method of doing this was as follows:

(1) He watched the worker doing his particular job and analysed the abilities he needed for the successful performance of the operation.

(2) Then he himself, an engineer, carried out at various times all the operations, and by introspection arrived at the requirements. This he considered the more important, since by doing we learn the "feel" of the activity and know more about it than by merely watching.

The abilities he found common to many branches were:

(*a*) Perception of space and form. This is essential for those who have to transfer a two-dimensional drawing to a three-dimensional reality and vice versa. "The pattern-maker has not only to perceive on his two-dimensional drawing the 'solid' pattern, but to 'see' the inverse of this pattern."

(*b*) Memory of form and size. This is important in many departments not merely for technical efficiency but because of the saving of labour and time.

(*c*) Motor ability.

(*d*) Attention.

(*e*) Creative imagination. "With the introduction of mass production methods, it is thought that this is no longer required. Actually, mass production methods have divided workers into the non-creative type and a smaller but important creative type. The latter is required to help the worker to devise means of overcoming difficulties that require ingenuity to solve."

(*f*) Accuracy of detail.

III. *Selection of Apprentices.*—Frank Holliday [1] described an investigation into the selection of apprentices for the engineering industry. The problem was how to select Trade Apprentices to become skilled tradesmen, and Engineer Apprentices to become competent draughtsmen or technicians, or to achieve fairly high positions on the production side of industry. After some years' experience he came to the conclusion that the general selection methods were wasteful and that the efficiency of the apprentices was low. He set out to investigate *whether or not* psychological tests could be of any help.

127 boys employed in a large engineering firm were studied; they consisted of three main occupational groups, namely Trade Apprentices, Engineer Apprentices, and Shop Boys whose jobs ranged from unskilled work to fairly skilled work in various shops. They were all tested for intelligence, and in addition were given a battery of group tests of a more specialized kind, for example, mechanical models, form relations, space perception, recognition of design. The actual work of the boys has been followed up in detail for several years. This enabled a comparison to be made between the results of the tests and the later efficiency. Comparison showed that those who did best in the intelligence test now tended to do best at Engineering Mathematics, and those who did best on the other group of tests did best at Engineering Drawing.

The intelligence test forecast general academic success as estimated by passing all three subjects, namely Engineering Mathematics, Engineering Drawing, and Engineering Science, and gaining distinctions: lack of success was measured by failure in one, two, or three subjects. For example, in a group of 65 apprentices 11 in the top quarter for intelligence passed in all three subjects, compared with 5 in the bottom quarter; 7 apprentices in the top and 4 in the bottom quarters gained distinction; of the 10 who failed in the year's work, 1 was in the top quarter of the list, 6 in the bottom.

The Test Battery was found to be associated with draughtsmanship and shops' proficiency, particularly in the more skilled trades. Holliday points out that the ability to *read*

[1] " Selection of Apprentices ", *Occ. Psychol.*, XIV, 2, 1940 and XVI, 1, 1942.

drawings is most important, because drawings are the language through which the engineer most frequently communicates his ideas. The tendency of the apprentices' work to improve or deteriorate was watched. One point of special interest is that as time went on the disagreement between the Test Battery results and the Works' reports tended to disappear. The two tests are both necessary. High intelligence alone is not sufficient to make either the good trade apprentice or the good engineer apprentice, but high intelligence is necessary for the first-rate engineer apprentice. A boy of extremely high intelligence, however, is not likely to make, e.g., a good turner, because he would not be satisfied with his job for long. In a very detailed survey the conclusion is reached that there is real value in the use of properly designed and administered psychological tests. "They not only enable especially suitable apprentices to be selected and the general standard to be noticeably raised, but are of unique value in enabling unsuitable applicants to be rejected, a number of whom would be accepted by using the more common selection methods." It is also important to realize that people learn more quickly a job for which they are naturally adapted. An important result was that after the introduction of tests the foremen and others who had to be responsible for the apprentices remarked that the recent ones were far superior, though they had no knowledge that a different method of selection was in force.

IV. Sometimes the motive for selection work arises out of a particular problem of an already selected group.

A laundry complained that in the sorting department an irritatingly large number of mistakes occurred. Since the trade had an experienced industrial psychologist he was asked to investigate.

No external cause could be discovered, so a probable explanation was that these sorters were not suited for the work. The object of the investigation was to see if, by some simple test, the efficient and the inefficient sorters could be identified.

To be satisfactory the test should be such that the girls who were best at it were also best at their work, and that the worst at the test were worst at their work.

The test[1] devised approximated to the work they were doing, technically known as an "analogous test". There were 100 small oblong cards on which were reproduced in the form similar to that of a laundry mark 2022, 2202, 2204, 2024; another 100 had each card prefixed by V, and another by W. The tests were to sort them according to instruction into similar piles. There were 4 tests in all.

The results for each worker could be assessed for speed and accuracy, i.e. the length of time taken to sort each group and also the number of errors. The management could give output figures. The original test was done on 30 girls. For simplification only the extreme results are given. The average output for the 7 poorest at the tests was 132, the extremes being 103 and 150. The average output for the top 8 at the tests was 165, extremes 145 and 191. The output of the sorter at the top for the tests, but with the low output of 145, was described by the charge hand as one who "could work well, but did so much talking that she never got on with the work". When being tested she could not talk, and so her natural ability brought her to the top.

Certainly this group of sorters would have been improved by the elimination of the worst at the test. They would probably have been more efficient at some other process. The next step would be to test the test on other sorters.

In most selection testing the emphasis has been on the actual work to be done as if it were in isolation. With the exception of students or apprentices, whose success is to a great extent judged by an examination, the value of a test has had to be judged by the assessments of some person in authority who comes in direct contact with the worker. Now in many occupations success is determined by other factors of which often the assessor is unconscious. Thus assessments of clerical workers include not only the typing or shorthand done, but whether the clerical worker is willing to do extra work, whether she can co-operate with the others, whether she holds herself aloof, and so on. One girl's output of shorthand and typing was excellent if she could do it for people of whom she

[1] H. G. Maule, "Selection Tests for Sorters", *Journal of Institution of British Launderers*, 1936.

was not afraid, but since she belonged to a pool and was too terrified to work for some of the directors she was ranked as less effective than her gifts warranted. Had she been a subject for typing tests her test work would have been excellent but her office rating would have been mediocre: she would have helped to lower the connection between the two. This kind of incident must happen frequently. Again, people who have to rate others are often influenced by their own prejudices and tend to think that some workers are better or worse than others when actually they are not.

Therefore, even when it has been found that a certain person has the necessary technical qualities for a particular job, the framework of that job has to be considered.

A most important consideration is the setting of the work. Has the person to work with a group and be able and willing to adjust his work to the others, to be willing to give help and to seek it should occasion arise? Has the same work to be done in isolation—for example, the one person in a firm doing a particular job? Has the work to be done for one person? These social variations are extremely important in determining success or failure for some people.

Again, in doing an occupational analysis it does not follow that the ingredients of success or failure are the same in all. An obvious example is that two typists might for practical purposes be equally good even by a measured output, although one might be quicker than the other; if the slower one was absolutely accurate and the quicker one a little careless the total correct output at the end of a day might be the same. It is possible that there are a number of compensations that will have to be taken into account when we know more.

In some people emotion may be a complicating factor. A sorter in a laundry who was quick and intelligent at packing was slow at sorting, because certain of the dirty clothes aroused extreme disgust, which made her fastidiously careful and therefore unnecessarily slow at handling them.

Hence, in studying an occupation there is needed:

(1) A knowledge of the details of the work.

(2) A knowledge of the tests that will grade people according to their efficiency at a particular job.

(3) A knowledge of the particular social setting in which the work has to be done.

Selection testing has been most effective in the occupations requiring skill with things, e.g. some forms of engineering, or clerical work concerned primarily with symbols of things either in words or numbers. When we come to such work as that of salesmanship, for example, so far the results have not been successful. One reason may be that there is no such things as just salesmanship; the salesman or woman who is to sell suits or dresses requires other qualifications than the one who sells watches. The hours of work may be the same, the general material conditions of the organization the same, the physical standards of fitness the same, but there is something else needed in the one case which is not so essential in the other, namely, an understanding of the customer, a knowledge of human nature, kindness and courtesy and critical appreciation—desirable perhaps in all salespeople but essential for some.

These qualities, however, are not to be measured by any physical or intellectual examination; they are what we vaguely call temperamental. The assistant in a frock department who was heard to say to a customer, "Of course Madam has no figure, how could any frock suit her?" and the bright young thing, as yet slim, who looks at the middle-aged woman suffering under the middle-aged spread and says, "Of course, Moddom, you take it in the width", may be physically fit, intelligent as regards books and figures, but it will be admitted that they leave much to be desired as successful saleswomen. They may seem isolated instances, but they are not so.

Those responsible for selecting people sometimes think the problem of selection is merely that of finding (*a*) the degree of intelligence or other qualities required for a particular job; (*b*) the person with that degree.

Such knowledge would be better than relying on chance and often would give a good working arrangement,[1] but when we

[1] Alec Rodger, "Planning for Vocational Guidance", *Occ. Psychol.*, XIII, 1, 1939; "The Use of Tests in Vocational Guidance", *Occ. Psychol.*, XIII, 3, 1939.

know the various intellectual and practical qualities we only know part of the problem. Let us assume two typists equally efficient at typing dexterity and equally intelligent. Can we predict equal success in a given environment? The answer is No. One of them may be moody, resentful of criticism, irrationally antagonistic to any command, uncertain of herself, or liable to worry at night over possible and even impossible mistakes; the other may be bright, reasonably careful but able to dismiss from her mind work that can no longer be altered, easy with others, whether equals or superiors in position. Even of the engineers, Max Tagg remarked that some kinds of work demand, in addition to the physical, intellectual and practical qualities, tact, initiative in small things, grit and perseverance; others need quick and accurate decisions, while for some jobs the worker must be adaptable. These differences are unrelated to practical ability or intelligence, and are usually called temperamental or emotional differences.

Most people recognize their importance, but so far we cannot test for them. They will be considered in detail in another chapter. Before discussing them it might be useful to discuss some of the methods by which people have tried, and do try, to get some clue to these emotional and character qualities:

(1) The search for some rapid, successful, and easily applied method of selecting people by temperament has through centuries proved alluring.[1] Aristotle is credited with the view that the forehead, eyebrows, and eyes are indicative of certain emotional and character qualities, and Rhazes in the ninth century held that "from the form of the body is the temperament known. He recognized two classes: (*a*) the graceful and thin, (*b*) the thick and obese. The former have little courage and lack energy, while the latter are hardworking." A trade journal recently asserted that it is "risky to put a pronounced blond to dull routine involving sustained efforts; the small dark type does most of the hard mechanical and managerial work in Europe and America". Caesar's objection to the lean and hungry look of Cassius and his preference

[1] Greenwood and Smith, "Body-build and some Mental Traits", *Occ. Psychol.*, XV, 3, 1941.

for the round type implied a supposed relation between fatness (or probably roundness) and acceptance of the environment, contrasted with leanness and revolt against it. Or, in the form adopted by A. P. Herbert,

> So many citizens I see,
> A sort of poodle seem to be
> Or else a sort of pug.

If it were possible from a knowledge of height in relation to width to predict temperamental qualities, particularly in regard to practical efficiency, the value for selection in industry would be immense.

The probability of such a relationship has been investigated. 582 people, consisting of 232 adults and 350 children, were measured for (*a*) height without shoes, (*b*) chest circumference after maximum expiration. The height was divided into the chest circumference and this expressed as a percentage. If a person were literally "as broad as long", then the chest measurement and height measurement would be the same and the percentage would be 100. The closer the percentage is to 100, the broader is the person; the smaller is the ratio, the slimmer is the person. It is then possible to grade people according to this ratio.

The same people were also given an intelligence test and were graded for efficiency at work.

The adults were also assessed for nervous symptoms, as well as for speed and accuracy of movement, by the dotting test. Each of these estimations could be compared with the body-build measure.

The final result was that, as far as our knowledge exists at present, from the point of view of selection, the body-build measurement is of no practical value.

If we wish to estimate temperament we must test for temperament, realizing that our methods are fallible; we are not likely to get a short cut by this method.

(2) Some people believe that handwriting reveals the secrets of temperamental make-up. In so far as it is a personal activity it will certainly express something; as St. Augustine said about our dreams, we may repudiate them, but they are ours. What exactly is revealed in handwriting is much more difficult to define. Of course if the work to be done needed

only legible handwriting, then selection in accordance with the requirement would be reasonable, but if handwriting is to be used to determine mental qualities there are many better ways. I doubt if the employers who claim to judge character and temperamental qualities by handwriting really carry out a fair experiment. They do not, as far as I know, choose their staff on handwriting alone in the absence of a personal interview; they usually consider the handwriting in the light of some other knowledge.

Much patient research has been conducted, but the results so far are not likely to encourage personnel managers to accord it much weight.[1]

No matter how carefully testing is done, nor how reliable the tests may be, they cannot be substitutes for the personal responsibility of the management. They give more evidence on which to base judgment, just as the doctor accepts the help of tests, blood counts, X-ray, electro-cardiograms to give him more data—but the final diagnosis has to be made by him.

Tests are of great value since they reduce the play of personal prejudice and introduce an objective standard; nevertheless selection, and still more guidance, using all that science can offer, will remain an art.

A misplaced worker is not only a loss to the firm, he is difficult to work with, develops a grudge against life because of his lack of success, and becomes unhappy.

The remedy is that we need to take seriously the selection of people for work, both for the success of the work and the happiness of the worker.

In one of Emerson's poems the mountain and the squirrel are reported to have quarrelled as to their respective powers, and the mountain scoffed at the squirrel's feebleness, to which the reply came, "If I cannot carry forests on my back, neither can you crack a nut". It is easy to forget and to expect of the forest carrier, nut-cracking.

SELECTION FOR MANAGEMENT

The word management, interpreted in a wide sense, means "the application of skill in the control of things or persons".

[1] Robert Saudek, "Experiments with Handwriting", London, 1928.

Managerial posts usually involve control of persons and things, though the relative importance of each varies from post to post.

The application of skill to the control of others is a special case of the application of skill to anything. Skill in any activity, whether bodily or mental, requires:

(1) A predisposition or natural ability for that skill. The belief that hard work can make up for absence of natural ability is false; hard work will improve a lesser degree of ability but not produce it. The foundation for the belief lies in the fact that in actual practice a lesser degree of natural ability, carefully exercised by hard work and training, does at times produce results that may be better than those from a naturally more gifted but less assiduous person.

(2) Continuous exercise of that skill in order to acquire proficiency. If, as Aristotle said, we learn to harp by harping, so we learn to manage people by managing people, not by thinking we can.

(3) Training by skilled executants, thereby reducing the learning period.

The first problem, then, is to select those with the natural ability so that the ability may be trained. A certain amount of negative selection takes place naturally; there are people who refuse to consider any job when responsibility for others is involved. "I prefer to do the job myself rather than to watch other people" reflects this attitude. It is found in factory workers, scientists, artists, etc. They refuse promotion to the rank of foreman, or administrator as the case might be, and where their resistance has been overcome the results are often, though not always, unsuccessful. These people apart, there remain two main groups from which the future "manager" (using the word generally) will be recruited:

(1) From the ranks of those who are already doing some job in a subordinate capacity, about whom something is already known, e.g. the foreman from the workers, supervisor of a group of clerical workers from the typists. These must already have an efficient knowledge of the work of their department, and those in authority know how efficient they

are. They now have to know not only the job but the doers of the job, and it is here where the greatest ignorance prevails—in fact, some would deny that there was anything to know.

(2) From young people leaving the secondary and public schools or the universities who wish to train for management. Of the potential effectiveness of these, little is known. The head boy at school and the outstanding student at the university are not on that evidence alone necessarily likely to be successful in a position of authority.

Most people engaged in Industrial Psychology have been repeatedly asked if there is any way of choosing foremen who will not lose their heads with a little power. It is well known that some people who as subordinates are quite reasonable members of the group become with promotion dictators in miniature. Power over others is a very heady draught. A banker once expressed this idea as "A capacity for pushing sixpences across a counter is no guarantee of an ability to supervise the pushers of sixpences".

How is this selection to be made? Are all those who wish to take up this work, if reasonably presentable, to be tried? Some little selection is made by headmasters and the various advisory bureaux, but these selections are often made on the rather negative principle of inadequacy for an academic or professional career.

Is anything known of the mental requirement for management? Some suggestions have been already discussed in a previous chapter. They included intelligence, temperamental qualities, and character development. The discovery of the possibility of some of these in inexperienced people is difficult. Intelligence can within fairly well-defined limits be tested, knowledge of their technical qualifications can be obtained or tested, but for the other qualities which belong to the emotional and character qualities there is no such aid to diagnosis.

The ultimate decision will have to be made on evidence which cannot be subjected to objective tests, for example, such qualities as strength of will distinguished from obstinate persistence, ability to see oneself in perspective, emotional

control—these cannot be measured in terms of any units now known to us, and yet they are of vital importance.

In any enquiry objective data are an advantage, but we are sometimes apt to overlook that valuable scientific knowledge has been obtained by controlled observation, and at present much psychology, particularly that involving social relations and character qualities, is dependent on this method. The usual form of this for selection purposes is the age-old method of the interview. This may be conducted by one person or by a committee.

Actually the interview is a special case of human relationship, and generally suggests the need for getting information not to be obtained otherwise. Children learn the art quite early; it is not unknown, even if unacknowledged, for a child to interview, sometimes very adroitly, a parent or teacher. Interviews are not all of the same type.

I. There is the interview commonly known as a "viva voce", held as supplementary to a written examination; the purpose is to find out if the candidate has a real understanding of his subject and to distinguish mistakes made in the written papers, that might be merely slips from those due to ignorance. This is relatively an easy form of interview, though the candidates usually need sympathetic handling and examiners vary considerably in their skill.

II. The interview for a job involving other than purely technical qualifications. Those who have to interview are quite often ignorant or vague about their aim, so that candidates for the same position are interviewed from different points of view.

It is extremely difficult to describe the characteristics of the successful interviewer. From the point of view of ordinary social life some highly successful interviewers give the impression of the opposite. Awkward pauses, hesitancy, self-consciousness, whether expressed as undue shyness or hauteur, are definite hindrances to the successful interviewer.

One essential is a manner that does not suggest the judge. It is extremely easy for a very large number of people to feel guilty; in fact, I heard an extremely intelligent person once say, "I always feel guilty whenever the ticket examiner on a

bus asks to see my ticket, though I know I've got the right one". The ordinary interview has a much wider aim than that of judging in the narrow sense.

The interviewer (1) seeks to get from the candidate certain definite information that can be checked, (2) notes his appearance, voice, manner, and (3) helped by the general impression the candidate's personality makes on him, tries to get an idea of what he will be like in quite different circumstances. If in the course of the interview, tests, particularly of a practical kind, can be given, the test situation often throws considerable light on some temperamental qualities. With adults this is rarely possible. Questioning must play a considerable part in interviewing, and it is wise to begin by questions that concern actual matters of fact. The interviewer should have a clear idea of what he wishes to find out, be familiar with the general requirements and have in his mind, even if not on an actual paper, the relevant questions. If, however, the candidate gives the information spontaneously, or actually answers unwittingly a question meant to be put later, it is better not to interrupt. Sometimes, in a misguided attempt to have everything mechanically the same for every candidate, an interviewer keeps to a rigid formality which cannot achieve its object. Observation of small signs is useful. Not only what a candidate says but how he says it may be a clue to his personality.

Definite rules are not likely to help, since most people have to evolve their own methods, but in the light of a little knowledge of the errors made some general points of view are given:

(1) The ordinary rules of courtesy that normally maintain between human beings should always be observed. The person in high authority who snaps at the junior he is interviewing as a beginning is illustrating what not to do, but unfortunately he is setting a pattern that might be followed by the chosen candidate when he is in authority.

(2) A casual manner affected in a misplaced attempt to be informal often defeats its object. The candidate should be able to feel that his interviewer is interested in him.

(3) The interviewer should listen as much as possible, only giving his own views if it is necessary to encourage the candidate.

As the interview progresses, a general impression of the candidate will be forming, which will gradually receive definition. The form this impression takes varies from person to person according to his own make-up. The good visualizer may be seeing the candidate in his mind's eye in the position he is seeking, picturing him getting on, or not, with So-and-so. Other people keep a running verbal comment below the focus of consciousness. Ultimately an opinion has to be expressed in words; to get the exact words that shall convey exactly what one means to another is very difficult. Only experience can help. Even though some people think note-taking makes a candidate more nervous, it is desirable in all normal circumstances, particularly where a number of candidates have to be interviewed.

Where a group of people and not one person does the interviewing, other complications arise. One writer thinks that the presence of colleagues makes people somewhat artificial and that one person bent on self-display may dominate the group. Sometimes a certain artificiality is set up so that the members of the committee try to impress one another instead of getting the maximum knowledge of the candidate.[1]

Individual Differences of Candidates

It is well to be aware of certain extreme types that may give a false impression:

(1) The person who immediately feels himself in the presence of a judge. He responds to all questions, however objective, with the idea in the background that at all costs he must defend himself. His attention is divided between replying to the questions adequately and defending himself—a state of conflict likely to render any estimate difficult. There are posts for which this type is most undesirable, but there are some people who are quite well balanced and easy in manner except in this one situation.

(2) The person with extremely high standards may honestly believe that his abilities or intelligence are not high because

[1] R. C. Oldfield, *The Psychology of the Interview*, London, 1941.

he compares what he does with these ideals. His actual performance may be much higher than that of others, but where he is not personally known he may fail to reveal himself, unless the interviewer is unusually expert.

(3) The person who is stimulated by an audience may appear better than he normally is; granted reasonable knowledge, he may impress the interviewer too favourably.

(4) So also does the person who, being rather a good actor, puts up a "good show"; his movements may be well controlled, speech well modulated, manner neither self-assertive nor self-depreciatory. But his artistic performance may hide many weaknesses. In interviewing young people the plausible person may give a better impression than the far superior person of somewhat uncouth or less-experienced manner. The social setting must be allowed for.

Degrees of Responsibility

There is no doubt that there are great individual differences in willingness to accept responsibility, and also that jobs vary in degree of responsibility.

(1) The first level, e.g. foreman, supervisor, head of a small group. Here the responsible person has a limited field, but he is becoming more important with the present-day development of industry.

(2) The manager of a number of units responsible to some higher authority. He has more responsibility than the first group but has not to take the final responsibility. Many people are successful at this level even though they rarely consult their superior authority, but may fail as a final authority.

(3) The director of a large organization or one-man business. These may have advisers, but the final decision for policy, etc., rests with them. It does not follow that all those who are good with limited responsibility are equally good at taking final control. General Wavell makes the same comment about generals, many of whom are "excellent executive commanders as long as they are controlled by a higher commander, but who get out of their depth if given an independent command". It is difficult to see how any

interviewer can find this out. Only the opinion of someone who has an intimate knowledge of the candidate in his work could give an opinion, and even then mistakes can occur.

In making decisions about individuals (apart from intellectual and technical qualifications) there are three words frequently used as if they stood for almost the same quality, namely, personality, temperament, and character. While the line of demarcation is difficult to draw, they nevertheless do represent different aspects of mental life. By personality is generally meant "the effect upon others of a living being's appearance, sounds, behaviour, etc., so far as they are taken to be distinctive signs of that individual. Personality, therefore, can be expressed by physique, colouring, expressions, etc., as well as by clothes and behaviour—all these may be completely natural or artificially modified. Behaviour includes gait, gestures, manner, voice, and speaking." [1]

It is usually the personality that can be experienced in an interview rather than the character which is frequently its aim, character being "the comparatively stable structure of a person's mind, wrought by abilities (habits, techniques, skills) into sentiments".

Temperament stands for the emotional as distinct from the intellectual aspects of the mental make-up.

Perhaps some day we may have a more objective method of selecting those for positions of responsibility, but that day has not yet arrived.

Training

It has long been recognized that for the perfecting of any skill in sport or speech, in art or science, expert training is essential for all—with the possible exception of the genius—so that any movement that is unnecessary or hinders the desired end may be discarded and those that further it encouraged. That the same applies to the movements required for an industrial process has not received sufficient recognition.

An untrained worker can be very expensive, for not only may he fail to obtain his maximum efficiency but he can waste

[1] T. H. Pear, "The Modern Study of Personality", *Bulletin of the John Rylands Library*, 22, 2, 1938.

valuable material or hold back other workers. The apparent simplicity of many industrial operations has tempted many to regard training as unnecessary.

Ford estimated that 43% of the jobs in industry required one day or less to learn, 36% required under a week, 6% under a month, 14% any time up to a year, and the remaining 1% up to 6 years. Even if that analysis be correct, it can only refer to the movements themselves without regard to the fact that they are only part of the total learning process.

In nearly every industry where investigations have been held, even though the object was a study of hours, or ventilation, sooner or later the investigator has commented on the need for training.

In silk-weaving large and consistent differences were found in the rates of doing standard operations and in the methods adopted by the weavers.[1] Also the weavers who were not good used a greater amount of effort for each unit of output than those who adopted good methods. Similar, though smaller, differences were also found among cotton-weavers.[2] In metal-polishing striking differences showed both in the methods of work and in the movements adopted by workers.[3]

Leaving on one side those higher branches of engineering, etc., for which several years' apprenticeship are required, what are the usual ways of teaching a beginner?

(1) An entrant is put to work under an operative experienced at the particular process. This has the advantage of letting the beginner both learn the process and become accustomed to the general atmosphere of the works at the same time. The assumption, though, is that anyone who can *do* something can teach it, an assumption for which there is no evidence. Merely looking back on one's schooldays will bring to the memory of most of us, teachers who were brilliant at their subject, whether a language, science, craft or skilled bodily activity, but were hopeless at teaching it. The highly proficient person has frequently forgotten the stages of his

[1] P. M. Elton, *An Analysis of the Individual Differences in the Output of Silk Weavers*, Ind. Health Res. Board, No. 17, 1922.

[2] S. Wyatt, *Variations in Efficiency in Cotton Weaving*, Ind. Health Res. Board, No. 23, 1923.

[3] E. Farmer, *Motion Study in Metal Polishing*, Ind. Health Res. Board, No. 15, 1921.

development and he himself needs training to teach. "Those who can, do; those who can't, teach", said Bernard Shaw, and this, like many epigrams, is true or false according to its setting. Those who are expert often prefer to get on with the job itself rather than teach others; those who can't, i.e. are less interested in the actual doing, may find satisfaction in helping others to be perhaps better than themselves.

Another difficulty is that an expert, particularly if on piece-work, may be more interested in his own earnings than in the learner.

(2) To offset this some organizations arrange for qualified workers to act as instructors, for which they receive extra pay. Here again there is the element of luck in the teacher, and one who has himself learnt his art by watching others may have stereotyped already useless movements of which he is unaware because never corrected; these in his turn he passes on, and so on to the third and fourth generation. Also, to be a beginner among a lot of experts may be disheartening. When a number of people are learning an activity together there is the interest of the group and the stimulus of reasonable rivalry, there are other people who are as ignorant as oneself, and certain faults can be corrected in the group without the inexperienced worker feeling so nervous as when he is the only one.

Both these methods have the drawback of tending to a limited and narrow outlook. It is not unknown in these days of the mass production of small parts for a worker to have no idea of the relation of the part he is making to the whole. Many examples have occurred during these war years of people engaged on some process vitally important to the war, though not realized by them as such, wishing to leave in order to do war-work.

No one should be allowed to remain in ignorance of the significance of his work to the completed whole.

Some factories where the management has imagination have dealt with this problem by having on the wall a large drawing of the completed article, e.g. a tank or an aeroplane, and the part, probably quite minute, which the particular department was making, coloured in bold relief.

Alternative Methods of Training.—Where there are large numbers a special room should be set apart for teaching purposes, properly fitted with the necessary equipment for the various processes, with desks, lantern, epidiascope, or means for showing films. Instruction should be given in the various stages from the raw material to the finished article as far as possible, supplemented by periodic visits to the main works to study some specific process. The untrained observer looking at any complex or highly developed thing without guidance sees very little. Information *about* the materials used, their history and discovery, can be a thrilling story; there is far more romance in factory work than is realized. The workers on refrigerators have rarely considered the romance of their development nor the amenities to our lives due to the science and technical skill that have made them possible.

Making rivets may not be an exciting occupation, but they are of supreme value. At an early stage in the war a British submarine after a most dangerous and adventurous time arrived back almost tied together with bits of string and only just not a wreck. An officer relating the story finished by saying "If one rivetter had failed to do his job perfectly we should have been sunk". The moral is, why not let rivetters and all the other workers of parts know that the strength of the whole is that of the weakest part, and so there must not be a weakest part if good work can avoid it? So much of modern industry seems to the individual meaningless, because nobody has given him the chance to see the meaning.

There should be in charge a teacher or teachers who know the work and all about it, and who have learnt to teach. It might be quite a useful innovation if those teaching in industry learned to teach as teachers in schools learn to teach.

In order to keep his interest alive, the teacher ought to be in close contact with the actual work of the factory and should superintend the students when they go round it.

In a large organization it is relatively easy to have a school. Miss A. G. Shaw has described the method she adopted for training women: [1]

"It was found that, though the jobs varied considerably,

[1] A. G. Shaw, "The Systematic Training of Workers", *Labour Management*, November 1936.

they could be grouped according to typical movements used in performing them and that all jobs had a few common features. The scheme was then set up for a preliminary training to include these common features, which were (*a*) the handling of a screw-driver, (*b*) the use of a hammer, (*c*) the simultaneous use of both hands, (*d*) the arrangement of material.

"This was followed by specialized training in one of the following groups: fine assembly, simple assembly, drilling and capstan lathe work, coil winding, insulating, testing, inspecting.

"After the first week of the preliminary training the operators are given a test, the pass standard of which is set so that only the quick learners pass and the remainder repeat their training for another week."

They are not allowed to leave the school until their training is complete, and they are placed eventually according to their pass marks, the reports of the teachers, the girls' own inclinations, and the factory demand.

The instructor explains the reasons for making the right movements, and the learner is trained to realize the principles underlying the use of each tool.

This is only a bare outline. No two organizations can do things exactly in the same way.

Where numbers are small and only a few workers are taken on at one time, it would still be advisable to have a room set apart, and one or more teachers who did teaching when there were entrants to be taught.

It might be possible to arrange for training centres on the principle of those now organized by the Ministry of Supply. Even in the simplest operations a considerable time usually elapses before the beginner reaches maximum efficiency.

More research is needed in respect of the speed with which skill can be acquired in different types of occupations. Quite apart from other uses, such knowledge is important for the well-being of the individual worker and for productive efficiency.

The length of the learning period will be dependent on the amount of skill required, on the learner's ability for the work, and on his interest. It is probable that a large number of

different processes require the same or closely related skills, and that if learners were taught adequately they might be able to learn fairly quickly an apparently very difficult process.

There are in almost any group of learners very considerable individual differences. In one firm it was found that at the end of the 36th week of learning the efficiency of the best worker was 75% better than the worst.

A highly educated woman who for experience was learning a simple industrial process graphically described in a lecture her difficulties: "I experienced exasperation, annoyance, and at times despair", and again, "Although I was shown how to do things I still made mistakes", and at the end of a morning of mistakes the foreman said, "You're making the mistake all the beginners make".[1] Her final conclusion was that the learning process is by no means the easy process many people imagine it to be, and she recommended the industry she was addressing to take up the problem of training as seriously as it took up technical training, for which it had an elaborate scheme.

Many processes, however, require when learned little thought, so it is advisable to teach a learner several, thereby adding to his self-respect by giving a feeling of power.

What must the Trainer know?—In the first place, he must have made a study of the sequence of the processes concerned, and have analysed the movements and done a time study. If he could have had a special training under an expert in the principles of Time and Motion Study, so much the better. He should know about hours, rest pauses, the particular hazards, if any, of the work, be on the look-out for those who have many minor accidents, should train people to use both hands and have studied the general lay-out, position of tools, benches, etc., and have experience and knowledge of people.

It is easier to know the qualities required for some particular process than for a successful teacher.

During the period of learning careful note should be taken of those who show any unexpected aptitude or high intelligence or understanding of people, so that after an adequate period

[1] M. M. Mellis, "Industrial Psychology", *Journal of Institution of British Launderers*, XIX, 6, 1938.

at a job they should be considered for promotion. No organization can afford to waste gifted people on work that is below their capacities. But to begin with an inferior job is not a hardship; there is no other way of really learning.

The Supervisory Class

While it is necessary to urge the necessity for training workers, far too little attention has been given to the training of those who are to be in some supervisory position, i.e. all those who are in charge of others. There is an ill-founded belief that the person who is good at a particular job will, by that fact alone, be good at looking after other people doing it, whereas with each promotion in the supervisory class the less need is there for doing the actual skill.

An American writer says that one of the chief bottlenecks in the defence effort is lack of proper supervision. Owing to the disproportionate expansion of industry there are not enough competent people for the many supervisory posts. It is impossible in the present circumstances to devise a comprehensive training scheme for those in authority, but, from the complaints voiced in many factories, incompetent supervision is an important factor in inefficiency, lowered morale, or general discontent. Taking merely one example. Those responsible for directing policy frequently fail to make those responsible for executing it understand exactly what is wanted, sometimes because they are not really clear about it in their own minds, and sometimes because they have not trained themselves to translate the idea into words. There is always a double translation concerned when one person understands another. Mr. A has an idea which he wishes to have carried out; this he expresses in words to Mr. B; he in his turn hears the words and from them must get the idea. Ideally Mr. A's idea and Mr. B's should correspond. They often do not. And when Mr. B has to explain it to Mr. C, and so on, the end result is often very different from the beginning. The staff call it contradictory orders or "nobody ever knowing what he ought to do".

One method of improving the position is to arrange for those who are in a supervisory capacity to have regular meetings

where the final authority explains his requirements, and the others, including the foreman level, discuss possibilities, ways and means and difficulties. Some problems are only obvious to those of the foreman level, and it is of their views that the higher management is often oblivious. Such meetings also help to educate and train all those taking part.

It was clear to most students of industry before the present war that the training of entrants into industry was of great importance, and greater still the need to train those in positions of responsibility for people.

The First Level of the Supervisory Class.—Normally the selection will come from the ranks of the workers. The direct head of however small a group must have that indefinable something called character; he must have sufficient independence to make himself felt and yet not be aloof. No one who is in authority can be at the same time one of the group, for the unit is the person in authority and the group; he is outside the group and yet in it. He must be able to lead and not mistake "bossing" for leading. Most people agree that he needs tact, though tact is not a synonym for feeble yielding to every wind. "The foreman today does not merely deal with trouble, he forestalls trouble. He has to see that conditions (machines, materials, etc.) are right, to see that instructions are understood, to see that workers are trained to carry out the instructions, trained to use the methods which have been decided on are best. The test of a foreman now is not how good he is at bossing, but how little bossing he has to do. He is a key person whose job is not only to deal with trouble but to forestall it." [1]

Those in the other ranks of supervision should be on the look-out for those fit to be promoted "from the ranks".

Again, at this level some training is necessary unless the job is merely one of allocating the work. Some of those who have started at the bench and become foremen are worth much more training. There have been a few efforts, organized by Technical Institutes and the Institute of Industrial Administration Technical College, to supplement their knowledge of the bench by classes in the evening, giving them some idea of the

[1] Mary Parker Follett, *Dynamic Administration*, 1941.

book-keeping that may be necessary, organization, costing, and the problem of human beings. The actual subject-matter of the classes will obviously depend on the kind of work and the time available. I know from some experience of lecturing to these classes, both men and women, that they are extremely keen and interested students of psychology. There is no necessity to make the training formal. Discussion of various topics would be more useful if presided over by someone who knew how to see that everyone took his part. There is too frequently with this kind of organization an opportunity for the facile speaker with the "gift of the gab" to monopolize too much of the time himself.

Where there is an apprenticeship scheme the works training might be supplemented by part-time work at a technical college. There are some fairly elaborate schemes almost of the nature of a post-graduate course.[1]

If the importance of the foreman was not realized before the war, the war has thrown it into relief. Neither technical skill nor mere seniority is an adequate reason for promotion to this work. Success at supervision demands, in addition to technical knowledge and practical experience, the ability to deal with people, and this needs training. He more obviously than most other grades has to get on with superiors and subordinates, and this, except to the very few, is a difficult task.

Recently the Ministry of Labour and National Service has undertaken the training of foremen, thus recognizing their importance. After the war the scheme should be extended.

Other Levels of the Supervisory Class.—The other supervisory groups, managers of various degrees of importance, enter in two ways, either directly from the university or other place of higher education, or from the first supervisory grade.

However selected, training is necessary, but, apart from a few independent schemes, little has been attempted. An investigator of labour wastage and output problems writes: "In most factories the immediate need is not the creation of more officials but the proper training of the management in

[1] Locke, "An Approach to the Problem of Foreman Training", *Labour Management*, April 1942; A. P. Young and T. H. Burnham, "Selection and Training of Foremen Supervisors", *ibid.*, March 1934.

the handling of people". It might be possible for someone with imagination and organizing ability to devise a scheme in which the universities and the various industries took their place. Doctors have to learn their trade by theoretical work and practical experience, so also do the majority of teachers. A wider mental training and an opportunity for continuous development ought not to be impossible to devise. The great danger of the supervisory class is mental rigidity, fixed habits of thought preventing adjustment to new ideas, of which one product is "red tape".

Chapter V

TIME AND MOTION STUDY

The industrial aspect of studying human movements came from America, and was initiated by Frederick Winslow Taylor. The story has often been told, so it will suffice here to outline the main points. Taylor was an experienced engineer, who, in his interest in and knowledge of the machine, was not blind to the worker of the machine. "We can see our forests vanishing, our water powers going to waste, our soil being carried by floods into the sea. But our larger wastes of human effort are less visible, less tangible, and are but vaguely appreciated." [1]

In 1878, while acting as foreman in a steel company, he insisted on studying *how much* of any kind of heavy labouring work a man well suited to his job ought to do in a day. To his surprise he found no constant or uniform relation between the amount of energy exerted and the tiring effect of the work.

He set out to show, by a study of people actually working, that there was a preventable loss of efficiency, and that the way to prevent this waste was to study a business as a scientific problem and find out its laws, rules, and principles. The object of management should be to develop every branch of the business to its highest state of excellence, so that the prosperity should be permanent; this should include the development of each member of the business to his maximum efficiency, so that not only could he earn more money, but could rise to the highest grades for which he had ability. His observation of organizations showed him, what is still true of many, that workers of all grades learned the details of their work by watching those more proficient. While many of them with practice developed a commendable copy of the original, they often, consciously or unconsciously, adopted many unnecessary and faulty movements, some of which might be

[1] Frederick Winslow Taylor, *Principles of Scientific Management*, New York, 1911; also Leon Walther, *Technopsychologie du Travail Industriel*, 1926.

harmful in the long run to the worker, or might prevent him from attaining his maximum output.

Taylor maintained that a better method might exist, and that there was only one way to discover it, namely, by "an analysis of all the methods and implements in use, together with accurate, minute, motion and time study".

He knew that certain incentives, e.g. chances of promotion, higher wages, shorter hours and better surroundings, would encourage a man to work harder, but he saw that for an effective foundation more must be done. To attain this, firstly, the old rule-of-thumb method must be replaced by a scientific study of each element of a man's work; secondly, the workers must be selected, trained, and developed; thirdly, the management and the workers were to co-operate so that there should be an assurance that the scientific methods were utilized; and lastly, there must be an almost equal division of the work and the responsibility between the management and their workmen. It is necessary to put Taylor's work against the background of his philosophy, since the popularity of part of his theory has tended to obscure the fact that it was only a part.

Taylor's experiment with those loading pig-iron is now a classic and illustrates a number of important details of method. Firstly, he *watched* these workers and *noted* their movements, which were: stoop, pick up a pig, walk a few feet to the truck, throw or place it on the truck, return to the pile of pigs—this sequence being repeated again and again. Each man handled about 12½ tons per day.

Secondly, he *experimented.* There were 75 men employed; he selected one who seemed physically able to do more. He induced him by the promise of increased wages to do exactly as he was told. So all day long when he was told to pick up a pig he did, when told to rest he did. By 5.30 p.m. he had loaded 47½ tons. In the same way man after man was trained, but only 1 in 8 was physically fit for the extra work; the others were put to other work.

He next turned his attention to tools. He found that the weight of the shovels that were in use varied, but not in relation to the work for which they were to be used. He again selected some first-class workers, paid them extra for trust-

worthy work, and then timed how long it took a labourer with the right type of shovel to push it into a pile of material and draw it out properly loaded under different circumstances. The result was that the number of men required was reduced and the cost to the company less, although the remaining individual workers received more.

There are many criticisms that can legitimately be made against Taylor's experiment as a scientific experiment. If he wished to show the effect of a study of movements, then all the other conditions should have remained the same; actually not only were the movements altered, but the general background was different. A part of his success in increasing output and diminishing fatigue was due to his introduction of rest pauses, to financial reward, and to shorter hours. Also, the general idea permeating the whole policy was to increase the output for the owners, but he realized that attention to those whose skill was necessary for that increase was of vital importance. He writes: "All employees should bear in mind that each shop exists, first, last, and all the time, for the purpose of paying dividends to its owners".[1]

In judging an idea, however, it must be put into its period in historic time. The 19th century had as part of its industrial background the belief in the supreme merit of increasing output and the reduction of costs by lowering or keeping low the wages. Only the most far-seeing thinkers would be aware of the assumption tacitly made.

Taylor's great contribution, and it was great, was to approach problems which had been thought either not to exist or to be easily solved by common sense, in the spirit of scientific enquiry. As Farmer says, "He was a pioneer in an unknown field of research and his great and lasting contribution to the science of industry is the method he adopted".[2]

His work influenced Frank B. Gilbreth,[3] whose study of bricklaying is famous. By means of an adjustable scaffold to prevent stooping, by rearranging the mortar-box and pile of bricks, and having the bricks sorted by a labourer and placed

[1] F. W. Taylor, *Shop Management*, New York, 1903.
[2] Eric Farmer, *Time and Motion Study*, Ind. Health Res. Board, No. 14, 1921.
[3] Frank B. Gilbreth, *Motion Study*, London, 1911 ; *Psychology of Management*, New York, 1913 ; *Fatigue Study*, London, 1916.

with their best edge up, etc., he reduced the movements from 15 to 8. He then trained his bricklayers to make movements with both hands at a time, and introduced simple apparatus to do away with "tiresome and time-consuming motion".

The result was that he trained workmen to do 350 bricks per man per hour against the previous 120. Gilbreth analysed the work into a series of elementary operations or movements, each of which he timed, and noted those that served no useful purpose, and these he would eliminate. In addition, going a step further than Taylor, he compared various workers with one another, not only in regard to the total time to complete an operation, but the time for each movement forming part of the whole operation. He observed that there were considerable individual differences, so he conceived the idea of taking the shortest times in which each movement could be done and combining them to make a standard time. To take an imaginary example: suppose the movement is to take a pencil from a box and begin to write; the gross movements are, stretch the arm to the box, pick up the pencil, bring it back for writing. There are 3 movements. Suppose 3 people did the operation, and the results were:

1st	movement	done	by	A	in	1	sec.,	by	B	in 1½ secs. and by C in 4 secs.
2nd	,,	,,	,,	A	in	3	,,	,,	B	in 4 ,, ,, C in 2 ,,
3rd	,,	,,	,,	A	in	2	,,	,,	B	in 1 ,, ,, C in 3 ,,
			Total			6				6½ 9

Then, since A did the first movement in 1 second, it is possible to do it in this time; B and C take too long. The second movement can be done in 2 seconds, since C does it; and the third movement can be done in 1 second, since B does it. Therefore the best time is 1+1+2=4. This was probably the result of his engineering training; physiologically and psychologically there is little to commend it. However advantageous careful training may be, yet ultimately each individual will tend to adopt a method most suited to himself. Every investigator finds considerable individual differences even among the most experienced workers. The phrase the "one best way" has proved as provocative and often as misleading as the "human machine".

It has made considerable appeal to some people, probably because it seems so reasonable and practical, but it has also aroused severe criticism. If interpreted as a kind of probable limit past which there was no possibility of reduction it could be useful, and this is what Mrs. Gilbreth, who worked with her husband and continued after his death, seems to mean when, in response to criticism of it, she says that the phrase was intended to mean "the best way available, given the persons, equipment and tools in use, but with the right to improve the work place and the work method".[1] It was to be used as a standard from which necessary individual deviations could be made, but it "was never thought of as a pattern to which everyone must conform, no matter how much he rejoiced in assets or suffered from handicaps". Certainly there has been considerable misunderstanding if this were the case. It often happens that people in writing an account of their methods tend to over-simplify and to give an appearance of rigidity that in all probability they did not in real life practise.

Ralph M. Barnes, writing on this subject in 1937,[2] says that the terms "best way, optimum manner", and "method of maximum efficiency" are some of the terms used to denote the object of this first phase of Time Study, but that they mean that the object is "to find the best way all factors considered".

Mrs. Gilbreth described Motion Study as (*a*) a philosophy of work inasmuch as it is interested in looking for the causes of effectiveness in work. Production cannot stand alone, it must think back to design and raw materials, and forward to the final use; (*b*) an attitude of mind; since all activity is a combination of motions it must be efficient and productive and the work must give satisfaction; (*c*) a method and a technique, i.e. it showed how best to perform the activity.

The difficulty of discussing Time and Motion Study as formulated by its first exponents is that it forms part of a comprehensive system of management and, as such, is concerned with the relation of the management to the workers, with wages systems and rates, with incentives of various kinds, with general welfare as well as with the timing of work processes and the study of the movements involved.

[1] Lilian M. Gilbreth, "Time and Motion Study," *Occupations*, New York, Vol. 12, No. 10.

[2] *Motion and Time Study*, New York, 1937.

Much of the criticism levelled at the work of both of these pioneers is concerned with the methods of stimulation. In practice piece-rates were lowered, but by improved methods of doing the work the workers could get a higher output and therefore they were able to earn more. The workers, however, felt that, while this might be true, yet as sometimes practised, the system necessitated too great a strain over a continuous period. A physiologist or psychologist would not assume that a rate that was possible once would necessarily be possible continuously, nor that the quickest movement was necessarily the best, nor that standardizing movements for all was, even if possible, desirable, since even the best workers may achieve their excellent work by somewhat differing movements.

It will also have been noticed that in describing the pioneer experiments the remark occurs: "the number of men required was reduced". Here is the focal point of much objection to such work. Taylor says he found other work for those who could not adapt themselves to his higher standards, but in periods of heavy unemployment it would not be surprising if this was not believed. And there is no doubt that some of the developments of the Taylor-Gilbreth system in more recent times have resulted in reduction of staff and speeding up of the remainder.

Time and Motion Study concern themselves with:

(1) The details of the process that are external to the actual activity, namely, (*a*) the tools and materials used, which should be properly prepared and adequately placed; (*b*) the regularity of the supply; and (*c*) the sequences from beginning to end, which should be done in the minimum of time.

(2) The movements made by the worker dealing with the materials. The study of movements, which is often looked upon as the whole of the system, is simply the psychology of habit-formation, and from that angle it will be considered here.

A habit can be studied from two points of view: (*a*) when fully established, i.e. when proficiency has been reached; or (*b*) when in the process of being formed, i.e. during the learning period. Both are important, since the perfection of the expert quite frequently disguises the difficulties he experienced as a learner.

When an experience or sequence of experiences is frequently repeated we know that there is a tendency to repeat it, given the cue, without conscious thought. The characteristics of an established habit are the uniformity and ease with which it is performed, the tendency for the activity to work itself out to the end, and its independence of attention. The beginner, on the contrary, is variable, makes unrhythmic bungling attempts, and has to give full attention to each detail.

"The performance at the beginning falls short of intention; only a certain series of contractions of certain muscles in proper proportions and proper order are capable of realizing the end aimed at, with the maximum rapidity and certainty, and minimum obstruction and failure and corresponding effort." [1]

Observation led to these generalizations, but later experimental work was able to show what happened between the bungling beginnings and final facility. To watch the expert telegraphist tapping out a message in Morse gives no clue to the slow, uneven process of learning; many learners can be seen even with their legs rigid, and the light, even pressure on the key, which is the aim, takes a considerable time to perfect. An ever-increasing number of industrial processes involve the formation of muscular habits, and knowledge of the psychology of habit-formation is essential.

In the laboratory it is possible to form muscular habits for experimental purposes and by means of a stop-watch to time the various efforts and so study the stages.

Every student of any habit, whether in himself or in others, knows that a teacher is an advantage, that improvement is quicker when at the various stages an expert, not only at the activity in question but at the teaching of it, is available. The business of the teacher is to observe the performance of the learner, to encourage the actions that further the desired end, and to discourage those that interfere. If learners are left to "pick up" a habit they often retain movements which are unnecessary and therefore wasteful either of time or energy.

This is precisely what Taylor and Gilbreth aimed at in that part of their work devoted to the study of the movements

[1] G. F. Stout, *Analytic Psychology*, I, p. 258.

The wasteful movements were to be dropped, good ones to be encouraged. In addition to the purely human aspect, the material instruments, e.g. the tools of the activity, were to be a help, not a hindrance. They were really introducing some of the methods of the laboratory into an industrial activity and trying to measure accurately the stages of learning after having analysed the finished product.

In a simple way every person who is skilful at some activity studies it, and, at least as far as observation helps him, he uses Motion Study to help or criticize someone else. "That's a clumsy way of doing it", says the parent to a child. "That's no way to do it", says the mistress to the maid; "it's quite easy done this way."

In both cases the speakers aim at an easier movement, omitting the unnecessary movements. Rarely do even teachers, unless in the case of sport, learn to go much further.

The Process of Habit-Formation

It is always a good thing for anyone interested in a study of skilled movement to experiment on himself before attacking the problem of other people.

Take some relatively simple industrial process such as handkerchief folding, tying the bow on chocolate boxes, or placing collars on a collar machine. Find out what has to be done and then repeat the process a number of times and let a critic time each effort with a stop-watch and note the times in seconds and describe the movements.

Or take the favourite laboratory experimental habit, the following with a pencil or large needle of the outline of a star drawn on a card, the hand being seen in a mirror. As before, time the sequences of efforts. If a more difficult task is desired, use the left hand.

It will be found that the rate of improvement is not constant, that when improvement has occurred it is not permanent—many examples of backsliding occur—and that there are stages when no improvement at all is observed. The same kind of development is known in sports and games of all kinds and is equally true of industrial processes.

The observer should also note the unnecessary movements, of which the doer may be quite ignorant. In distinguishing

the useless from the useful movements care must be taken to make sure that what appears useless really is so. Sometimes what appears to be a useless one is really an advantage by making a more rhythmic sequence. In one process of brush-making the workers throw the back of the brush into the air and catch it, apparently quite unnecessarily; actually the additional movement makes with the preceding and succeeding one a rhythmic whole. Farmer also found the value of a curved rhythmic movement in the process of sweet-dipping.

In forming any habit, it is essential not to form in any part of the process, a bad habit. When this happens it has to be altered later, but "nothing we ever do is, in strict scientific literalness, wiped out", so that there is a tendency in moments of stress or absentmindedness to go back to the earlier method; technically this is known as regression. "The unexpected return to some previous habit is one of the commonest human errors in all mechanical activities. Innumerable instances can be gathered from games and from daily life. A man who has driven a motor-car with the levers to the left, and then becomes habituated to the more ordinary form with a right-hand brake, may find in an emergency that he is groping to the left. A golf-player who is 'off his game' finds that he has fallen back to some long-conquered fault." [1]

It has been suggested that some inexplicable accidents may be due to this. Hence one part of the teacher's job is to prevent as far as possible the fixing of faulty methods. In investigating sufferers from telegraphists' cramp it was noted that some of them had regressed to the laborious style of sending, characteristic of many learners.

A very simple Time Study might reveal that a machine is too quick or too slow for the worker, and hence strains the one and irritates the other; it might show that one worker in a group has too easy a time and another too difficult.

When in 1919 the Industrial Fatigue Research Board was formed in succession to the Health of Munition Workers' Committee the problem of Time and Motion Study proved to be important, firstly from the point of view of research to see how far it was possible to apply these methods to industrial

[1] "Medical Problems of Flying", *Medical Research Council Special Reports*, 1920.

movements, and secondly when the method of timing was used, in order to investigate environmental conditions, or the effects of different lengths of working days.

The English investigators had the very great advantage of being independent of the industries they investigated. It was their business to obtain data by such means as they could and from a consideration of the evidence to reach conclusions, positive or negative, without having to consider whether their results agreed or disagreed with any preconceived theory or group interest.

Analysis of a number of investigations into such diverse industries as moulding and casting hand-grenades, cotton and silk weaving, sweet-dipping, chocolate-covering, buffing of spoons and forks, laundry work, etc., showed that in each process there was an amount of unproductive time, useful neither to the worker nor to the management, and that there were very great individual differences. As Taylor found with shovels, some of these researches revealed the necessity for more recognition of the worker of the machines or the user of the tools when the engineer was designing them. These researches, extending over a period of about twenty years, show that there is plenty of room for the application of the physiology and psychology of habit-formation.

So much for the general aspect. Let us consider Time and Motion Study in a little more detail.

"Time Study is the study of the time taken to perform each particular operation in an industrial task, and from the data thus obtained endeavouring to fix the proper time that the task as a whole should take."

"Motion Study is the study of the movements involved in a task with a view to eliminating such as are unnecessary and improving the others." [1]

Actually in most investigations both are essential, though in any particular one, one or other may be of primary interest. Definition often looks simpler than the facts appear to be. Given an industrial task, where does one begin in a process that seems to be continuous? The answers to these questions will depend on the nature of the work and the motive for the study. Nor can it be assumed that two

[1] Eric Farmer, *op. cit.*

researchers working independently would in all cases select the same units. Here is a simple example of Motion Study, in which the steps are analysed. The materials are a bottle of gum and a brush.

Actual Movements.	*Generalized Description.*
1. Reach for the gum bottle.	Transport empty.
2. Grasp the brush.	Grasp.
3. Carry the brush to the paper.	Transport loaded.
4. Position for gumming.	Position.
5. Gum the paper.	Use.
6. Return the brush to bottle.	Transport loaded.
7. Insert the brush.	Pre-position.
8. Release the brush.	Release.
9. Move the hand back.	Transport empty.

The units into which an activity could be analysed Gilbreth called therbligs (i.e. Gilbreth backwards). The generalized description will be recognized as very common sequences that would apply to an enormous number of industrial and domestic operations.

As this sequence stands, anyone might ask what is the use of detailing a series of movements that are practically one unit movement. Perhaps so, but suppose the gum bottle is just out of reach, so that the user has to stretch his arm to get it; then the first and the sixth movements may take a second or more extra time. Suppose the sequence of movements takes place 20 times an hour, and that 3 seconds are used unnecessarily with each sequence, i.e. 60 seconds or 1 minute an hour, which in 8 hours will mean at least 8 minutes; if there are 100 workers, that would mean 800 minutes or over 13 hours in a day. This kind of loss has been noticed many times in industrial processes. An interesting example[1] was given by H. Maule when timing the process of folding sheets. The sequence of movements was: collect a sheet as it came from the calender, fold it, place the folded article on a table. In the course of timing he noticed that a disproportionate amount of time was taken in the last movement owing to the position of a table on which the folded articles were placed. By calculating the time taken and multiplying it by the number of sheets folded in a week he found that 20 miles a week were

[1] H. G. Maule, "Production Methods", *Journal of Institution of British Launderers*, May 1935.

walked unnecessarily. The operation of folding sheets is a rhythmic and energetic one. To add to this a walk of twenty miles a week was out of all proportion to the modern desire for exercise. By a slight rearrangement of the table this was altered, and yet no one had noticed it before this.

A domestic version of a time and motion study is given by Miss A. G. Shaw.[1] It illustrates the sequence of movements in toasting bread by means of an electric toaster, and shows the reduction in time when, instead of the ordinary method, both hands are used, and the movements simplified. (Page 146.)

It is frequently argued that to save 2 seconds on an initial 4 seconds is of no particular importance. If the activity is to be performed only once, or at most 2 or 3 times by one person, the objection is valid, but if that same sequence of movements is to be performed hundreds of times by hundreds of people, the saving is of considerable value. Hours of work might quite satisfactorily be reduced, or rest pauses introduced, by the accumulation of such savings.

There is nearly always some opposition to alterations in the fixed habits of most people, but beginners might be taught the more economical ways of doing jobs, and new processes should be studied before those who are to do them learn uneconomic methods.

It is necessary to distinguish between Time and Motion Study as a scientific investigation and mere speeding up. It does happen, as a rule, that a study of movements is followed by increased output, but any system which results in what workers call being "keyed up" stands condemned. The proper use of Time Studies is to suggest lines of improvement, to form the basis of training, and to determine the relation between processes, not to standardize the workers. It is therefore a means to an end, not an end in itself. A Time and Motion Study is essential in new processes in order to discover the most satisfactory method of doing the particular activity for the purpose of instruction of entrants, and to fix rates of payment. Some of the objections to this work have come from those connected with long-established processes, where little change takes place from year to year. Even here in not a few processes the work might be facilitated by intelli-

[1] A. G. Shaw, "Motion Study in the Home," *A.E.I. News*, VII, 7, 1939.

PUTTING BREAD INTO TOASTER

Ordinary Method

Left Hand.	*Right Hand.*	*Approx. Time in Seconds.*
Pick up bread	Open side of toaster	½
Put into toaster	Hold open	1
	Close toaster	½
Move to other side of toaster		1
Pick up bread	Open toaster	½
Put into toaster	Hold open	1
	Close toaster	½
	Total Time	5
When toast is finished.		
	Open toaster	½
Take out toast	Hold open	½
	Close toaster	½
Move to other side of toaster		1
	Open other side	½
	Hold open	½
Take out toast		½
	Total Time	4

Total time for loading and unloading toaster in the ordinary way with two slices of bread, *approximately* 9 *seconds.*

New Method

Left Hand.	*Right Hand.*	*Approx. Time in Seconds.*
Pick up bread with thumb and 1st finger	Pick up bread with thumb and 1st finger	½
Open toaster with 4th finger, and this operation brings bread into position to drop into toaster	Open toaster with 4th finger, and this operation brings bread into position to drop into toaster	1
Close toaster	Close toaster	½
	Total Time	2
Open toaster	Open toaster	½
Pick up toast	Pick up toast	1
Close toaster	Close toaster	½
	Total Time	2

Total time for loading and unloading toaster with both hands symmetrically with two slices of bread, *approximately* 4 *seconds.*

gent Motion Study. In a number of industries that have come into being during the last 20 or 30 years, and which owing to rapid development are constantly changing, there is no other way, except by rule-of-thumb, of rating them and teaching them. I once asked a Time and Motion Study expert employed at a large engineering factory if the people he timed objected. He cheerfully replied, "If they did, I should get the sack. It's up to me to do my job successfully and tactfully." In time such work becomes an integral part of the system, accepted both by workers and management. There are considerable developments of technique which are described in detail in the text-books.[1]

Intelligently applied, Time and Motion Study is an excellent instrument, but, like all instruments, it may become an end in itself, in which case it is either useless or pernicious. Mechanically used, it loses all humanity and the muscles of the worker are considered as an appendage to the machine instead of a part of the human being.

It is, however, quite unnecessary for want of imaginative study to subject an ordinary worker to the lot of the sinner whose fate is described in the rhyme:

> And then he played extravagant matches in fitless finger stalls,
> With a cloth untrue and a twisted cue,
> And elliptical billiard balls.

Time and Motion Study would have seen to these faulty tools, and this trivial example, in spite of its absurdity, is not altogether remote from the methods of some factories.

Henri Fayol [2] has tried to study scientifically the work of the director of an organization with the same aim as Taylor, namely, to eliminate the useless activities, whether of thought or movement. He began by a kind of job analysis of business operations, which he says can all be classified as technical, commercial, financial, insurance, accounts (that is statistics), and administration.

The first five are not concerned with general direction and are generally recognized as important, however large or small the organization may be. Administration has not been

[1] Those interested in details, particularly of engineering processes, will find an excellent exposition in *Motion and Time Study* by Barnes, 1937.

[2] *Administration Industrielle et Générale*, Paris, 1931.

adequately studied nor its functions sufficiently defined, much less has the need for training been realized.

Administration comprises the capacity (1) to look ahead and draw up a programme, (2) to organize, that is, to form a unity of the material and the social elements of the organization, (3) to control the personnel, (4) to co-ordinate all the efforts of the organization in order to facilitate the harmonious working of the whole, (5) to exercise such control that the policy of the organization is properly carried out.

An exclusively technical education is not an adequate preparation for administration. Just as in the case of the bench-worker the hindrances to effective bodily activity must be eliminated, so for the administrator it is necessary to render as effective as possible the working of his mind.

It is perhaps not beside the point in this connection to note that if some heads either of departments or organizations analysed their activities systematically they might find that there was considerable waste: to look busy is not equivalent to doing creative work.[1]

Not only the worker with his hands but "well-intentioned people using a lot of misdirected energy without the use of brains or common sense waste more than all the deliberate idlers in the world. The overworked man may be an example of bad organization." Or, as R. L. Stevenson says of the industrious fellow, "He sows hurry and reaps indigestion; he puts a vast deal of activity out to interest, and receives a large measure of nervous derangement in return. Extreme *busyness* is a sign of deficient vitality".

[1] Professor Cyril Burt has used the principles of Motion Study for the interpretation of some of the problems of phonetics, as applied to the learning of a foreign language and to the difficulties of a mentally defective child.

A. P. Herbert in "What a Word" has subjected official and commercial correspondence to the principles of Motion Study. The movements concerned are those of the muscles used for speech and for typing. By an elimination of the unnecessary words, and consequently of the movements required, he expresses the meaning of a letter in 35 instead of 66 words, or 157 instead of 294 letters.

Chapter VI

TEMPERAMENTS, PARTICULARLY THE NERVOUS[1]

In discussing industrial problems reference is often made to nervous strain, nervous irritability, temperamental qualities. Most people attach a vague meaning to these phrases, but would find it very difficult to express their meaning precisely.

So far in discussing the factors that affect the worker it has been assumed that all the people were capable of adjusting fairly easily to reasonably good conditions of work. Such an assumption cannot, however, be made for all; there are people who find conditions to which others are neutral extremely trying, but they may be unaware that they are different.

Now the person who has not the requisite intelligence for the higher regions of intellectual attainment is easily recognized and understood; the person who lacks some special aptitude—who, for example, can never *do* drawing, engineering of any kind, play an instrument, and so on—is also understood, and after initial trial is rarely induced to bother about it; he acquiesces in his failure and may even pride himself on it. But our intellectual and practical development do not exhaust our mental make-up. Of equal, if not of greater, importance is the emotional life, for "here are to be sought the sources of all mental energy and the motives of all human action".

Man may be a rational animal, but he is also an extremely emotional one and is not averse, in disregard of reason, "to cutting off his nose to spite his face". Observation shows that two main groups of emotions may be distinguished: (1) the aggressive group, for example, joy, anger, self-assertiveness; and (2) the inhibitive group—grief, fear, disgust, self-submissiveness. If the first group are in the ascendant, the result is an aggressive temperament; if the second, a repressed or inhibited temperament.[2]

[1] The data and experimental work for this chapter are taken mainly from Report 61 of the Industrial Health Research Board, 1930.

[2] Cyril Burt, *The Subnormal Mind*, London, 1937.

On the whole, the 19th century neglected the temperamental life; but throughout history there runs a recognition of the importance of the emotional or temperamental make-up of individuals for health, efficiency, and happiness. A long line of observers, chiefly the more unorthodox doctors and Fathers of the Church, that is, those whose work brought them into responsible contact with human beings, have given as a fact of observation that there are considerable differences between people, expressed very clearly in their susceptibility to, and behaviour in, disease and death, and also in their reactions to other people. In spite of these differences observation shows that some people are more like one another than others, and so for as long as we have written records we have attempted classifications.

There is a curious family likeness about these classifications, not to be wholly accounted for by the popularity of Galen's work, for in spite of the rediscovery almost every century of his 9 temperaments, only 4 ever really achieved popularity, namely, the Sanguine, the Choleric, the Phlegmatic and the Melancholic, and of these the Sanguine and the Melancholic are described in the greatest detail and are by common consent held to be opposite types. The Sanguine is depicted as cheerful, quick in mind and action, somewhat inconstant, courteous, not quarrelsome, gracious, affectionate, "quipping without bitter taunting" as a 17th-century writer expresses it; the Melancholic is gloomy, dull, constant in determination, stubborn, grim, not ready to make friends, but, according to his more sympathetic describers, with the virtues of his defects, since he tends to weigh everything, to be reliable and uncorruptible; to the less sympathetic he is crafty, sad-countenanced, "the aquafortis of merry company, the contemplative slumberer".

Between the two, much less vividly described, were the Phlegmatic and the Choleric; the former is weak, slothful, treacherous, with a tendency to colds, and has the somewhat negative virtue of "not being given to craft or wrangling"; and the latter is characterized by vehemence of speech and action, swift movement, boldness, despising laziness, ambitious, but having the drawback of not weighing words and of being "bitter taunters, scornful mockers".

Cattell, writing in 1933, distinguishes two types called by him the Surgent, characterized by cheerfulness, sociability, quickness of apprehension, impulsiveness and originality, and the Desurgent, having the opposite reactions.

In the main, descriptions of temperamental types are of two kinds. In the first place, some ideal standard is taken, as with Galen, and the variants from this are really of the nature of failures to attain this standard; or in the second place, extremes are marked off and people fall somewhere between these extremes. The best-known example of this is Jung's Introvert and Extravert.

The distinction between the two lies in expressiveness. The extravert gives expression to "any tendency in movement and gesture, in facial play, in voice, in pallor or flushing, in emotional symptoms of every kind". He adjusts easily to the external world, has many interests, deals with life as it comes, acts first and thinks afterwards, and is "at home in the tumult and struggle of life". In contrast is the introvert, who is more interested in the inner life than in the outer world, appears calm and unemotional, since his emotions are rarely freely expressed; he tends to think and deliberate before acting, so his actions are uncertain and he finds difficulty in dealing with conditions requiring quick action.

Extremes certainly exist, and they often fail completely to understand one another; the majority of people lie between these extremes.

In the 16th century Ambrose Paré attempted a quantitative classification:

(1) Those who were emotionally perfectly balanced, that is, those who experience the emotion appropriate to the situation, fear when fear is reasonable and useful, anger when anger is useful, and so on, and who can act accordingly.

(2) Those whose temperamental organization is adequate for the duties required of them but not altogether perfect.

(3) Those who are somewhat unbalanced, but within the limits of health; for example, a person rather too liable to be afraid but not thereby prevented from carrying on, or one perhaps too easily stirred to anger although not sufficiently so as to impair his work. His efficiency and happiness may be impaired but not seriously undermined.

(4) Those whose temperamental lack of balance interferes with health.

Discussion of Classifications

What can the classification of people into types give us? No one would be likely to believe that the types represent any real fixity, but rather that they represent the commonest kind of emotional behaviour of an individual in given circumstances. If one had, for example, an account of all the emotions experienced by someone as well as the circumstances evoking them over a considerable period of time, then it would probably appear that for each person there was a majority of responses of the same kind—that, for example, in one there would be a large proportion of cheerful responses, while in another there would be a large number of gloomy responses. If we use the classical terminology, the one is Sanguine and the other Melancholic. We should also find that certain people were more like one another than other people, and so the idea of types would evolve. But it does not mean that the sanguine can never be melancholic nor the latter sanguine; but that there is a tendency, other things being equal, for one kind of response to occur more frequently. Extreme types are easily recognizable. There is the person who, for example, out of the reported news selects the most gloomy aspects, whereas another habitually selects the most cheerful. Usually each is unaware that such a selection has taken place, and neither can understand the other.

An example of cheerful and gloomy responses is given in the contrasted characters of Mr. Foster and Mr. Escot in Peacock's *Headlong Hall*:

> Contemplate the vast gain of human industry—seas covered with vessels, ports resounding with life, profound researches, scientific inventions, complicated mechanisms, etc., employment thus given to innumerable families and the multiplied comforts and conveniences diffused over the whole community.
>
> You present to me a complicated picture of artificial life and require me to admire it. Seas covered with vessels, everyone of which contains two or three tyrants and from 50 to 1000 slaves, ignorant, gross and active only for mischief. Ports resounding with life, in other words noise and drunkenness. Profound researches—to what end? To teach the art of living and disseminate independ-

ence and liberty and health? No, to multiply fictitious desire, invent unnatural wants.

It is equally important to note that a number of people, perhaps a majority, tend to be neither, even if intermediate types are interposed between the extremes. Some writers, most clearly Lotze, have suggested that the types are really age distinctions, the child being sanguine, the youth sentimental (=melancholic), the man choleric, and the old man phlegmatic. If this were true we should have a measure—supposing that we could test for the types—of a person's emotional age, a really very necessary, but very remotely possible, requirement.

Emotional experiences are the expression of a relationship between some environmental agency and the person experiencing the emotion, and potentially emotion-arousing experiences even for people of the same type are not equal in number or strength. And yet, while emphasizing the difficulties, the problem cannot be neglected, for experience shows the importance of temperament for success in life, particularly when the work involves getting on with others.

People who are really intelligent when the problem concerns things or symbols of things are often pathetically unintelligent when the problem concerns another human being. They treat subordinates, for example, as if they were automatic machines —surely unintelligent behaviour, use them as objects for the reception of their emotions or spectators while they display their emotional disturbances, and fail to realize that that is not the end. The head of a department who has irrationally vented his bad temper on his staff is sometimes surprised and pained when a little later he is not received with the enthusiasm he expects. He quite overlooks the reverberations of his own temper, and cannot realize that his staff are not automatic machines, responding to each emotional change in him. Resentment at unfair anger can last a long time and have consequences; is it natural that a waitress or shop assistant whose chief has irrationally vented his bad temper on her should behave as if she were quite tranquil? She might control her fears or rage in public, but it will be displayed in some form, and that form may be absence through sickness, an accident or breakage, irritability with others.

In estimating temperamental qualities one difficulty is that, except in extreme cases, the expression of them in life is dependent not only on the person expressing them but also on the environment calling them forth. All estimations also have to be made by some person whose standard is liable to change. Some time ago four directors of an organization graded their immediate subordinates, whom they knew well, into four categories according to their "ability to get on with others".[1]

To only 2 out of 29 did all the directors give the same grade: with regard to 16 there was a difference of 1 grade between the highest and lowest award; with 5 there was a difference of 2 grades, and with 6 a difference of 3 grades, i.e. one director ranked a man as A and another as D.

Again, the assessor is usually unaware of the effect of his own temperament on others, so some people never see others naturally. A good example of this is given by A. C. Benson in his Life of his father, sometime Archbishop of Canterbury. He writes: "I do not think, as I have said, that my father was conscious of the terror that he could inspire; he suffered himself much from shyness, but not nervousness, and from a great deal of acute mental depression, which in early days had a blackness and fierceness of misery that must have been very trying to those most nearly connected with him. I believe he never attended a meeting of the Governors without saying gravely to my mother, that this time he expected to receive his dismissal. He had joked about it before—but *this* time it was serious!"

Some people have thought to overcome these difficulties of assessment by the use of rating scales; this gives an appearance of statistical accuracy, but the assessment is still personal and likely to vary within wide margins, possibly unknown to the assessor.

How are we to assess temperament? Tests can measure intelligence so that a young person may be ranked according

[1] "Sociability" is not exactly the word, for two people may, when in a group, give the impression of being very happily adjusted and yet to themselves be very different; one might elect to be with the group, preferring to be with others rather than to be alone, whereas the other might accept the group and be successful with it but, if given the choice, would prefer to be alone.

to a fairly definite objective criterion. But how can one compare one temperament with another? Is A's fear greater than B's, and if so, what is the standard? What is the effect of the other emotions on the fear? From observation of many people in the course of industrial investigations it is clear that the emotional organization, i.e. the temperament, is of vital importance.

It is not always realized how complex each moment is as regards possibilities of experience. For example, X gives a command to A and B, and X is, in all probability, only conscious of what he wishes to have done. If A and B were purely rational and aware that they had to do it, they would use their energy to devise means for its execution. But that command, in addition to being a command, is given by X, and X's manner of commanding might, quite irrationally, infuriate A and leave B unmoved; then it belongs to the category of commands, and A may always resent commands of any kind merely because they are commands, while B may prefer to obey rather than to initiate. The intelligence with which A and B attack the work when they do begin, and the practical ability with which they execute it, may, at least in theory, be quite outside these reactions. The fringe of emotional possibilities surrounding, in this case, the command is sometimes more real than the content of the command, and may be reflected in the difference in the way in which X's commands are received compared with Y's. Suppose that A and B have both responded with resentment to a command of X; they will differ in their treatment of that resentment. In one it will be allowed full sway and will tinge his whole response; the other will recognize his own tendency, judge it to be futile, and refuse to let himself act on it.

As an industrial problem the investigation of temperament came through a disability associated with telegraphy. Telegraphists who have been trained to "send" telegrams by the Morse or Baudot systems are liable to a disability that prevents them from sending effectively. This disability may be of such a nature as (*a*) to interfere with most of the muscular activities of the hand and arm, or (*b*) be limited to the sending of one particular sequence of "dots" and "dashes". The most obvious explanation was that the constant delicate movement

made in "keying" had resulted in chronic muscular fatigue, the cure for which would have been rest; or that some organic disease affecting the nerves and muscles of the arm had been set up. Neither explanation fitted the facts, for a detailed study of the general environmental conditions failed to find any one that was always associated with cramp, and no organic weakness has so far been revealed.

Attention was next turned to an experimental study of the differences, with regard to neuro-muscular disability, between telegraphists with cramp and those without cramp, by means of the ergograph test, the dotting test, the sending of a telegram with an apparatus that registered instead of dots and dashes the pressure exerted. One would naturally expect that telegraphists suffering from cramp would be inferior at all such tests to telegraphists free from cramp. The tests, however, failed to differentiate the two groups adequately, some of those with cramp being quite as efficient as those without, though the extreme cases were fairly clearly marked.

The next stage was to find out the differences, if any, in the temperamental make-up.

The results showed that over 75% of the telegraphists with cramp had symptoms which would lead, quite apart from the cramp, to a diagnosis of a mental disturbance known as psycho-neurotic or in popular language "nervous"; in the other group only 35% had such symptoms. This investigation, and the accident investigations, passed through similar stages, leading from a study of the external and general conditions to the personal.

This investigation, involving as it did a study of nervousness, opened the way to the possibility of extending the method to other problems, to throw further light on this as on the others. Some of these problems are:

(1) What is the incidence of nervous disorders in different groups?

(2) Why, in some groups, does sickness absence from the so-called nervous disorders increase even in the presence of excellent material conditions?

(3) What are the external conditions that cause a nervous person to break down?

(4) Why are some workers erratic, oscillating in output between two extremes for no apparent cause?

(5) Why do some people suffer acute discomfort on account of conditions that are to others neutral?

It will be the work of years to get even approximate answers to these questions. The first problem was to attach some definite meaning to the vague phrase the "nervous temperament".

The use of the word "nervous" in this connection has no relation to the organic nerves, but stands for some disturbance of emotional balance, which may be reflected in difficult behaviour, in a so-called nervous breakdown, in erratic or abnormal work curves, or in irrational unhappiness. There is a considerable body of opinion holding that "nervousness" is on the increase, but the same view has been held for nearly two centuries. A study of nervous symptoms as revealed by the sufferers themselves and those who work with them show that faulty emotional adaptation to the environment is involved. The same symptoms are described by Galen in the 2nd century, and, though the names vary, in every succeeding century. The word "nervous" came into popular use in the 18th century, due to the interest in the physiology of nerve conduction: the use of "irritability" to describe a physiological property of an organic nerve may have suggested a connection with "irritability" of temper and led to the belief that they must be connected. Previous generations believed the same symptoms to be caused by the circulation of the blood, the humours of the body—in fact, by whatever was the prevailing physiological interest of the period, and in our own time the glands have occupied the position of cause.

That the symptoms of "nerves" are not the product of a machine age is illustrated by a comment of Dr. Cheyne writing in the 18th century. He estimated that nervous disorders, by which he meant "spleen, vapours, lowness of spirits, hypochondriacal and hysterical distempers, make almost one-third of the complaints of the people of condition in England". His alleged cause is environmental, namely "modern luxury". In the early 19th century Dr. Trotter remarked that nervous disorders were not confined to the middle and upper classes

but were also found in the poorer classes. His list of symptoms includes: "an inaptitude to muscular action, or some pain in exerting it; an irksomeness, or dislike to attend to business and the common affairs of life, a selfish desire of engrossing the sympathy and attention of others to their own sufferings; with fickleness and unsteadiness of temper". He estimates that they constitute two-thirds of the diseases with which civilized society is afflicted, and thinks they are due to an inherited predisposition as well as to the luxury of modern life.

Details of a Recent Research

Unlike intelligence or practical skill, there are no means of estimating temperament except by means of a personal interview. In this research this was done by Dr. Culpin, an experienced medical psychologist. The object was to see if in an interview it was possible to find out how people did behave and feel in emotionally toned situations.

From an industrial point of view the success of any worker involves: (*a*) skill in his actual work; (*b*) ability to adjust easily to equals, superiors, and subordinates; (*c*) ability to adjust to the more general conditions of that work, e.g. varying stress, monotony, etc.

The interviewer made it quite clear that there was no question of "ought", and the responses were discussed as interesting phenomena. It is not possible in research work to produce real emotional situations to see how people would behave, so descriptions in words have to be used. Experience of many subjects has shown that, in the great majority, there was a willingness to help, sufficient powers of introspection, and adequate memory to provide useful data. In the interview the subject was asked how he dealt with various situations that might arise in the course of his ordinary industrial life. Such situations refer to his superiors, subordinates, equals, his work and interests.

(1) *Reactions to Those in Authority.*—Assuming that the person in authority is reasonable, and that his relations to his subordinates are not limited to blame, the attitude of different people varies within a wide range. Asked how he feels if sent

for by his Chief, A will describe himself as mildly apprehensive at first, but the feeling will pass off; B will experience interested wonder, and hope for a rise in salary; C will feel shaky at the knees; D will prepare for some most improbable worst; E will feel that he had done something wrong though knowing he has not; F will feel all right if he knows he has done wrong but apprehensive if he knows he is innocent. Such are some of the descriptions given by the subjects to a situation that happens to the majority quite frequently. One girl said that she was frightened if she had to take down shorthand notes from someone she considered in authority, that she had not the faintest idea what she wrote, and only her excellent automatic knowledge of shorthand enabled her to carry on. A laundry worker graphically described herself as "faintified and worrified".

(2) *Reactions to Subordinates.*—People in authority often admit to being in awe of a group as such, so that they cannot address their own subordinates without acute discomfort; some would never attempt it. They may assume a blustering or autocratic manner to prove they are not afraid. Some show their difficulties in a propitiatory manner expressed in speech, voice, or attitude, and worry their subordinates by futile criticism or tactless opposition.

They may live in fear of bankruptcy, the equivalent at that level of the "sack".

The well-balanced people can adjust to the group easily and may get pleasure out of dealing with the group.

(3) *Reaction to Oneself.*—The capacity to deal fairly with oneself varies greatly. There is at one extreme the person who is never sure he is right; should he be challenged, that immediately causes doubts to arise: he is always wondering if he is right, and even the assurance of a competent outsider fails to carry effective conviction. At the other extreme is the person who is irrationally sure he cannot be wrong; he dare not let himself be wrong. The well-adjusted person can see himself in perspective, and just as he knows that there are people who are taller or shorter than himself, so he recognizes that there are people who know either more or less than

himself, and he suffers emotionally no more in regard to the latter situation than to the former.

(4) *Reaction to Equals.*—Each person has to adjust not only to his superiors and subordinates but also to equals. A man who readily gets into touch with others when there is need, who can realize their point of view, emotional as well as intellectual, and adapt himself to it, is more likely to be happy and successful at his work than the shut-in person, who on all occasions "keeps himself to himself", makes no friends, and dislikes strangers. An opposite type, and obviously not likely to be noticed in the group, is the person who cannot be happy away from the group; he is a failure to himself, not to the group.

(5) *Attitude to Work and Conditions.*—Some subjects, instead of realizing their mental states as personal, objectify them, and interpret their personal state as a quality of the work or of its conditions. Hence noise, or the absence of noise, light, stuffiness, types of machines or keys, assume a disproportionate significance. If only the particular feature that appears so wrong could be altered, all would be well; the irrational nature of the complaint is disclosed when the alteration is made and the mental state is then reflected in some other impediment to complete satisfaction. In others there is an irrational inability to consider a piece of work finished. They take abundant pains when doing it, finish it with meticulous accuracy, and then begin to have doubts about it. As long as it is possible they keep the work under their own control; when it has gone they try to recall it under various pretexts, and when away from it are liable to see the mistake they have not made as a persistent visual image—feel certain in the dead of night that they have written "London" for "Liverpool", put poison in a prescription, or telegraphed the wrong word, etc. The severity varies from a mild attack that might affect anyone to a total inability to resign any work voluntarily. I once saw a young ironer of this type who was regarded as abnormally fussy and her peculiarity recognized, so that the manageress used to go and take the beautifully finished article from her. I did not know enough at the time to

ask her about herself. As she became worse in the late afternoon, I looked upon the symptom as a fatigue phenomenon. These are temperamental differences in reaction to repetitive work. The extraverted person, dependent on external reality, suffers more than the introvert who may find relief in reverie or direct thinking.

Information with regard to these various attitudes to life was sought from each subject in an interview lasting about 20 minutes. A rigid questionnaire was not used, for the variety of symptoms and of their mode of expression is infinite. The general scheme was that the subject was led through various hypothetical situations, such as those described above, that would stimulate the symptoms most commonly encountered. If a subject talked easily he was allowed to follow his own path, questions being asked either when he stopped or when some explanation was needed.

Subjects sometimes described themselves as nervous because of a feeling of discomfort at examinations or of uneasiness when undertaking something new. Such characteristics, in so far as they did not deter the person from action or interfere with his happiness when the occasion was over, were not called symptoms; they are the common human reaction to the unknown and can be modified by experience.

Remembering that emotional would be more accurate than nervous, we can distinguish a symptom from a useful characteristic or a harmless idiosyncrasy by its consequences. The emotion of fear, for example, with its complicated machinery of adjustment, has been of biological utility in the race; but that which arouses the fear, as also the mode of expression in action, should, for health, bear a useful relation to the situation. Normally a group of conditions that has aroused fear should cease to do so if experience has proved the absence of dangerous or unpleasant consequences. Sometimes, however, such a fixed association is made between the arousal of the emotion of fear and some particular group of circumstances that, given these circumstances or part of them, the emotion must follow.

For example, it would be reasonable for a person to fear his Chief if the latter had power to dismiss him for a mere

whim, or if he were a bully. If, however, his actual experience of his Chief is that he is reasonable, with no power of dismissal, and yet he always experiences fear in his presence, knowing it to be irrational, then that automatic useless response is called a symptom, an emotional mal-adjustment to the situation.

In addition to being interviewed, each subject was tested by means of the dotting machine. In a study of Telegraphists' Cramp it differentiated the cramp subjects from the others better than any other test. The actual form used was a modification of the original made by Dr. Schuster, described on page 28.

It did prove possible from an interview to classify people, almost on the lines of Ambrose Paré, into (1) those who, for practical purposes, could be regarded as emotionally balanced; (2) those who had slight difficulties occasionally or in regard to one particular condition; (3) those who were somewhat unbalanced, but not to such a degree as to interfere seriously with efficiency or health; and (4) those who were finding their emotional difficulties a serious hindrance.

Types of Symptoms

Taking a surface classification, the symptoms were of two types:

(1) Symptoms appearing in a recognizable emotional form, chiefly of the nature of fear, connected with some specific thing or general situation, e.g. fear of the dark or of something associated with the dark, fears of being looked at in a restaurant or at work, to such a degree as to interfere with behaviour, fears connected with authorities, causeless apprehension, irrational worries connected with the work or with the imagined judgments of other people, and such like. A person with such symptoms when in a position of authority gives the impression of strain; he is irritable with subordinates, and hence appears erratic and unreliable and is frequently accused of nagging. These symptoms are called "anxiety" symptoms.

(2) Symptoms chiefly expressed in consciousness by unreasonable "drive". The person says he is forced to think certain thoughts—which may be emotionally unpleasing,

apparently futile, or abstractly speculative—while recognizing them as irrational. The penalty for fighting against them, even when that is possible, is great stress. Such symptoms are called obsessional.

It is not easy to detect these people, for their symptoms may not be expressed in unusual behaviour and they frequently deny that they themselves are "nervous" though they may admit to being "nervy". They rarely display their mental state; they believe strongly in the power and importance of self-control, which they exercise consciously. They tend to overwork and often are unable to rest easily; they give the impression of taking the line of the greatest resistance. When a breakdown comes it is usually ascribed to overwork, though the overwork itself is a symptom and not the cause of the state.

They may be over-conscientious either in general or merely in regard to some one particular. They are often intellectually superior, some occupying important positions; yet their mental conflicts, in which they use up much energy, seem to prevent them from reaching their highest efficiency. Their insistence on self-control may be the expression, as an over-compensation, of the recognition of the fact that they know there is a part of themselves they do not control.

Examples: (1) *A Well-Adjusted Person.*—AB finds his work interesting and looks forward to getting on—goes in for sports, hobbies, and other activities not connected with his work—is sociable—enjoys being with people—if shy at first with strangers, becomes less so with experience—respects authority, but is not overwhelmed by it—can be observed without undue emotion—can hold his own with and against his fellows—can realize himself in relation to others reasonably, i.e. is neither unduly elated at his own attainments or unduly depressed at what he cannot do—if in authority is neither afraid of nor regardless of his subordinates.

(2) *Anxiety Type.*—CD calls himself nervous—has always been afraid of the dark—imagines something is going to rush out at him—cannot work successfully if anyone watches him—trembles all over if sent for by his Chief—worries over his work or imagines mistakes—worries about other people's opinion of

himself—doesn't get on easily with others—has days of causeless apprehension. Such a person is usually recognized by others as "nervous". Even though he should be in supreme command, his subordinates *en masse* can constitute an authority before which he mentally quails, and he attempts to hide his state by over-compensating. He seems unfair because he is too afraid of being wrong or of making a generous mistake, hence his praise is neutral.

(3) *Obsessional Type.*—FG is an example of another type—he says he is not nervous—but has to dissect everything he does and then dissect the dissection—speculates on what might happen to people or the world—wonders who he is and must go on till thoroughly tied up—must go back to verify what he knows he has done—gets agitated if something is out of place, tries to train himself not to, but something makes him—must concentrate even on mechanical work.

Comparisons of Groups

Over 1000 people have been examined, including factory workers, clerical workers, technical and administrative workers. It was found that "nervous symptoms" or emotional mal-adjustments were not limited to any one group, sex, or age, although the relative number of "nervous" to "not nervous" people varied in different organizations regardless of the kind of work done. The percentage of people in need of treatment ranged from 1% to about 7% in the selected groups. In one group the "well-adjusted" people formed 61% of the total, against 24% in another. The group with the 61% was an unusually selected group. Circumstances peculiar to the firm had drawn the attention of the medical staff to the necessity of selecting employees not only for physical and technical qualifications but also for temperamental, at which selection they became expert. This selection also resulted in a low sickness rate.

Two groups showed a striking similarity of distribution, namely 52% and 48% well adjusted respectively, 20% and 21% with slight difficulty, and 17% and 16% with serious difficulty. These groups were investigated with a considerable

interval between, but it is interesting to note that they were engaged in the same kind of work and had been recruited by the same kind of examination. It is some evidence of the reliability of the interview.

The next problem was to see if the presence of nervous symptoms was in any way reflected in work. Since all the people studied were sociologically efficient, i.e. earning or preparing to earn their own living, there was no question of extreme incompetence. Does the presence of nervous symptoms make adjustments to the ordinary economic environment difficult in any way?

Expression of Nervousness in Work

(1) *The Dotting Test.*—This test proved to be related in a very interesting way to nervous symptoms. There are in all 350 dots to be marked. When the average number of correct hits was worked out for the various types, i.e. the well-balanced, those with anxiety symptoms, and those with obsessional symptoms, it was found that the first group was more efficient at the dotting than the second group, but that the third group was very much more successful than either of the other two. For example, taking 240 dots as an arbitrary standard of success, in a group of clerical workers about 5% of the well-balanced and 3% of the anxiety group reached this, but over 29% of the obsessionals.

Omitting the obsessionals, there proved to be a gradual decrease in efficiency according to the severity of the symptoms.

It must be noted that this test is only of diagnostic value for extremes. There are a large number of people from whose dotting record no diagnosis can be made. When, however, a person of high intelligence and no disabilities, such as bad sight or stiff fingers, gives a record of 150 dots, anxiety symptoms may be suspected, and with a record of 300 obsessional symptoms.[1]

[1] It is necessary for any person who proposes to use the machine to inform himself of its limitations and complications. For example, there is a quite definite relation between success at this test and intelligence; hence what would be evidence of anxiety symptoms in a person of high intelligence might be an ordinary record for a less gifted person.

(2) *Output.*—There is a prevailing impression that nervousness has a detrimental effect on output, but evidence is difficult to obtain and proof is impossible. It is not at all clear whether the implication is that the nervous person sometimes cannot use the ability he possesses because of his nervous symptoms, or that nervous people are essentially ineffective in any walk of life. The problem is not one of merely academic interest, nor is it confined to this country.

V. V. Anderson in America writes that of 1200 employees 19% of sales people were problem cases, and that in the cases of accidents, work failures, etc., it proved necessary to take the temperamental factor into consideration.[1]

Dr. Toulouse as a result of a study of French workers concluded that slight nervous disorders are infinitely more frequent than is usually believed, and that their reaction on an individual's capacity for work is disastrous. He computes the loss in sickness, in diminished capacity for work, in accidents and irregular output, as financially very serious.[2]

Some light was thrown on the problem by relating the presence or absence of nervous symptoms to efficiency at work as determined by those in a position to judge. To estimate the financial cost one would need to know, (*a*) the total possible effectiveness of any given individual; (*b*) the decrease of efficiency resulting from the operation of nervous symptoms in cases where conditions do not permit of their constant expression; (*c*) the number of days lost through sickness due to these symptoms and the cost to the firm. Such knowledge is not available.

It must be remembered that, except in a few specialized occupations, efficiency has not altogether an objective criterion; usually efficiency demands an ability to maintain a certain standard of work, and also an ability to adjust without friction to other people. In practice a fairly wide margin of variability is tolerated. The relative importance of what might be called the impersonal and the personal aspects of efficiency varies with the nature of the work. A typist working alone, merely doing what she was given to do, would be

[1] V. V. Anderson, *Psychiatry in Industry*, London, 1937.

[2] "Le Budget de la Psychopathie dans le travail", *Revue de la Science du Travail*, March 1929.

efficient if she did it accurately, speedily, and with little variation; the head of a group of typists would be efficient in so far as she could inspire her subordinates to do well and without friction the maximum amount of work. She might, if one considered only a short period, get this maximum, and that it was being done with strain either to herself or her subordinates might not be apparent. Sooner or later this strain, if present, would show itself, possible modes of expression being a high labour turnover among her subordinates in commercial firms or, where there is actual or virtual security, excessive sick leave or discontent resulting in less effective work. In complicated organizations it is not always easy to relate these conditions to any one individual, and so there is some difficulty in assessing efficiency.

One has also to take into account the person who makes the assessment. One person judges his subordinates according to his own feeling, another from a more general view. The data are obviously imperfect, but it seemed worth while examining them to see whether there existed any relationship between the presence or absence of nervous symptoms and efficiency at one's work. Extreme cases are well known, but may be misleading. A girl liable to hysterical attacks when there is a pressure of work, a young man who is emotionally upset when criticized, a supervisor who gets "on the nerves" of his subordinates, will obviously be inefficient in most occupations; as an offset there is the emotionally overscrupulous person, who in the right place is invaluable because of his dependable scrupulousness. Nor is efficiency a unitary condition; two people might be efficient at the same kind of work and yet have very different qualities.

(*a*) In a group of 69 men graded into 4 categories, A, B, C, D, for efficiency by their departmental heads, 61% of the A group were well adjusted and only 35% of the D group of workers.

(*b*) In a group where there was already a serious incapacitating disability, namely telegraphists suffering from cramp, investigation disclosed that about 76% of them had nervous symptoms, apart from the recognized disability.

(*c*) Similarly, in miners suffering from Nystagmus investiga-

tion showed the presence of nervous symptoms as part of the make-up of the majority.

The last two groups constitute extreme disabilities; the first group was engaged in work where a symptom could not receive such direct expression in the work.

Nervous Symptoms and Erratic Work Curves

All students of output have at times been faced with erratic or extremely variable curves in individuals, apparently not to be accounted for by any obvious condition.

In an investigation of typists for another purpose it was found that some of the records were of this type. As an individual temperamental study of each person had been made, it was possible to relate the output curves to the temperamental make-up. One subject with serious emotional mal-adjustment used to vary between two extremes, being either very good or very bad; while another had a very wide range of variability, practically any figure between her extremes being reached some time. The well-adjusted people proved much less variable.

Adaptation to Others

In many occupations efficiency in actual performance is not the sole criterion; it is necessary also to adapt to other people. In a small factory where everyone was known and where one person's behaviour was known to and could affect the others, descriptions of all from the point of view of adaptation to others were obtained. "Difficult" as used by the assessor included:

(1) Those easily upset or hurt, so that if young they cried when criticized or if older showed undue resentment.

(2) Those who were too truculent, so that any order, regardless of its merits, was likely to arouse opposition.

(3) Those who were too reserved and so did not mix with the others.

(4) Those who for some reason not apparent seemed to cause trouble around them.

As opposed to "difficult" were those who got on easily or

appeared to do so, and also a more negative type who seemed to get on, or rather did not "not get on", because they lacked the strength or independence to oppose. Some special cases were assessed as doubtful; they seemed to be somewhat difficult, but the assessor was uncertain whether this was due to high spirits, adolescent instability, or was symptomatic of more serious mal-adjustment. All had been examined for nervous symptoms. Of the 106 described as easy, 57% were in the well-adjusted class and 16% were definitely mal-adjusted; of 56 described as difficult, 31% were well-adjusted and 46% mal-adjusted. In two other groups a similar result was obtained. It is not suggested that social adaptability can take the place of intelligence or knowledge of the work, but these things being equal, social adaptability is an important component in the qualities necessary for efficiency. Nervous symptoms, then, become of additional importance by their direct relation to the smooth running of an industrial organization.

Nervous Symptoms and People in Authority

Among the subjects of this study have been a number of men and women holding positions of authority either as directors, proprietors, or departmental heads. They have been included in one group though actually belonging to different organizations. The majority held their position by virtue of ability. There were 47 men and 33 women. The numbers are too few for any generalization, but it is interesting to note that over 70% of the men and nearly 70% of the women have either no symptoms or symptoms only in a very slight degree. None of the men, and only 3% of the women, had serious symptoms. Evidently some selection tending to reject the worse types of nervous people has taken place. In one organization it would have been deliberate; it was not possible to get information about the others, but a rejection of those with a high sickness rate or a reputation for being "difficult" would eliminate some.

The problems of nervous symptoms and sickness can be studied from two aspects:

(1) The nervous type of those who have had much sickness absence.

(2) A comparison of the kind of people who have sick leave with those who have none.

So far the data available for such studies do not permit of more than a tentative opinion.

An opportunity occurred to see what kind of people had a nervous breakdown in one of the groups interviewed. 40 people who had had at some time more than 30 days' sick leave for a nervous breakdown happened to form part of one of the groups. Of these, 62·5% were diagnosed as having, as part of their make-up, nervous symptoms, and only 37·5% seemed well-adjusted; in the whole group of which these were a part, 47·5% had symptoms and 52·5% were free.

In two small groups it was possible to compare those who had had no sick leave during the previous year with those who had been absent. In each group it was found that those who had not had any absence for sickness had a higher percentage of well-balanced people than those who had had sickness absence. On the whole, there was a constancy of direction, i.e. the nervous people tended to be less efficient than the others and also to be more difficult to get on with, to be less satisfied with their work and to have a higher sickness rate, that is, the nervous person finds adjustments to the ordinary environment more difficult.

Must the Nervous Person break down?

An interesting question is whether the nervous person inevitably breaks down? It must be remembered that a nervous symptom is the expression of a relation between a person and his environment. For the purpose of argument let us suppose we have two people of equal intelligence, equal practical ability, equal vitality, and each with an irrational fear of observation. Let one be a typist working in a room alone, and let the other work with others and with a supervisor observing. The first will be able to work unwatched, and hence her particular symptom will rarely be "touched up", and that in itself is an advantage. Again, when people with this fear are watched they are liable to make mistakes, so the second typist will not only suffer acute mental discomfort, but also the effect of this expressed in mistakes and the conse-

quences of these mistakes. The full weight of the latter will depend not on the symptom but on the conditions of the work. The practical consequences are different and the second girl is more likely to have a breakdown. Some environments, i.e. those characterized by rigidity of organization and an arbitrary personal criterion of efficiency, are difficult for many nervous people. Ramazzini gave melancholia (i.e. nervous breakdown) as a disability of secretaries of great men, owing to the uncertainty of knowing how their work would be received. For example, the person who has ironed 20 shirts knows she had done so and knows if they are up to standard; the typist can worry for hours as to whether she has put "London" for "Liverpool", while the dispenser can picture the victim of an error dead or dying. The type of mind can be the same, but if its anxieties receive little stimulation in the ordinary daily routine there is less likelihood of a breakdown. The attitude of people in general and also of many in the medical profession to the "nervous" or psycho-neurotic person is that his symptoms, because frequently expressed in a mental form, are therefore controllable. Hence he is morally responsible.

This belief is well expressed in the following contribution to a conversation overheard in a queue: "And what I say to him is, that all he has to do is to conquer his nerves. And will he? No."

Some nervous people with a little help learn to understand themselves, and in the right environment carry on excellently; others need experienced treatment, of which, except for the few, there is none available.

Chapter VII

WHY WE WORK

> Who first invented work and bound the free . . .
> To plough, loom, anvil, spade—and oh! most sad,
> To that dire drudgery at the desk's dead wood?

In spite of the quotation from Charles Lamb, quite a lot of people work because they like it.

The distinction between work and play is not easy to draw, and it is even true to say that some people work harder to dodge work than those who do the work. Actually, the distinction lies not so much in what is done, as in the purpose of the doing; work implies something which must be done for the sake of something else, the compulsion coming either from outside circumstances, from the body or from the mind.

Play to a much greater extent is a matter of choice, being carried on for the sake of the pleasure it gives, so the amateur actor is playing and the professional working. Even so, the motives may change in the course of the doing, and that which began as work may become play and vice versa, or there may be elements of one within the other. Most people, however, who exchange their activities of mind or body for the means to live are working. The final end is to live. It is interesting and revealing to ask people if in the event of receiving a fortune they would remain at their present work. Can one imagine a person with a fortune continuing in routine repetitive work, or in the majority of industrial processes? On the other hand, those who find interest in their work, whether, e.g., artists, professional people, research workers, gardeners, might be unwilling to abandon their work or might continue it without the money motive.

If the question is put in the form of "Knowing what you do of the work, if you could choose again would you choose this?" a different distribution of answers may be expected. Whether they would choose the same or not may be dependent not on the nature of the work but on its compensations.

Discussions on incentives to work are usually too nebulous; there is no such thing as an incentive which can appeal to everybody, all the time; the age, sex, and type of the worker, as well as the nature of the work, have to be considered. The incentive must be put in its setting. For example, the person with security of tenure accepts that almost unconsciously, and the other incentives have to be judged against that background; the worker on a weekly wage, particularly during the period between the two wars, might feel that security of work would be the best incentive, impelling him to work he would otherwise reject. To some people security would be an incentive to seek something else.

(1) The first motive to consider is the money to be earned. Apart from what wages will buy, they symbolize a recognized position in society; the person receiving wages is independent, he is receiving something in return for something, so he respects himself and is respected.[1] It was the absence of this motive that rendered abortive so many of the otherwise excellent schemes to help the unemployed. There was only one way to help the unemployed, and that was to employ them in recognized necessary work. The philanthropic schemes, while helping to alleviate the monotony of having no work, were no substitute for real work.

Given the work and wages, what form ought the payment to take to act as a motive force to work to capacity? Should payment take the form of paying for the actual work done, or should there be a rate fixed by the time worked? Expressed in this way, and it usually is discussed in this form, no answer is possible. As with so many other problems, the answer depends on the nature of the work and on the make-up of the worker.

If the work is inherently interesting and the primary condition is quality, then an adequate time-rate has advantages. It takes away from the worker any temptation to do more, and therefore perhaps less perfect work, because of the desire to earn more. With this there may be as an inevitable consequence the absence of incentive to do the maximum. But one cannot have it both ways.

[1] Denys Harding, "Social Implications of Industrial Psychology", *Occ. Psychol.*, X, 3, 1936.

Should the work be inherently uninteresting, of a repetitive type, then if an adequate output is to be secured the interest should be attached to something other than the work, and on the whole the piece-rate method of payment has advantages.[1]

Again, the financial motive might be much stronger with a man desirous of marrying than with a woman of the same age, and with middle-aged workers compared with most young ones.

There are, however, many individual differences, and to assume that any motive is invariably effective is to misinterpret the evidence. There are people who prefer a time-rate because they can then concentrate on producing the most perfect work, and this motive will be found in the most varying occupations. A panel doctor gave as his reason for this particular form of practice that he could give as much time as he thought necessary to each patient, and he knew that the patient had not to worry about the bill.

When the wages are adequate and permit of a margin for occasional demands, other motives play an important part, and those who act on the belief that every man has his financial price are often disillusioned. I have heard complaints from managers who cannot understand that overtime, though well paid, will not compensate for everything.

On one occasion on a lovely summer day a factory received a sudden and urgent order, necessitating overtime. Trouble came at the refusal of the younger workers. But was it surprising that a girl who was going to meet her boy and spend an evening out of doors would feel that a little extra pay at the end of the week was an insufficient inducement? In this particular case the manageress made an appeal to them not to let her down, and they stayed. She was popular, known to be fair, and to be very much interested in all of them, so the immaterial factor of loyalty did what the material factor money could not.

(2) Though there are lonely jobs, yet on the whole work involves the companionship of people of similar interests,

[1] Wyatt and Langdon, *Inspection Processes in Industry*, Ind. Health Res. Board, No. 63, 1932; Wyatt, Frost and Stock, *Incentives in Repetitive Work*, Ind. Health Res. Board, No. 69, 1934; Wyatt and Langdon, *Fatigue and Boredom in Repetitive Work*, Ind. Health Res. Board, No. 77, 1937.

and that in itself gives satisfaction. Psychologists recognize a deep-seated instinctive tendency to seek to be with others, and work provides a ready-to-hand group. This is probably one of the reasons why factory work is more popular than domestic service.

(3) With this companionship of equals, subordinates, and authorities there are endless opportunities for sympathy, love, anger, elation, and even "envy, hatred and malice and all uncharitableness"—reprehensible, no doubt, but human. Some people who are in no way outstanding as workers get a position of their own with their fellows on account of their character qualities.

(4) In work there is a chance to express oneself and an opportunity for ambition, so even repetitive work to an intelligent person is endurable, if it is looked upon as a stepping-stone to something else. A number of people said that quite ordinary routine work was interesting if from it promotion might be obtained. A London organization with considerable interests in the East had a staff engaged mainly on ordinary clerical work, but with the very high proportion, namely almost 70%, of people who liked their work; in the course of the interviews it was quite clear that the organization afforded plenty of opportunity for the ambitious; only 3·3% disliked their work.

(5) There is a satisfaction in the exercise of skill, and the attitude of mind of the artist can be discerned at times in workers who are apparently doing work that seems extremely dull. One must, however, look at the worker not merely as the doer of a process but as a human being; and the satisfaction in the particular skill might not be obtained by everybody. The worker of a large machine, in discussing the personal difference between doing the work by hand or by the machine, said he liked to feel he had control of a big machine and that it gave him pleasure to manage it. The adoption of particular machines by particular workers and their dislike of other people using them, or to a temporary removal to another, also reveal a satisfaction that is not always recognized by an outside observer.

(6) And one must admit that even the prospect of monoton-

ous work with a group may be preferable to having no fixed work that must be done. It is not everyone who can provide himself with satisfactory occupation; a fixed job settles the question.

(7) Work may be a drug to save oneself from one's thoughts.

(8) To earn leisure. Some people work hard at dull or repetitive work in order to earn enough to do what they like after work hours. One highly qualified woman who was doing work far below her capacity said she did it because by it she earned enough money for her needs, and her brain was sufficiently fresh at the end of the day to enable her to do creative work of her choice. She resisted any attempt to promote her.

Karl Groos in his book on the play of adults gives, among other motives, freedom from the constraint of "must". The work that will buy this freedom is to certain people well worth while. Dorothy Sayers, discussing the attitude of the artist to work, says that he will use his escape-from-work in order to do what he calls "my own work", and nine times out of ten this means the *same work* (i.e. the exercise of his art) *that he does for money*. The peculiar charm of his escape is that he is relieved not from the work but from the money. "His holidays are all busman's holidays." [1] This attitude of mind is met with in industrial skills quite frequently when the work is not so subdivided that the worker can hardly realize what is his work.[2]

E. L. Woodward in *Short Journey*, 1942, relates the story of a man who was brought from London to repair some iron work on a fine gate belonging to All Souls, Oxford. The work was a 3 or 4 days' job. During his leisure time he walked about Oxford looking at all the iron gates and railings.

In this context an interesting example was given by Christopher A. Lee:

A group of young girls was engaged in threading needles for older girls doing embroidery. After they had been working for some time, we thought that they would feel encouraged to work harder if set on piece-work. The record up to that time was 96 dozen needles threaded in one day, which was considered a good performance. When the piece-rate was fixed no new records were made,

[1] *The Mind of the Maker*, London, 1941.

[2] Denys Harding, "Subdivision of Assembly Work", *Journal of Institute of Industrial Psychol.*, V, 5, 1931.

and it appeared to have little effect on production. In a short time, however, the output fell until the average figure was about 75 dozen needles a day per girl.

We then realized that we had chosen the wrong type of incentive. The girls had little interest in increasing their wages, since they lived at home and handed over their pay envelopes to their parents, who did not reward increased earning by an increase in pocket money. So we finally arranged to set a task which, when completed, left the girls free to play or use their time as they liked outside. The task was fixed at 100 dozen, although the workers' representative thought this was high, in view of the previous record; we submitted that the girls had not yet worked under the influence of a genuine incentive, and promised to bring down the limit if it proved too high. On the second day the forewoman came to me and asked what she should do: it was only 2.30 p.m. and all the girls had done their 100 dozen. They were, of course, allowed to go. This set them off; and the incentive of leaving early became secondary to their enthusiasm to make new records.[1]

During a special enquiry workers were asked to put in order of importance certain conditions of work. The final analysis gave the following result. Security of employment,[2] Comfortable working conditions, Good supervisor, Opportunities for promotion, High wages, Opportunities to use ideas, Work that needs thought, Short hours, Work that needs no thought. It is probable that much industrial work involves the suppression of some instinctive "drives". Self-assertiveness in some organizations can receive little expression, nor can acquisitiveness. With reference to the latter, a factory owner once complained that as soon as 6 o'clock struck every employee stopped and dashed out, whereas, as he continued, "I don't think of doing that; I don't mind how long I work." He seemed to forget that the place was his own, that he was pleasing himself by extra work, that he could choose to a certain extent when he would work, and that more work meant more trade and more success.

Where there is fundamental trust between management and workers any system will be found to work and personal loyalty is the best basis.

Talks or lectures on loyalty have usually no effect, though as incentive they may furnish subject-matter for the good mimic.

[1] C. A. Lee, "Some Notes on Incentive in Industry", *Human Factor*, VI, 5, 1932.

[2] Security of Employment is not synonymous with Security of Tenure.

II. SOME SYMPTOMS OF SOMETHING WRONG

(*a*) *Are Accidents Accidental?*

Accidents.—In its original meaning an accident was merely something that happens, but the word is now limited to something unexpected and harmful, that might happen to anyone in like circumstances. To be sure, popular wisdom has generally recognized that there are some people who enjoy a natural propensity to be where an accident is likely to occur, but that is offset by the salutary effect of having had one accident—"you'll take more care another time"—or the fatal inevitability that exacts three mishaps should two have happened.

The introduction of machinery on a large scale during the 19th century led to a considerable increase in accidents of all kinds, ranging from the trivial to the fatal. Since the machinery liable to cut or bruise or wound the human worker was the obvious cause, the obvious cure was to limit the possibilities of the machine in this direction. Hence the introduction of guards wherever possible and the various regulations of the Ministry of Labour and National Service. In addition, the Royal Society for the Prevention of Accidents, originally the Safety First Association, has done its best by talks, committees, posters, etc., to direct attention to the problem and to suggest means of controlling them.

Although accidents in factories are taken seriously, and organizations with varying enthusiasm and success have tried to reduce their accidents, yet the inertia of the community in the face of the appalling waste of human life and health by road accidents is no tribute to our social development.

As far as industrial accidents are concerned, experience has shown that, by the negative method of reducing the dangerous nature of the machine, accidents are not adequately reduced. In 1918, H.M. Inspector of Factories said: "However well machinery is guarded, we cannot look for more than a 10% reduction in the accident rate by the provision of safeguards alone".

What other conditions, apart from dangerous machinery, play a part in causing accidents?

I. *External Environmental Conditions*

(1) *Atmospheric Conditions.*—Most people have experienced the numbing effect of cold fingers and the attendant clumsiness, as well as the unskilful bungling caused by excessive heat, i.e. heat to which one is not accustomed. If, however, such loss of skill happened when a person was occupied with a machine that could cut or hurt in some way, then his chances of having an accident would be increased with alterations of temperature, and if this were so, then one way to reduce the risk would be to keep the temperature within a safety range.

To test this possibility, H. M. Vernon[1] analysed the accidents and the temperatures at a fuse factory for 6 months, and later, in collaboration with Mrs. Osborne, two shell factories for almost a year. At each factory it was found that the frequency with which minor accidents occurred was relatively large at low air temperatures and high temperatures, but relatively small at the temperatures in between these extremes.

In the fuse factory, and also in one of the shell factories, the most favourable temperature was from 65° F. to 69° F., but in the other shell factory from 70° F. to 74° F. At the higher temperature the accident rate for the men rose more steeply than for women, which the writers think was probably due to the more strenuous work done by the men, so that their exertions would make them more uncomfortable. The high accident rate noted at the low temperatures might have been due to the workers getting their fingers numbed by contact with the cold metal shells and fuses they were manufacturing, or with the stream of soapy water in which most of the lathe-produced articles were turned.

A similar result was noted in an investigation among boot and shoe workers. Three times a day for a year the temperature of the "clicking" room was recorded and related to the minor accidents. The accident rate was lowest at a range of temperature from 55° F. to 59° F. It rose gradually with increasing temperatures to a maximum at 69° F. and over. The air temperature seldom fell below 55°, but a slight rise in the accident rate took place when it did.

[1] Osborne, Vernon and Muscio, *Two Contributions to the Study of Accident Causation*, Ind. Health Res. Board, No. 19, 1922.

In a study of miners the frequency rate of accidents was found to rise rapidly with the rise of temperature, being three or four times greater at the highest temperature than at the lowest. The effects of a too high temperature can be reduced by seeing that the air is not stagnant; the higher the temperature, the more rapid should be the air currents. An absolute standard temperature for all classes of work cannot be fixed, since a lower temperature is better for work involving heavy muscular effort and a higher one for lighter work; if, however, the temperature rises above or falls below the desirable one, accident rates rise. Hence the importance of adequate ventilation. Quite apart from the physiological effects of too high or too low temperatures or of stagnant air, anything which makes a worker feel uncomfortable attracts his attention to himself and therefore away from his work, and so is likely to involve him in an accident if circumstances provide the means.

(2) *Lighting.*—If a worker on a job involving dangerous machinery cannot see his work clearly, then his chance of having an accident is increased, but it is equally true that during a period of artificial lighting there are more accidents than during daylight. In an investigation made by a Departmental Committee of the Home Office there proved to be on an average an excess of 25% in accidents during the hours of artificial light. During the war the black-out has resulted in increased accidents owing to workers passing from a well-lighted bench to an insufficiently lighted passage.

(3) *Speed of Production.*—It would seem probable that, other things being the same, with increased speed and therefore more work produced per hour there would be an increase of accidents. It is difficult, however, to get proof of this, for increase in output is often due to improvements in the condition of the work, but in the fuse factory already mentioned, under the same conditions of work, it was possible to compare the minor injuries per 10,000 workers per week with the average hourly output, which was increasing. This average increase in production was considerable, and the accidents increased with it. One effect of speed is that a speed that is

comfortably stimulating when the worker is unfatigued may induce the feeling of "being flurried" later in the day, so that, as with the other environmental conditions, attention is diverted and the risk of an accident is increased. A fixed speed for all workers throughout the day is not advisable.[1]

(4) *Hours.*—In the course of an investigation it was found that the accidents were 2½ times as many when a 12-hour day was being worked as when the working day was reduced to 10 hours.

II. *Personal Conditions*

(1) If a group of young people are on the same job as a group of older people, even though they may all be experienced workers, it has been found that on the whole the younger group has the higher rate of accidents. Most people would agree that this might be expected, but the proper conclusion is not always drawn, namely, either to keep young people from such processes or else to train and supervise them better. Their physical immaturity and their temperamental "dash" and lack of foresight render them particularly susceptible to danger.[2] [3] [4]

(2) A group of inexperienced people will have more accidents than a corresponding group of experienced people in the same conditions. It has been mentioned in a previous chapter that beginners ought to receive training even though the process is simple; this tendency among the inexperienced to have more accidents is an additional argument for training. It must not be assumed that the inexperienced people are necessarily the young. During normal times people do not in very great numbers enter industry at the same time, but during war-time many people of all ages quite unaccustomed to factory conditions are being engaged.

(3) That emotional disturbances, causing perhaps irritation

[1] H. M. Vernon, *Accidents and Their Prevention*, Cambridge, 1936.

[2] Major Greenwood and Hilda M. Woods, *The Incidence of Industrial Accidents*, Ind. Health Res. Board, No. 4, 1919.

[3] Greenwood and Yule, "A Contribution to the Study of the Human Factor in the Causation of Accidents", *Journal of Royal Statistical Society*, 83, 2, 1927.

[4] E. M. Newbold, *A Contribution to the Study of the Human Factor in the Causation of Accidents*, Ind. Health Res. Board, No. 34, 1926.

and failure of attention, may lead to accidents is more difficult to prove, but observation shows they are important. All the other causes can be and have been demonstrated by statistical evidence, but evidence of the importance of these emotional states can only be obtained indirectly. The same attitude of mind that expresses its annoyance or anxiety by banging the telephone or by angry retort could, if the worker happened to be on a dangerous machine, result in an accident.

(4) A lowering of physical health can, by reducing the available vitality, interfere with skilled actions and help to increase the accident rate.

(5) No discussion of the conditions of the human body and mind that may lead to accidents can omit to mention the mental state comomnly called "careless"; in fact, the immediate response of most people to those who have suffered or caused an accident is "Don't be so careless". Professor Pear has remarked that we seldom apply the epithet to someone whom we really like. The word "careless" does imply that there has been an absence of thought where thought was demanded, but as soon as we come to look into the question we find that the explanation explains very little. Sometimes we do have to acknowledge the fault of carelessness when, knowing that some risk was present, we refused to give the necessary thought. Even here we are forced back to ask for a reason. Few people would be careless just for the sake of being careless. The failure to apply the required thought is usually because we were thinking of something else, at the moment of more personal interest. What appears careless to an outsider may in actual fact have been due to too much thought. Attention to a part of an action which has become automatic invariably results in some interference, which will result in an accident or not according to circumstances.

> The centipede was happy quite
> Until the frog for fun said,
> "Now pray which leg goes after which?"
> Which wrought him up to such a pitch
> He lay distracted in a ditch
> Considering how to run.

If his distraction had caused him to lose control of an industrial machine, things would have been more serious.

Any of the above factors that may precede an accident may be judged by an outsider to be due to carelessness. Wherever there is a possibility of an accident, even the most proficient ought to exercise the necessary care.

III. *Accident-Proneness*

If we could arrange for groups of workers to have ideal working conditions, one group to consist of young workers, another of the older, another of the inexperienced, another of the experienced, and let all of them be in good physical health and all emotionally well-balanced, it would still be found that in each group a few would have more than their fair share of the accidents. If the environment is adverse there will be more accidents than in a good environment, but this will be due to some, not to all of those present. In other words, there is some evidence that the people popularly described as "all thumbs" do exist. In technical language they are known as accident-prone.

When during the last war two statisticians,[1] Professor Greenwood and Mr. Udny Yule, had their curiosity aroused by some accident figures in munition works, history was made.

They had accident records of a number of people doing the same work, under the same conditions, for the same time. They knew how many had no accidents, how many one, two, three, and so on. They then set themselves a mathematical problem, the nature of which can be suggested by a simple illustration. Suppose one had the patience to toss in succession a hundred ordinary pennies a great many times, say 1,000 times for each penny, and made a record for each of the number of times "head" turned up, the hundred series would probably not give very different results; of course they would not all be "fifty-fifty", but it would be *very* unlikely that many would give 90 heads. But suppose for 99 trials an ordinary penny were used and for the hundredth a double-headed penny. Then the set would *always* give one set of trials with 100% "heads". Now if instead of a completely trick penny

[1] Greenwood and Yule, "A Contribution to the Study of the Human Factor in the Causation of Accidents", *Journal of Royal Statistical Society*, 83, 2, 1927.

or completely normal pennies one used coins so made, with the centre of gravity so displaced that in some "head" and in others "tail" was more likely to come uppermost, the distribution might deviate from the fifty-fifty very much more widely than "chance" would explain easily. The fact that some pennies were "head prone" would betray itself in the record. In what way the distribution would deviate from "chance" is a purely mathematical problem. Using the appropriate arithmetical method, they could discover whether the accidents were scattered fairly evenly among the workers, or whether after having one, prudence prevailed and accidents ceased or were at least reduced, or whether one or two were but a prelude to more. Actually, of course, some people were affected in any one of these ways, but the fact that emerged from the statistical analysis was that on the whole the majority of the accidents happened to a minority of the people, i.e. that there were people more susceptible to accidents than their fellows.

E. M. Newbold,[1] after analysing statistically accidents for a number of groups, concluded that "so far as the variation in the number of accidents per person goes, our facts are in accordance with the theory that the chance of an accident differs for each person; but they are not in accordance with the theory that the chance is the same for each person, even allowing the chance, while remaining alike for all, to vary from time to time during the period of observation.

Since the original research, published in 1920, the same methods of analysis have been applied to a number of transport and industrial groups with the same result. The statistical investigators, however, could not from their evidence commit themselves to what the individual difference was; they merely said that some people seemed to be peculiarly susceptible.

The accidents studied in these researches are minor ones; major accidents cannot by their very nature occur frequently. A study, however, of the relatively few major accidents, as well as the minor cuts and bruises of a group of 14,000 workers belonging to different trades, showed that those people who had more than their share of minor accidents had also an

[1] E. M. Newbold, *A Contribution to the Study of the Human Factor in the Causation of Accidents*, Ind. Health Res. Board, No. 34, 1926.

excess of major accidents. The same relationship is revealed between the number of sickness absences and accidents. It has also been shown that those who have many accidents during one period tend to do so during other periods, and that they tend to have accidents both at home and at work, the particular kind of accident, whether a cut finger, a bruised knee, or burn, being dependent on the circumstances. The point is that if there is a possibility of having accidents the same people tend to have them.

With this evidence available, the next step was to try to find some means, other than a recorded accident, by which the particularly susceptible people could be found out at an early stage, and then diverted from occupations where the nature of the work produced an environment conducive to accidents. It has to be remembered that a person particularly liable to accidents may be instrumental in causing an accident to a person not liable by nature. The research into selection tests, undertaken by Farmer and Chambers, has extended over nearly 20 years, and the results published in a series of reports.[1]

Accidents occur usually when we are doing something, so in the search for tests a choice was made of performance tests involving rapid and accurate co-ordination between hand and eye, as well as intelligence tests, tests for mechanical aptitude and perseveration. Over 600 workers engaged in such varied occupations as sweet-covering, packing sweets, shipwrights, engineers, dockyard apprentices, Royal Air Force apprentices employed as carpenters, engine fitters, etc., have been studied. It was possible to grade each subject according to his success at each test and according to his accident rate. The results suggest that in most of the tests those with the better scores tended to have the fewer accidents, and a combined score of three of the tests revealed a difference of 48% in the accident rates between those who "passed" and those who "failed".

[1] Farmer and Chambers, *A Psychological Study of Individual Differences in Accident Rates*, Ind. Health Res. Board, No. 38, 1926 ; *A Study of Personal Qualities in Accident Proneness and Efficiency*, *ibid.*, No. 55, 1929 ; *The Prognostic Value of Some Psychological Tests*, *ibid.*, No. 74, 1936 ; Farmer, Chambers and Kirk, *Tests for Accident Proneness*, *ibid.*, No. 68, 1933 ; Farmer and Chambers, *A Study of Accident Proneness among Motor Drivers*, *ibid.*, No. 84, 1939.

Later the testing was extended to 1,800 apprentices in the workshops of certain Naval and Royal Air Force Establishments, and the results of the earlier enquiry were confirmed. Some time later an investigation on similar lines among omnibus drivers was made. An examination of their accident records had shown that, as with other groups, some people were more liable than others in the same conditions of risk to have accidents. The psychological tests showed that those who failed had a higher average accident rate than those who passed.

If the people who did badly in the tests and also those who had an excessive number of accidents during an initial period of work were transferred to work where the risk of having an accident was less, the accidents of the remainder would be considerably reduced. The research workers do not claim that any tests so far studied will infallibly select the accident-prone and reject the others, but only that they will select a considerable proportion of them, and that the rest will have a low accident rate and a high proficiency rate. The tests, however, are only valid for skilled workers; no relation has so far been shown between tests and accidents among unskilled workers.

The notion of accident-proneness has aroused much discussion and even more misunderstanding. Because all the evidence points to the susceptibility to accident of a minority in a group where all are equally exposed to risk, this does not mean that "accident-proneness" is the only cause of accidents. It is necessary to distinguish between accident-proneness and accident-liability. A person who never left his bed would not be as liable to an accident as the same person would be if he regularly risked the hazards of the roads. Everybody, accident-prone and the rest, is more liable to have accidents in some environments than in others. We are all accident-liable, not all accident-prone.

Liability to accident is largely determined by the degree of risk to which a person is exposed. Certain environmental conditions are more dangerous than others, and certain periods of life and degrees of experience have been shown to increase the risk of accident.

Accident-proneness is a narrower term and "may be

regarded as a set of personal qualities, some of which have been measured, rendering some people more liable than others to sustain accidents".

What can be done to reduce Accidents?

In the first place, everything possible should be done to reduce the risk of accident by improving all the environmental conditions that have been found to be associated with accidents.

By law dangerous machines must be guarded, but they should also be timed to run at the best speed, from the point of view of safety as well as of production.

Everything possible should be done to keep the environmental conditions, lighting, heating and ventilation, within the limits known to be the safest. A relative triviality, but often overlooked, is the desirability of clean windows; as much daylight as possible is advisable both for health and for output. The attitude of all those in authority can play an important part in reducing accidents; there is no need to be fatalistic about them. But the management must take a vital interest in their reduction and enquire immediately there is any sign of an increase; all schemes that will further each person's responsibility for avoiding accidents should be encouraged. If a high accident rate was considered as shameful as a high typhoid rate, something drastic would be done.

The supervision of the young and also the inexperienced worker should be some particular person's work, not just left to anybody.

Since fatigue and any bodily or mental change that reduces, even temporarily, general well-being increases the tendency to accidents, those responsible should be on the look-out, particularly with juveniles, to help them and modify those conditions that are modifiable. And all should be educated to avoid unnecessary risks. Since the accident-prone can be discovered (*a*) by their early accidents and (*b*) by tests, both methods should be used. Tests are not possible on a large scale at the present, since they involve apparatus, an experienced tester, and can be given only to one person at a time.

It is, however, not too much to hope that, when there is less urgency in setting people to a job, large-scale application of this method will be undertaken. Also, in the light of our knowledge of intelligence testing and the tests for some special aptitudes, there is quite a reasonable prospect that some form of group testing will eventually be available.[1]

(*b*) *Breakages and Mistakes*

Sometimes mistakes instead of resulting in accidents in the narrower sense of the word, i.e. involving some injury to the body, affect a thing outside the body. There really is no very clear line of demarcation. The typist who hits the wrong key and therefore prints wokr for work would probably in the same frame of mind or general circumstances have cut her finger if her machine had been of that kind. The usual explanation given is carelessness, but that prompts the further problem of why the person is careless sometimes and not at others. As in the case of accidents, it is as well to look at the external environment and also at the person.

An interesting investigation was made some years ago by investigators of the National Institute of Industrial Psychology.[2] There were two kinds of breakages: (1) direct, i.e. those when an article was dropped or damaged at a particular time and place; and (*b*) indirect, those not due to a particular person at a particular time, but happening because of repeated mishandling. An analysis of a number of breakages showed that, of the total, 39% were of the direct kind.

In spite of the obvious explanation of carelessness, the investigators came to the conclusion that real carelessness, in the sense of disregarding the normal care requirements, was rare. The state of mind associated with a breakage was given as:

(1) It just happened, i.e. the person causing the breakage felt as if the event were apart from him.

(2) The person "knew it was going to happen but felt

[1] Emergency Report No. 3, Ind. Health Res. Board, 1942.

[2] G. H. Miles and A. B. B. Eyre, "An Investigation into Breakage Problems", *Journal Inst. Indust. Psychol.*, I, 4, 1922.

powerless to prevent it". Again there is a feeling of passivity.

(3) The victim felt his mind went momentarily blank.

In all these descriptions there is a recognition after the event of a mental failure to control the situation.

The investigators examined the external conditions under which the work sequences were carried out, and found that there were a limited number of danger points; for example, 54% of the breakages occurred at point A, 25% at point B, 8% at point C, while the rest, 13%, occurred during transit.

It was easy to miss these danger points, since the danger would appear insignificant to the worker. If, however, an operation has to be repeated thousands of times a day, even minor difficulties may become serious. It was found that at one point in the circuit, articles had to be brought rapidly under a nozzle, filled, and passed on to another worker. When the article was being filled, care had to be taken to avoid clashing with the nozzle. This tended to reduce the speed. On occasions when the demand exceeded the rate of supply there was an incentive to speed up, but the necessary care caused delay, and hence irritation and breakages. The requisite alterations to avert a clash were arranged.

The external damage points were only part of the whole. In addition, the human or personal conditions played a part; for example, excitement, fluster, irritation, tended to spread, particularly when rush periods followed slack ones. It is recognized in general psychology that emotion can be excited not only by some condition that normally would excite it but also by seeing the expression of an emotion in others. If a few people expressed irritation and general excitement the contagion would soon reach others. A feeling sometimes described as being "keyed up" is an excellent background for inaccuracy of movement. When the person who has to transmit orders does so in an impatient voice, further exasperation is caused. Modifications were made in this particular case by the installation of impersonal signals.

As a measure, records of the number of articles handled at one danger point during 2-hour intervals were kept and also the number of direct breakages occurring there. It was

possible to compare the records before and after the various alterations. The results are shown in the following table. The number of breakages out of every 1,000 articles was estimated.

	10 a.m.–12 a.m.	12–2 p.m.	2–4 p.m.	4–6 p.m.
Breakages before .	2·2	3·3	2·2	5·7
Breakages after .	1·7	1·8	1·9	1·6

The considerable difference at the end of the day indicates that there had been a reduction in fatigue. It was also suggested that there should be a better method of selection and training of staff.

In another investigation, in connection with bottle breakages, it was found that although the work was done by boys the opinion that the breakages were due to carelessness was untenable. The causes resolved themselves into bad design of machines, irritating incidents, cold hands and the necessity for awkward movements.

Breakages and accidents have much in common, and it is probable that the people who have many of one will also have many of the other, but research so far has not been able to develop along this line. From the practical point of view there should be considered the external environment, which may be an important contributory factor, and the personal, both physiological and psychological, partly controllable and partly probably unconscious.

(*c*) *Grievances*

Most of us would agree that there is something really heartening about good honest grumbling, expressed in speech to someone as audience who will not take it too seriously. The grumbler does not intend to do anything about it nor expect that those who listen will. He is just expressing an emotional mood and feels better in consequence. With this kind of harmless, in fact healthy, grumbling a study of grievance has nothing to do. The student of industrial conditions soon learns that grievances, whether called complaints or discontents, are rarely to be interpreted at face value, nor can they be investigated, as a general rule, by systematic definite study.

Much of the best information has been obtained incidentally to other work. Occasionally, as a consequence of serious trouble, specific interviews have been held in order to find out the cause.

Grievances, like any other human product, can be classified into groups that have certain characteristics in common, and classification will vary according to the person classifying or the purpose of the classification. For convenience, grievances may be classified according to subject-matter, the kind of people who have them, and whether something can or cannot be done to redress them.

The Subject-Matter of Grievances.—Since the war there has been an increase in the conditions that conduce to grievances, and a study of them on the lines of motion study is needed, i.e. find out what they actually are, eliminate the useless and deal with the useful. Even if a grievance is imaginary, i.e. no basis in fact to anyone but the "griever", yet that is a fact of mind, and may be as real practically as something with substance. The subject-matter of present-day grievances may refer to the following main themes:

(a) *Material Conditions in the Factory or Outside.* A fruitful source of environmental grievance has already been referred to, namely, lighting. The substance of the grievance was the refusal of a right, the right to daylight when there was daylight. The fact that actually there was enough light to see the work did not deal with the difficulty, because the grievance lay in not having their rightful ration of daylight.[1] It has already been pointed out that the sensible thing to do is to take every precaution to utilize as much daylight as possible. Practically any environmental condition that thrusts itself into consciousness can act as a focal point for a grievance, and the attitude of mind that "strains at a gnat and swallows a camel" is very common. Once let the idea of something wrong in any environmental condition enter the minds of a few, and the grievance will spread more quickly than any disease germ.

[1] "Men are not angered by mere misfortune but by misfortune conceived as an injury. And the sense of injury depends on the feeling that a legitimate claim has been denied." According to C. S. Lewis in the *Screwtape Letters*, the Devil knows this characteristic of humans and he advises a junior whom he is training in the art of temptation to exploit it for his own ends.

Since the war, grievances have attached themselves to conditions that impinge on the efficiency of the place of work but which actually refer to outside agencies. Of these, a dominant complaint has been transport, the breakdown or delay of which has at times made life extremely difficult for very many. There was no grievance about transport in a town where after a severe air raid transport was completely disorganized. Every member of a particular firm turned up eventually, even though late in the afternoon, after walking in some cases for miles by roundabout routes. This was something that could not be altered. Other outside grievances are the difficulties attaching either to being in other people's homes or receiving others in one's own home; and the lack of adequate provision for children while the mothers were at work. Shopping and housework have since the war provided the ground for a crop of grievances.

(b) *Conditions of Work, usually relating to wages, hours, and a general sense that the place was "not all out" for the war.* Prior to the war relatively little was heard about the difficulty of estimating wages. The Trade Unions and Employers' Federations or Trade Boards came to agreements and revisions could take place. Now thousands of women are in industry who have had either little or no experience of wages. The result is that many of them cannot understand the basis of payment; some feel that it's just a toss up whether one gets a good wage or a poor one. This is partly due to the difficulties of assessing particular jobs, which, normally a highly skilled operation, is now inevitably in the hands of less qualified people. Nor can the subject be considered purely rationally. A person may agree to work for a particular wage and actually find it quite adequate for his needs. But if someone else doing apparently less work receives more, then there is a grievance. An absolute improvement, if it does not involve a relative improvement, rarely gives satisfaction. A comparatively trivial cause of complaint related by W. Raphael was the title of a job, namely, Back Door Clerk [1]; this was satisfactorily converted into Goods Control Superintendent. The complaint was not quite as trivial as it appears at first sight; it is rather difficult to respect oneself and one's job when it is described as "back door".

[1] "A Study of Grievances", *Human Factor*, XI, 3, 1937.

Grievances about "hours" if they are recognized as fair, that is essential, are frequently the expression of the cumulative effect of fatigue, which is well known to be an excellent grievance-producer.

A very common grievance among those engaged in work recognized as war work is expressed in the phrase "we're not going all out". Stoppages and delays are a source of much annoyance. "It is doubtful if employers and managers realize how strongly workers resent waste of time and energy through obstacles to production. Poor routing, a shortage of tools, defective materials or inadequate supplies of them, frequent changes of work, breakdown in machinery and congested working spaces, are a few of the ways in which potential energy may be wasted." [1] When to this is added exhortation from speakers of all kinds to make the maximum effort, grievances develop with the rapidity of weeds. To be criticized for not doing what circumstances which you cannot control prevent you from doing, produces feelings of considerable violence. Closely allied is the grievance of those not doing what they think is war work. Quite often it is most essential, but this is unrealized.

(c) *Those in Authority.* To workers on the bench this means anyone from the foreman upwards, but the foreman chiefly. Sometimes most of the officials of the clerical and administrative staff are included; they are looked upon as remote and quite uninterested, and in many firms the workers feel that nobody is interested in them personally. Foremen inadequately equipped and trained for their work are frequently a source of grievance, and the gulf separating directors and other people in authority from the rank and file leaves the latter with the feeling that nothing will be done even if they do complain. At the bottom of the grievance is the feeling that as human beings they do not matter. One of the most striking contrasts between one organization and another lies here. "Subordinates who would readily report defects in machinery hesitate to allude to such intangible matters as worry or discontent among the staff, or to what appears to be trivial personal feelings", is the conclusion of an experienced investigator of grievances. An example of what appeared

[1] Hall and Locke, *Incentives and Contentment*, London, 1938.

trivial to the management but of great importance to the sufferers is well illustrated in the following incident:

Not long ago it was reported to a labour manager that a group of women workers flatly refused to obey their foreman, who had ordered them to change from the work they had been doing to another job in another room. The report was true. There they were in their original work-place, full of grievances gradually increasing in intensity. When the labour manager asked them quite calmly what it was all about, the answer was that the foreman had just ordered them to go and they didn't want to. She pointed out to them that the work they had been engaged on was not at the moment so necessary as there had been no raids recently, but that the new work was extremely important to the Navy. "Why didn't he tell us the reason?" was the question as they set off to the new work.

Other difficulties have been found to be related to the absence of praise, when the only contact of the people in authority with subordinates was to find fault. This is sometimes expressed in the form of grievance that the staff are never consulted. In dealing with grievances it must be realized that the apparent substance may merely be a symbol of something else. They have to be translated.

Those Who have Them

As grievances vary, so do the people who have them. Some will be made by intelligent, well-balanced people who have decided that something really wrong exists and that it can be remedied. Such people are a blessing in any firm, and they should be encouraged to bring grievances, either of their own or of their colleagues, to the notice of the authorities. The "nervous" temperamental people have already been shown to find difficulty in adjusting to the various conditions of life. They probably look upon themselves as more "sensitive" than their fellows, pride themselves on their sufferings, and hence tend to exaggerate difficulties; some of these people must not be taken too seriously, since if one cause of complaint is remedied they will find another. The nervous person does, however, bring to notice things that are wrong, and may serve as a signpost

warning of possible trouble. But the most evenly balanced person is likely to indulge in grievances when fatigued, ill, or even "off colour". During the war it is fatigue that is likely to be the commonest of these causes.

What can be done? Nothing or Something?

It often happens that there really is nothing to be done, the substance of the grievance is inherent in the nature of the work or of its conditions. In this case the only sensible thing to do is to explain. Where this is done it makes all the difference between a vague grievance gradually spreading, easily reinforced by other possible subjects for complaint, and a wholesome atmosphere. If each person in authority had actually been in the position of the subordinate workers, even for a short period, he would gain much. Just as we bear easily other people's income taxes and other towns' bombs, so we are apt to minimize the frets and frictions of other people's circumstances.

If something can be done, it should be done quickly and graciously. The writers quoted above continue with an emphasis on "The importance of attending promptly to reports by the workers of any untoward circumstances which prevent them from reaching their accustomed output." Otherwise they tend to say, "What is the use of reporting anything? No one takes the slightest notice." There is any amount of evidence in support of the view that people are not seeking an easy life all the time, but that the basic grievance is when life is made harder on account of conditions that could and should be remedied.

Grievances are symptoms and should be diagnosed and the remedy applied; they waste energy needed for other things. No one need fear the possible attainment of a condition of "dead perfection" through the treatment of grievances. There will always be the "nervous" person to keep alive the need to redress grievances, but such grievances need not assume the proportions they do in some places. In short, let the grievances be merely grumbles.

> And isn't your life extremely flat
> With nothing whatever to grumble at!

(*d*) *MISFITS*

An opportunity occurred during 1936 to make a study of a number of unemployed girls who were in attendance at a Junior Instruction Centre.[1] The Junior Instruction Centre was run by the local Education Authority, was subject to inspection by the Board of Education, and was financed by the Ministry of Labour. It worked in close co-operation with the local Junior Employment Exchange, and the type of instruction given was non-vocational. Such a centre can only be established "when there are (or are likely to be within a short time) within a radius of five miles of the centre not less than 50 persons between the ages of 14 and 18 who have been out of work for a period of twelve consecutive working days".

Some of the girls actually attending the school were there because their firm was working on short time, so strictly speaking they were not out of a job; the majority were unemployed in the strict sense of the word. The period of time at the school was only a few days in some cases, for they left as soon as they found work, or work found them.

The first step of the study was to compare the industrial history of this group with a similar group, differing only in being in full employment, selected at random from the records of the Ministry of Labour. Three measures for comparison were used: (*a*) the duration of the first job; (*b*) the average number of changes during the first year of employment; (*c*) the amount of time actually in employment expressed as a percentage of the time they could have been employed. Some of them were 15 and so could only have been at work for a year; the oldest were 18 and so had had 4 years in which to work.

Compared by each measure, the unemployed girls proved to be less stable. The percentage of the unemployed girls who had kept their first job for about a year was 29 compared with 57 of the other group. The average number of changes during the first year was 2·2 for the unemployed against 1·0 for the others; 27% of the unemployed had remained in

[1] May Smith and Margaret Leiper, "A Study of Temporarily Unemployed Girls", *Occ. Psychol.*, XIV, 2, 1940.

work for over 90% of the possible time, compared with 79% of the other group.

The two groups are certainly not clear-cut, but the most extreme cases were among the unemployed. Is the first year of work a criterion of later instability?; does the "rolling stone" keep on rolling, or does it come to rest? Some clue to this was afforded by relating the changes in the first year to the average number of changes per annum. Out of 17 who had more than 4 changes in the first year, 16 maintained for the following 3 years a high yearly average; they continued as they had begun. On the other hand, nothing can be predicted concerning later stability from the first year's stability. About a third of those who had started well found it difficult to settle after losing a job, and so became unstable.

The question next considered was the kind of work taken up by each group; had those who were less stable taken up for some reason jobs of a temporary or unskilled nature?

The various occupations were therefore analysed roughly into (1) those providing a certain amount of definite training, e.g. the Post Office, dressmaking; (2) routine clerical work; (3) routine factory work; (4) miscellaneous temporary occupations. The main difference between the two groups was found to be in the number of those entering a trade which gave some training compared with those taking up temporary or unskilled work. Over 25% of the control group, compared with 14% of the unemployed group, entered occupations where some training was given; no practical difference was found between the relative numbers of those who entered clerical work or factory work, but among the unemployed a greater proportion had started with temporary work.

Some of these girls are real tragedies. How can they learn to be good citizens or reliable workers when they never remain long enough anywhere to form useful habits or to know the work? One girl who had been in employment about $4\frac{1}{2}$ years had had 26 jobs in that time, an average of about 6 jobs a year. Here is an outline of her industrial career: she began as a messenger and stayed at it for just over a year and left to get more money, then she went to serve in a shop for $4\frac{1}{2}$ weeks and left because the work was too hard, then 5 weeks in a factory which she left without reason, 2

weeks as a District Messenger, 3 weeks in a factory for which she was too slow, another factory for 1 week and was dismissed as unsuitable, and so on. She was an extreme case, but unfortunately by no means the only one.

In contrast is another girl of the same age who during about 4½ years had 2 jobs, and only left because her firm failed; she got another post and was still in it when last she was heard of. During the interim she was at the Centre.

Reasons for Leaving

A study of the alleged reasons for leaving was made. These reasons must, of course, be accepted as representing only part of the total picture. Resignation or dismissal may in actual life depend largely on the speaker's point of view. Sometimes the employee just forestalls the employer, so that a resignation may hide an impending dismissal. Interpreting the alleged reasons at their face value, they can be roughly classified into (1) those where the employer took the initiative and refused to employ the worker any longer; (2) those where the employee took the initiative and left; (3) those in which circumstances uncontrollable by the individual intervened, e.g. the removal of the firm or of the worker's family from the district, or where the work was specifically of a temporary nature; (4) health reasons.

The reasons given by the employer for dismissing the young worker included slackness of trade, unsuitability for the work, mild insubordination and unauthorized absence, of which the first and second occurred more frequently.

Where the worker took the initiative the reasons could be classified into (1) general unspecified objections to the work or its conditions (including the employer, manager, or foreman); (2) specific objections to the work, such as—too dirty, too heavy, too long hours, wages too low, inability to adjust to the conveyor-belt system; (3) other work, usually with better prospects, found.

Reading through these histories, it is difficult to avoid the judgment that these young people were not properly looked after. Many of their complaints about the work really resolve themselves into criticism of the lack of training given, an insufficient degree of responsibility on the part of those responsible.

Again, the number of times the girls were dismissed as "unsuitable" suggests that the selection was poor, because the management did not know what kind of person was needed and so used the trial and error method. Surely no boy or girl leaving school should be allowed to take up purely temporary work, unless admittedly from the worker's point of view of a temporary nature. Some of the girls, for example, took up temporary work while waiting to enter the Post Office or go to a training school. Some of those who had drifted from one temporary job to another were by their fourth year out of school practically unemployable, and would need some specialized training before being fit to be responsible for themselves. It is true that the proportion is relatively low, but the actual numbers are not negligible. Such employment is waste, and we have no right to waste human life.

The next step was to test the girls at the Centre so that the official records might be amplified by some more personal knowledge. They were therefore tested individually, by performance tests for intelligence and by the dotting test for speed and accuracy of aiming and by an interview for temperament.[1]

Analysed according to intelligence and duration of the first job, the results showed that 8% of the highest intelligence group left before the end of one month and 72% remained for over 3 months. By contrast, 36% of the lowest intelligence group left before the end of one month and 44% remained for over 3 months.

The other measures of industrial stability give similar results. It looks as if those with the lower grades of intelligence tend to swell the ranks of the unstable, although it does not follow that each individual of low-grade intelligence has many jobs; for example, a girl who was almost mentally deficient was employed for over 87% of her possible employable time and a girl with a good record for intelligence was only employed for 55% of her possible time; but these are exceptions to the main trend.

[1] Tests where the subject could do something were chosen for practical reasons. The girls preferred something that did not suggest school. The tests used were those described on page 22 of the Industrial Health Research Board Report, No. 33, supplemented by Alexander's Passalong Test and Koh's Blocks.

In order to get a measure of consistent stability, i.e. one that would take into account not only the changes in the first year but also the average number of jobs over the succeeding period, three groups were made: (*a*) those with 1 or no change in the first year and not more than an average of 1·5 changes per annum; (*b*) those who had 2 or 3 changes in the first year and between 1·6 and 3·9 changes per annum; (*c*) those who had 4 or more changes in the first year and 4 or more changes per annum. Of the consistently stable group, 50% had an intelligence quotient of 90+, and 30% of 80+, and 20% below 80; the unstable group had only 18% in the higher intelligence grade, and nearly 64% were in the lowest intelligence grade.

The dotting test gave a similar trend, though less exaggerated.

Temperamental Characteristics

During the testing each girl's emotional behaviour was noted. The outstanding emotional reactions were at one extreme a rather aggressive antagonism, and at the other an undue timidity. No attempt was made to estimate the strength of their emotions on a scale. Ordinary adolescent shyness was easily distinguishable from nervous timidity out of all proportion to the circumstances.

Although the classification is necessarily rather vague, two main types could be identified: (*a*) those who seemed able to adjust themselves easily to their surroundings; (*b*) those with an exaggerated emotional reaction. These differences did not seem to be related to industrial stability, there being no practical difference between the number of jobs a year for the normal and for the more emotional. Temperamental instability, when linked to a poor intelligence, did, however, form a serious handicap.

Some Exceptional Cases

While it is necessary when dealing with groups to find out the general trend, yet the exceptions to the general trend are no less important from the human standpoint. The general trend of these figures is that the higher intelligence is linked

with industrial stability and vice versa. But here are some examples against this trend.

Low Intelligence but Industrially Stable.—H. E. had a poor intelligence rating, but was good at the dotting test. She was self-possessed and co-operative, but showed no "sense" over the tests, and had awkward fumbling movements. She was resentful at things in general, and had "nervous" symptoms. She kept her first job for over a year, when she left to better herself. She got into routine clerical work, which she liked.

W. Y. poor for intelligence and dotting. She was co-operative, but undeveloped, had a babyish manner and appearance, and refused to try anything she thought might be difficult. She got into routine factory work where dolls were made, and remained.

Consistently Unstable Industrially but with good Intelligence.—F. S. had 12 jobs in about 3 years. She was good-looking and attractive, and thought herself too good for the jobs available. She was anxious to better herself. She was dismissed from her first job as unsatisfactory, and after that she rarely stayed more than a few weeks; her longest run was 45 weeks.

R. I. had 14 jobs in $4\frac{1}{2}$ years. She left her first job because the heat made her faint, another because the wages were too small, another because the hours were too long, several because she didn't like them. The clue, though, was that she had set her heart on being an usherette in a cinema and she couldn't give her mind to anything else. She got it eventually and passed from official knowledge.

The above generalization can only be interpreted tentatively. The number of girls studied was only 100 and not all of them could be tested, but with this proviso the following trends showed:

(1) A connection between low intelligence and instability. In some cases the reason may be that the low intelligence prevents the understanding of instructions, even though the work may be routine.

(2) The "rolling stone" of the first year seems to continue to roll. This suggests that it is at this stage that more adequate

supervision is needed. Most of the work available for these girls was dull and of a routine nature, and at the larger number of the firms there was no welfare worker or industrial doctor to advise. Since the war one firm in particular which had a very high labour wastage of juveniles has appointed a woman labour manager, and the position is much improved.

(3) That "unsuitable" was rather frequently given as a reason for dismissal points either to ignorance of the requirements of the work on the part of the firm or to inadequate selection.

(4) Temporary work is not good training for girls of this age. It allows no chance of any work motive to be aroused nor useful habits to be formed.

Unemployed Boys

A study of a similar nature was made in the Tottenham area.[1] A group of 200 unemployed boys and a corresponding group, of the same age distribution, who had never been unemployed, were interviewed, with the object of seeing if there were any observable differences.

The final analysis showed that the average unemployed boy had a poorer industrial record and prospects than the average employed boy, as evidenced by the fact that during the period between leaving school and reaching 17 years of age, (*a*) the average number of posts held by the unemployed boy was 4·4 compared with 2·9 for the employed; (*b*) the average duration of jobs of the unemployed boys was shorter, e.g. 20% compared with 11% were held for less than one month, and 19% compared with 37% for over 12 months; (*c*) the reasons for leaving given by the unemployed boys were more often of a personal or of a trivial nature.

By the age of 17 the boy who knew what he wanted to take up (whether employed or not at the particular time of the interview) had better social circumstances, scholastic record, and industrial prospects than the boy who was still drifting occupationally.

Half the unemployed boys thought that they had blundered in entering their first occupation, and they showed an almost

[1] S. Bevington, *Occupational Misfits*, London, 1937.

complete ignorance of the wages, prospects, method of entry, or of how to find a job.

The author concludes that from the point of view of his social position, number in the family, school-leaving standard, the unemployed boy was scarcely distinguishable from the employed, but the latter had had better school reports, usually with reference to temperamental or character qualities. It is, however, lamentable that even yet the parents and the headmasters fail to give adequate vocational advice. It is recommended that Careers Masters, properly trained, should be available for each child; it is not enough for them to know the child, but they should be in contact with the parents, should know industry and should follow the developments and probable changes of occupations.

"The waste of ability, the thwarting of ambition, the deterioration of character, which result from the present haphazard practice indicate the urgent need for scientific review and replanning of the whole system of vocational guidance, selection and employment of young people."

Looked at from the point of view of industry the waste is almost as disastrous. No organization can be stable that has a constant drift of untrained irresponsible adolescents forming part of the staff. From the point of view of the community it is tragic.

(*e*) *Psychological Aspects of Industrial Sickness Absence* [1]

There is no hard-and-fast line between sickness and health, although there is a difference between the opposing extremes, radiant health and illness. Health is the expression of a successful relationship between the body and mind and the environment, but too often does it merely mean "not ill". Sickness absence must not be taken as exactly equivalent to sickness: there are some people who are never absent from their work, since they manage to recover from such minor disabilities as they suffer during a week-end. If they are not absent no one need know. Also, when circumstances occur that lead to a high sickness rate, for example an influenza epidemic or excessive fatigue, those who do not

[1] The discussion in this section is mainly taken from Report 75 of the Industrial Health Research Board.

stay away are often working with reduced energy, and really need rest though they do not actually succumb.

In the course of over ten years' study of sickness absence in industry some threads of the complicated web of causes have been unravelled. The actual sickness absence rate, however it may be expressed, is merely the final expression in arithmetical form of the effect of all the conditions acting upon individuals and the reaction of the latter to them. In this section certain aspects of disease causation such as disease germs, irresistible forces, poisonous fumes, and the many other hazards of life will not be considered, as they do not belong to the psychology of absence; the discussion will be concerned with the more intangible and personal aspects, beginning with some environmental agencies.

The following are some of the factors affecting sickness absence:

(1) *Differences in Methods of Payment.*—The factory worker in most organizations tends to have a lower sickness absence rate than workers in other occupational groups of the same organization. Now it is more usual for the piece-rate payment to operate in a factory than elsewhere, hence it is sometimes argued that the factory worker is unwilling to lose money by staying at home. It is also true that workers on a "commission" basis lose money by absence, and yet some of these have a high absenteeism rate. Expressed in general form, if the alternatives before any of us were to work or starve, it is certain that many who now remain at home for the minor ailments would of necessity be at work and, in consequence, the sickness absenteeism of the group to which we belonged would be correspondingly low; whether the mortality would be correspondingly high, we do not know. On the other hand, if by absence from work we were to lose nothing either in the form of money, promotion, appreciation by the authorities, or time, and conditions at home were comfortable, there is little doubt that many of us would be tempted to avail ourselves of such opportunities, and would find it hard not to avoid the discomfort of going to work when suffering from some of the minor ailments.

This, however, only represents the more objective point of

view and assumes that the same environmental conditions affect all individuals alike. If we subject a number of people to the same condition of no monetary loss for absence, we do not find that all of them stay away the same length of time for the same kind of illness. To some people an illness is something to be resisted as long as possible, a feeling of malaise is accepted as a challenge, and only a very serious disability will make them give up; nor are these people confined to any one walk of life. Others are so much interested in their work or in its conditions that they cannot bear to be away from it, and hence will behave as the previous group, although the motive is different. Some again cannot resist and others make no effort to, so they succumb easily to particular forms of illness.

(2) *Differences in Certainty of Work.*—Organizations differ considerably with regard to the mobility of their labour. Until we have many more details of labour turnover it will be impossible to know exactly what part is played by what is called "permanence".

The commercial use of the word is not quite equivalent to the dictionary definition. There are some organizations where there is contractual permanence, i.e. apart from major misdemeanours or a national cataclysm there is no likelihood of loss of work. There are also organizations where, although there is no contractual permanence, there is virtual permanence, i.e. there is little chance of bankruptcy or of staff reduction, and dismissal only takes place for serious inefficiency—sickness not being in that category. From the individual worker's point of view there is little difference.

"Permanent" is also used for the staff that is not temporary, i.e. there is so much contract that dismissal cannot take place without specified notice, but that period may vary from one week to six months.

A further complication occurs in that in the so-called "permanent" organizations there are many workers not on that basis. Such variations of meaning make a critical consideration of figures very necessary.

Sometimes where there is no contractual permanence, and

where in theory dismissal can take place at a very short notice, the nature of the work or of the conditions of the work are so highly specialized that, in fact, there is little chance of dismissal or of the worker leaving voluntarily. The practical result is equivalent to permanence. Where this factor of permanence, actual or virtual, occurs, then on the whole there is a higher sickness absenteeism than in other groups. There is, however, the modifying influence of—

(3) *Effect of Chances of Change.*—Some organizations are very much more alive than others; there are more chances of promotion or of change. While it is true that some people prefer not to change, and would refuse promotion if offered, yet the majority hope for change, and there is a valuable sense of adventure when a beginner feels that he may rise from the lower ranks to the highest. Firms that have branches in several towns or in other countries offer interesting possibilities of advancement, and thereby provide a stimulus; horizontal as well as vertical opportunities for promotion are valuable, and in some cases not enough advantage is taken of the possibilities available in the organization.

Inelastic conditions, in work of such a specialized nature that real change is impossible, form a very trying set of circumstances for some people, and are found associated with a high rate of sickness absenteeism.

When there is a prospect of continuous employment for efficient work, not necessarily within the same department, or even town, an individual has a better chance of being interested and of getting away from circumstances that may be to him intolerable. It is not only the work itself that has to be estimated but the conditions under which it is done. For example, a typist's work involves much more than the actual typing. The work is in a particular setting, which may be of more importance than the typing. The flow of work may be regular or irregular, sometimes quality and sometimes quantity may be required, an organization may be too rigid or too slack, the head may be incompetent and so on: these and similar circumstances may make all the difference between high and low sickness absenteeism in particular cases. Where circumstances make it difficult to pass to other organ-

izations or to do other work, stability can be achieved at the expense of mobility, and thus exaggerate the effect of the departmental conditions on the individual.

(4) *Personal Interest of those in Authority.*—It is possible for an organization to give the individual workers the impression that they are of no account as such, that the machinery of organization is of more importance than the people who are part of it. The result is a feeling of impotence on the part of the staff. An extreme example of this was the director who remarked, "I am entirely uninterested in the staff until they are entered up as statistics." Had vital statistics been his work his attitude would have been quite correct. Unfortunately, he was in a position of authority over people.

The difficulty of the head of an organization knowing all the individuals in it is often unsurmountable, but he can train his immediate subordinates by his own example and teaching to be intelligent and human in dealing with those under them.

A general attitude of grousing among workers may be a good medium for the cultivation of disease germs, and a most expensive luxury. Where workers feel that they will get justice and reasonable consideration; where such opposition as comes is inherent in things themselves, and not due to the wilful ignorance or lack of imagination of someone with more authority than ability, then there is a mental environment that will prevent the easy yielding to every chance of sickness. Naturally, no group of people can expect to be without the congenital grouser, who always finds all conditions wrong, but if the general mental environment is healthy, his attitude will not affect others.

(5) *Men and Women.*—In each organization the women have a higher rate than the men, although they are composed of younger groups. Various suggestions are offered by experienced people. Women are paid less than the men and so have less to spend on necessities. They very often have home duties apart from their industrial work; while this in itself may not be harmful, it is serious if it involves lack of fresh air or sleep. It is true that not all women in industry are so circumstanced,

but it is certain that the number who are is not negligible, and since the war the number has increased considerably.

It is possible that owing to the shorter industrial life of a woman the medical entrance examination is not so stringent. To the majority of women the industrial life is not looked upon as a career, so they may be less interested in making a success of it. No one explanation fits a majority of workers.

Since 1939 an ever-increasing number of women have been recruited into industry and the usual peace-time conditions have been accentuated. In almost every factory the women have practically twice as much sickness absence as the men, and the reasons given include the usual peace-time ones, with others in addition. When hours are considered it ought to be remembered that in addition to her factory work a woman worker usually has domestic duties as well, so that her day ought not to be considered as merely the hours in the factory. Her fatigue, too, in some areas has been increased by shopping difficulties and anxiety about her children, and in some cases by lack of factory experience.

(6) *Some Occupational Differences.*—On the whole, the clerical worker tends to have a higher rate than the factory worker, working under the same general conditions.

It is held by some people that the factory tends to select a physically better type than the office, or perhaps that the physically inferior types tend to drift to office work. In organizations where the same standard of fitness is demanded, this cannot be the chief reason. As a matter of fact, much factory work is physically unexacting, and from the point of view of the movements required there is little to choose between the factory work and clerical work involving the use of mechanical appliances. Some think that the clerical occupations attract a more intelligent type than the factory, thereby assuming that a high degree of intelligence involves a higher liability to sickness—an assumption not to be uncritically accepted. It is obviously difficult to prove or disprove, but where data are available such does not seem to be the case. That clerical work tends to recruit those who are better at examinations is probable, as schools often advise such pupils to become clerical workers. If an organization draws its

people from a limited group of schools where such a tendency exists, the factory will get the less bookish children. There is no reason to suppose that such are less liable to sickness.

Another factor of importance is that to many people there is a greater satisfaction in dealing with real things or their organization than in manipulating their symbols. In interviews with large numbers of people abundant evidence was collected that the clerical worker, as time went on, tended to become less satisfied with his work than the producer. This may be because, in dealing with real things there is usually an objective standard of efficiency and the worker knows if his work is or is not up to the required standard. This is not so for the clerical worker. The typist, for example, in some departments, may be liable to approval or disapproval on the arbitrary judgment of a superior, so that work that has been accepted for some time may on a particular occasion be harshly criticized because the superior is bad-tempered. The robust person takes no notice or is amused, but there are some who in these circumstances live in a state of anxious uncertainty, a mental background that prompts to refuge in illness. Some clerical work is of that particularly irritating type demanding attention irregularly and spasmodically on a general background of routine. If work is purely routine, then the worker can think of other things, and if it demands continued attention there is no problem; work that is neither one thing nor the other is trying. It cannot be said to cause illness, but rather to help to determine it.

With shop assistants, who have a higher sickness absenteeism than the other comparable occupational groups, there are some important differences in conditions. It is unlikely that there is any important physiological difference between them and their colleagues, but there may be temperamental differences. At this stage no final answer is possible. The general conditions of selling in a large store involve at least (1) periods of rapid work alternating with periods of comparative calm—the rush periods are more characteristic of some departments than others; (2) a constant adjustment to the claims, not infrequently irrational, of other people; (3) a fear of not earning enough commission when this is the basis of payment; (4) a fear of complaints. To the right type these conditions

are stimulating and interesting; to the wrong type a constant source of worry.

Personal Factors

In addition to the above more personal differences in mental make-up also play their part.

Conflict.—A boy or girl of factory environment put into clerical work for a slight examination superiority might find himself in a supposedly superior environment; if he is really able, or can adjust easily, he will probably settle down happily; if, however, he is the over-sensitive type that feels its lack of equality and over-estimates the opinions and judgments of others, he is likely to break down. The struggle to be superior may be against too great odds. An illustration of this kind of conflict on the conscious level occurred during a transport strike. A large organization had arranged for special conveyances for the staff and a limited number of routes were arranged. Members of the staff were asked to say where they could most conveniently board a conveyance. It was known that many workers said they could join at places actually far away from their residences, rather than admit that they lived in a less desirable neighbourhood. They preferred the discomfort of a long walk to the admission that they lived in a poor part. For the short duration of these emergency measures no serious consequence was likely to follow, but where such a conflict is long continued, and however it may be expressed, it can be a factor in determining breakdown. Even in this case it is unlikely to occur only in these particular circumstances.

Elton Mayo [1] records an example of a girl whose output and health varied in consequence of personal conflicts. The difficulties were domestic and concerned her relations with her (foreign) mother and her family. There were three periods: a first period when her production was exceedingly low and irregular, a second period when her production was still irregular but improving, and a third when her production was much higher and quite steady. In the first period she complained constantly of headaches; in the second period she talked of her home problems to the fellow-workers and

[1] Elton Mayo, *Psychopathological Aspects of Industry.* Reprinted from the *Transactions of the American Neurological Association,* 1931.

to the observer. At the end of this period she realized to her astonishment that the remedy was in her own hands. She was of age and earned enough to be self-supporting; she determined to live with another girl, a colleague. This determination and the putting of it into effect marked the third period of high and steady production, and cessation of the headaches.

(2) The conflict sometimes takes another form. There are people who prefer to be missing if any extra work is about. The problem for them is how to do so with honour. The best way out is illness. In one office I know well, a certain girl always had a heart attack when there was a rush of work. Nobody seemed to see the connection, primarily because these rush periods were at irregular intervals, sometimes with a considerable interval between. She was not malingering, but by the time she was adult she had made a fixed association between a heart attack and extra work so that the attack came automatically. If she had not been allowed in earlier days to get out of her work, the habit might not have developed.

An example of an early stage of this occurred with a schoolgirl, whose teacher reported heart attacks, but whenever she was examined by the doctor he reported that there was nothing organically wrong. It was then suggested that her attacks should be related to the school time-table. This was done, and the attacks were found to come on whenever there was a test or examination in mathematics, which she found difficult. Nothing was said, but at the next terminal examination the headmistress found her coming out ill. She treated her kindly, sent her to rest, but added, "It's such a pity you should lose your marks for mathematics; you shall rest this morning and do the paper this afternoon." The afternoon was to be devoted to sports. She did not try that way out again.

Another type very similar is the "martyr"; he or she also is not fond of difficult work, and one such indulged in "sickness" whenever there was something she felt she could not do easily. She would have to go away, and all the time she moaned, "I do wish I were like other people; I feel such a beast leaving the work, but what can I do?" Unfortunately

her environment lived up to it and really thought she was a martyr. A robuster treatment at an earlier stage might have worked wonders.

The Effect of the "Nervous" Temperament.—It is very difficult for most of us to realize that failure of emotional adjustment can lower the vitality and in consequence impair the health, thus rendering the person less resistant to any infection, or that it may even be expressed in serious disability, of which the following are examples:

Reference has already been made to the sufferers from telegraphists' cramp.[1] An examination showed that the majority of these had serious symptoms commonly known as nervous, or psycho-neurotic, such as irrational worry, inability to get on easily with others, being easily frightened or irritated, or upset by conditions that did not affect others, compulsion to think or do things although known to be unnecessary; that is, their emotional reactions are unstable, uncontrollable or unadapted.

The particular conditions of telegraphy require:

(1) Speed and accuracy under variable stress.
(2) The constant presence of a potential critic at the other end of the wire.
(3) Generally working with and in the presence of other people.
(4) A rapid muscular action involving delicate movements which, being under conscious control, can be easily disturbed by mental anxiety.
(5) A rigid objective standard of attainment.
(6) Finality of attainment, i.e. an error made cannot be recalled without being known to someone other than the agent.

Not all people are temperamentally fitted for successful work under these conditions. The fine movements employed can reflect, much more quickly and certainly, changes which would fail to disturb grosser movements; e.g. an anxiety, rational or psycho-neurotic, could easily come between the sufferer and his telegraphy, whereas the same mental state in

[1] Smith, Culpin and Farmer, *A Study of Telegraphists' Cramp*, Ind. Health Res. Board, No. 43.

a typist might show itself in errors of which she alone need know, and might fail to be reflected at all in the work of a machinist. Emotional poise as well as muscular efficiency is necessary for certain occupations.

Dr. Halliday [1] analysed the case records of 1,000 insured persons who had been certified as unfit for work and examined by a medical referee, with the object of finding out the proportion who had been incapacitated by psycho-neurotic disorder. He writes: "An anxiety state is now recognized to be an expression of fear or worry, which is a correlative of fear. It tends to occur when an individual encounters a painful or unhappy situation in life, and responds to it in a faulty way, so he becomes flurried and is unable to think clearly about his difficulty. His mind flees from it, and the flight is accompanied by those bodily symptoms and signs which are an expression of the emotional reaction of fear." His mind then becomes concentrated on the symptoms.

Some of the painful situations precipitating an anxiety state were found to be personal relationships, financial difficulties, occupational difficulties, and fear of disease. Some of these may actually not be facts of the environment, but they may be real to the sufferer. Dr. Halliday found that, taking men and women together, over one-third of these patients belonged to the psycho-neurotic group.

An enquiry made by Dr. Davies and Dr. A. T. M. Wilson [2] with 205 sufferers from peptic ulcer showed that in 84% the symptoms began after some event affecting the patient's work or finances or health of his family. Only 22% of a series of patients with hernia gave a history of any such event preceding their illness. When the patients of both groups were examined for the presence or absence of psycho-neurotic symptoms the majority of the ulcer patients showed the presence of such symptoms. "The ulcer patient is first and foremost a worker; and a large number will readily describe how they have difficulty in giving up work. There is an urgent, anxious and

[1] James L. Halliday, *Psychoneurosis as a Cause of Incapacity among Insured Persons*. Supp. to *Brit. Med. Journ.*, March 9 and 16, 1935.

[2] A. T. M. Wilson, *Psychological Factors in Organic Disease*. (A paper read before the Medical Society of Individual Psychology. London, May 12, 1938.) D. T. Davies and A. T. M. Wilson, "Observations on the Life History of Chronic Peptic Ulcer", *Lancet*, December 11, 1937.

compulsive quality in their activity, and if they are not working they are worrying." The hernia cases showed very few with these characteristics.

The writers conclude that "chronic ulcer is a structural change and that successful therapy depends upon attention given to the whole man—his work and his anxieties as well as his diet". We must ask why the patient has this particular manifestation of the disease.

Another industrial disability involving sickness absence is nystagmus, which is a disease of the eyes in which the chief objective symptom is oscillation of the eyeballs.[1] Considered objectively it would appear as a simple case of physiological disease, but a fuller examination shows the simplicity to be deceptive. If it were merely that a certain degree of oscillation incapacitated a miner the issue would be clear. The cases recorded, however, show:

(1) Miners with severe oscillation who are not incapacitated.
(2) Some with severe oscillation who are incapacitated.
(3) Some with oscillation and other symptoms, physical and mental, not peculiar to nystagmus, e.g. tremors, giddiness, anxiety symptoms, hysteria, etc.
(4) Some with the above symptoms but with no oscillation.

These conditions seem to place nystagmus and cramp in the same category, viz. that of psycho-neurotic diseases expressed in some people in symptoms of a partially disabling nature. In both diseases there is a common group of symptoms mental in character, and a physiological symptom supposed to be characteristic which may or may not be present. The psycho-neurotic develops whatever symptom the environment suggests

In a recent enquiry into sickness absence in munition factories it was found that gastric affections and nervous conditions were prominent causes of absence.

In a previous chapter it has been shown that the nervous person is not inevitably doomed to break down, but that, given some special stress, he is more likely to do so than his more emotionally stable colleagues.

A task for the future is the greater understanding of the mental difficulties of people.

[1] Millais Culpin, *Recent Advances in the Study of the Psychoneuroses*, London, 1931.

Chapter VIII

MEASURES OF HUMAN WELL-BEING[1]

The general idea that must have issued from the previous chapters is the complexity of all the problems that confront a student, whether belonging to or outside an industrial organization, and this is not because it is an industrial but because it is a human organization. In consequence, there is great difficulty in finding a measure to serve as an indicator of the well-being of such groups. Since the war much has been said about lost time in industry, and frequently public speakers have indulged in some vague figures purporting to stand for the time that might have been devoted to munitions but which has mysteriously been "lost".

The figures given have often been meaningless, but the use of lost time as a measure of human well-being, when accurately measured and intelligently interpreted, is a wise course.

The word "lost" is not perhaps the best word, but it has, by constant use, become almost a technical one, although a great variety of meanings are attached to it. "Lost" is a relative term; lost in regard to what? The enthusiast for racing who stops away from work to go to the Grand National would probably consider, especially if he had backed the winner, that his time had been anything but lost; his employer would consider the absence as lost time. Lost time in industry means the time that should have been spent in production or preparing for production, but which had been spent in other ways. Thus absence from work for any cause is lost time. Actually, certain conventions hold, so that meal-times, rest pauses, would not be included in lost time. There are two kinds of lost time: (*a*) time wasted which should have been spent in working, and (*b*) absence for a unit period of time, e.g. half a day, a day, or a shift. It is with this latter that we are here concerned. If absence is high, then there is a case for enquiry; but what constitutes high or low is not easy to decide.

[1] The data for this chapter are taken from Report 75, Ind. Health Res. Board.

Nevertheless, one would not expect that a well-organized, well-run firm would find its employees seizing every opportunity to absent themselves.

But before the cause of the absence can be diagnosed there must be some means of knowing how much absence there is. It is a remarkable fact that relatively few organizations systematically record absences, and some who do, fail to utilize the records. There are elaborate costing systems—though even these have not been achieved without much uphill work—accurate and reliable financial records, assessments of wear and tear on machinery, estimates of production, and so on, but the equally important knowledge of the coming and going, whether temporarily or permanently, of staff is not available.

There should be for each group of an organization an accurate daily entry of each person's presence or absence. This sounds easy, but actually many firms find the greatest difficulty in arranging that eventually some one department should be aware of each absence. It is generally assumed that the wages department must know of any absence, but there are firms, admittedly small ones, where the management says, "We just pay their wages if they are away; they don't stop away much". The trouble comes when something unusual happens and some accurate comparison is needed.

Methods of Recording

For each member of the staff there should be a card which should contain, at least, the following items:

Name and Works Number.	Date of Birth.
Department.	Date of Entry into Firm.
Occupation.	Date of Leaving.
Sex.	Cause of Leaving.

The rest of the card should be used for details of absences, namely:

Date of First Day of Illness. Date of Return.
Cause (if an accident, full details).

In normal times absenteeism except for sickness is not important. Even in war-time, with all the lets and hindrances affecting ordinary life as well as industrial, the absenteeism from sickness exceeds that of all other causes together. It is therefore important to have it carefully recorded. Many

organizations only include absence of longer than a certain amount, which varies from 3 days to 15 days. Such absence is covered by a doctor's certificate, and if the value of a sickness analysis were limited to a study of the more important disabilities, i.e. important as involving continuous absence, then there would be no objection to the method. Actually, the short absence, i.e. of 1 day or 2 to 3 days, is a valuable index of what is happening. Tuberculosis or a serious operation are arresting, but an organization can arrange for the patients, knowing that they will inevitably be absent for weeks. The short absence for colds or headaches or minor gastric disorders is actually more disturbing to a department, because it cannot be foreseen and arranged for.

The 1-day absence is the commonest type. This does not mean that it causes the greatest amount of sickness absence—usually it does not—but it cannot be judged only by its duration. There are many complaints from heads of departments about such absence, but there is no standard as to what constitutes a reasonable amount. It is generally found that 1-day absence covers the worst day of a bad cold, slight malaise, fatigue, disinclination to work, etc. In some occupations and in some departments of a firm the dislocation of work caused by such absenteeism will be greater than in others. The absence of a few skilled workers in a precision-instrument works or in the ironing department of a laundry can cause considerable inconvenience; in the typing department usually much less.

Some firms definitely discourage those suffering from a cold from remaining at work, and believe that 1 day at home is useful in preventing a serious attack and in limiting the spread of infection. Where this policy prevails it does not result in an increased absence rate if the "tone" is good.

Analysis of the days of the week shows that there is more 1-day sickness absenteeism on Saturday and Monday than on any other day. Apart from the obvious explanation of having a week-end off, such figures often hide an illness of 3 days' duration, although only 1½ are working days. The over-conscientious are liable to this line of conduct.

If the organization of a firm is such that only the absence, but not the reason, can be known, then a classification of the

spells of absence is of use. For example, in a small group of 183 women, 106=57·9% during the year 1938 were not absent through sickness. This is a figure worth working out. We tend to concentrate on sickness and overlook that a health figure is quite as important. The range, in so far as figures are available, is from 30% to 60% who are never absent during the year.

Of those who were absent, the spells of absence can be classified into (*a*) 1-day absence; (*b*) absence up to 1 week; (*c*) absence up to 1 month; (*d*) absence lasting for more than a month. There were 114 spells of different duration, of which 24 were of 1 day only, i.e. 21% of the spells were 1-day absence; 47=41·2% were over a day but not exceeding a week; 39=34·2% were of a month's duration, and 4=3·5% lasted more than 4 weeks. The short absence, i.e. a week and under, accounts for the greatest number of spells of absence. The long absence, i.e. over a month, only affects a few.

It will usually be found that the absenteeism of more than a month's duration is due to a small proportion of the people. In an analysis made of a number of organizations it was found that the range for men was from 1·3% to 5·2% of the given population, and for women from 0·8% to 7·7%. Roughly, less than 5% of the various groups studied have illnesses of more than 30 working days, and they account on the average for about 30% of the total sickness absenteeism.

Medical Diagnosis

For various reasons there is usually considerable difficulty in obtaining detailed medical diagnosis. Naturally the very short absence is not covered by a medical certificate, and in many cases when given the diagnosis is purposely vague. All that many of the diagnoses mean is that the doctor has reason to believe that the patient is unfit for his work. No refinement of classification can possibly get over these difficulties. In groups composed of less than 1,000 individuals there is little need for classification under such general headings as Diseases of the Respiratory System, Disease of the Naso-pharyngeal and Upper Digestive Tract, Diseases of the Circulatory System, and so on. The main distinction from an administrative point of view is between those illnesses

involving a few persons for long periods and those affecting many for short periods.

The medical staffs of industrial firms are often in a dilemma when tabulating the loss due to the various diseases represented on the medical cards. Should each diagnosis be treated separately, or can some, and if so which, be grouped? The first method produces a long and often useless list of diseases; the other produces a more manageable table but may obscure the data for comparative purposes unless each organization knows what is included in each group. For example, one doctor includes "influenza" in the group labelled "infections", and another with "colds and respiratory affection"; "nervous dyspepsia" might be put with "digestive affections" or with "nervous affections".

If a problem should arise concerning the incidence of digestive disorders, or of infection, or of nervous affections, the different classifications would obscure the facts. In order to see what kind of a table would result from entering each diagnosis separately, the sickness data for two large organizations were analysed.

The total sickness absenteeism for the year was calculated and the number of days ascribed to each disease was expressed as a percentage of the total loss. Although the two groups were quite independent, yet the distribution was similar. The resulting table consisted of 75 items; of these, 49 accounted for less than 1% each of the total loss, and the majority for less than 0·5%. The remainder could be grouped as follows:

(1) Colds and influenza, and the minor throat affections.
(2) Accidents.
(3) Gastric affections.
(4) Rheumatism, sciatica, lumbago, myalgia.
(5) Nervous breakdown, including nervous debility and allied disabilities.
(6) Various septic conditions.
(7) Operations.
(8) Special hazards.[1]

[1] During the war there are special hazards, particularly T.N.T. poisoning and dermatitis, due to the substances used. Since only a part of the staff are in contact with these substances, the number so exposed should be kept separate for statistical purposes.

Logically, it is not a classification at all, for there is no one basis of division. Strictly speaking, an "operation" ought not to be called a disease, but a method of treatment of an already existent disease; yet that is a frequent entry on industrial returns, and it serves its purpose. Colds and influenza have been put together, not because they ought to be so classified, but because in actual practice no differentiation related to facts is possible; at times every cold tends to be called influenza.

Nerves, nervous breakdown, nervous exhaustion, and other synonyms are fairly common diagnoses, but should not be included with organic nerve diseases, which are very rare.

How to express Sickness Absence

For a period of a year the simplest and least ambiguous figure is to count the number of days lost through sickness during the year and divide this by the number of men or women employed. All that this means is that if the days lost, instead of being limited to a few people, were distributed evenly, how many would each person have?

If a group of 2,883 men lost between them 9,485 days, then 9,485 divided by 2,883=3·39 days would be the sickness absence figure for the year. Then the number of days ascribed to each of the causes of sickness absence could be calculated and expressed as a percentage of the total loss, thus:

	Days lost.	Percentage of total loss.
Colds and Influenza . . .	3121	32·9
Accidents	968	10·2
Rheumatism and allied affections .	749	7·9
Gastric affections	512	5·4
Septic conditions	844	8·9
Nerves and debility . . .	190	2·0
Operations	598	6·3
		73·6
Other Causes.	2503	26·4
	9485	100·0

It will be seen that colds and influenza head the list, and this figure is fairly characteristic, i.e. about $\frac{1}{3}$ of the total loss

is due to this alone in any group. The other affections vary from year to year and from one group to another. In some organizations "nervous" disabilities are high, while in others they are low. These have been discussed in a previous chapter.

An interesting side-light on diagnosis occurred during an examination of sickness records in an organization for a period of 9 years. Examining the fluctuations of the various diseases from year to year, it looked as if there were some relationship between "gastric" and "nervous" disabilities, of such a nature that when one was high the other was low. It is now becoming more and more recognized that some gastric symptoms are connected with emotional troubles; the probability is that some at least of the gastric symptoms might equally as well from the point of view of diagnosis have been incorporated in the nervous group, for what one physician would enter as "gastric" another would enter as "nervous".

That emotional conflict, conscious or unconscious, can affect the digestive processes is known, but too rarely when the digestive disturbances occur does the doctor enquire about a possible emotional cause. Nor even then is there adequate opportunity for treatment. This does not rule out the effects of dietetic errors and the like, but the anomalies of the industrial gastric disorders are too great to be ascribed to this cause alone.

In working out a sickness rate men and women ought to be kept separately and, if the organization is large enough, age groups should be differentiated. In any case, the adolescents should be studied separately, since they are less stable than adults and a rise in their sickness rate needs enquiry.

So far we have only considered the yearly figure. If a weekly or monthly figure is desired, the days per person will be less than unity, so to avoid decimal places some percentage form is generally adopted. Or the number of hours could be worked out instead of days. The alternatives in use are:

(1) The total number of people absent through sickness during the week, expressed as a percentage of the number employed. This gives the case rate.

(2) The total number of days or hours or shifts lost through

sickness divided by the number of people employed and expressed as a percentage.

(3) The total number of hours lost, expressed as a percentage of the hours that could have been worked, i.e. the number of hours worked multiplied by the number employed.

Some organizations prefer one and some another, but the basic data are:

(1) The number of workers (men and women kept separated) employed.

(2) The number of hours or shifts or days lost.

(3) The number of hours or shifts or days worked.

If one of the above ratios is worked out every week and the result graphed, it will be easy to see whether the general health is improving or not, and if not measures could be taken to deal with it.

Labour Wastage

Another form of lost time has already been touched upon in the discussion on unemployed girls, namely, that which is usually called labour wastage. The use of the word "wastage" implies that the ebb and flow of employees is undesirable from the point of view of the firm; this is only partly true.

It is true that a completely static staff would be undesirable; an organization where no one left except to die would hardly suggest life. On the other hand, a completely unstable staff would spell ruin. Just as a town or country needs movement in its population but not constant change, so does an industrial organization.

It has been mentioned above that few firms keep adequate sickness records; still fewer work out their labour wastage. Perhaps if they did, something might be done to deal with the problem of those who remain such a short time. The analogy for industrial labour wastage is the death rate.[1] Every method in use for the measurement of death rates has its application to the measurement of labour wastage. So far as a particular organization is concerned, a worker who has left has died and a worker who is engaged is born.

[1] M. Greenwood, *Labour Wastage*, Ind. Health Res. Board, No. 75.

The first problem is to measure the "deaths" in relation to the population for a year. If the organization were completely stable so that the only change was "death", i.e. the number leaving, then the wastage rate would be this number divided by the number there at the beginning. Usually, however, the number employed is not quite so simple, so the number leaving should be divided by the average number employed, which can be obtained by taking the number on the books at the beginning of each month and calculating the average. It happens in some forms of industry that large numbers are taken on for special limited periods, e.g. sales, seasonal work; these temporary workers ought for both labour wastage and sickness calculation to be kept in a class apart. If some of them are kept on afterwards, then they should be included as ordinary entrants.

During periods of considerable expansion, which occur sometimes even in normal times and which during a war are almost the normal condition, much time would be saved by a study of the duration of "life" in the particular organization. A simple method of calculating this is to find out the number of men and of women who left during the unit of time selected and divide this by the average number employed and express the result as a percentage. Omit from the leavers and from the number employed those appointed only for a limited definite time. This is a crude wastage rate, and is the most important rate to find. It, however, makes no allowance for age, length of service or occupation, but these can be worked out similarly.

Example

Period of time.	Average number employed.		Number leaving.		Crude wastage rate.	
	M.	W.	M.	W.	M.	W
Jan. 1st-31st	316	964	16	101	5·1	10·5

It is useful to work out such a rate for different sections of an organization. Where it is found that the wastage rate is high in a particular section, a reason should be sought.

In one firm, out of 524 entrants on a given date 130=24·8%

left before the completion of a month's service. This was a very high loss. By a study of particular departments it was found that the greater part of the loss was due to women on the kitchen staff. So far the statistics. An enquiry revealed that the conditions left much to be desired.

In most processes some little time must pass before a beginner is proficient. Suppose that a period of three months was needed before an entrant could be of real value, and suppose that 90% of those entering on any date left before the expiration of 3 months; obviously the organization would stand to lose considerably. Although such a supposition is exaggerated, yet it is improbable that in any case all the entrants would complete the course, so a knowledge of the number leaving at different stages is desirable.

If it is known that a certain percentage are likely to leave before the end, allowance could be made so that the number taken on and trained should be sufficient to compensate for the expected loss. The method of working this out is not difficult. Suppose that on 1st March 100 entrants begin to learn a job, and that by the end of the first week 5 have left=5%; that means that 95 remain to begin the next week; if of these 4 leave, then $\frac{4}{95} \times 100 = 4{\cdot}2$ gives the loss per cent. and 91 begin the 3rd week; if of these 4 leave, then $\frac{4}{91} \times 100 = 4{\cdot}4\%$, and 87 are left to carry on for the 4th week; if 5 of these leave, then $\frac{5}{87} \times 100 = 5{\cdot}7\%$, and 82 are left. Expressed as a table it is:

Weeks of service.	Number present.	Number leaving.	Number leaving expressed as a percentage.
1	100	5	5·0
2	95	4	4·2
3	91	4	4·4
4	87	5	5·7

So at the end of a month only 82 remain of the original 100; if 100 would be needed by the end of the month, then, assuming that this was a usual rate of leaving, it would be necessary to take on 122 to allow for this loss.

It has been found that in normal circumstances the highest

wastage as a rule occurs during the first month, though there are exceptions. In war-time this cannot be assumed.

Of what value is a wastage rate? If the wastage rate is high in the first few days or weeks there is something very wrong. If the reason given is "dismissed as unsuitable", then the method of selection or training has been faulty, or the conditions might be so bad that few people, having experienced them, would remain, in which case drastic alteration is necessary.

Some of the conditions that in peace-time lead to a high labour wastage have already been discussed; they include material environmental conditions such as lighting, too long hours, faulty selection, inadequate training, unrelieved routine, as well as faulty management. Occasionally a high wastage rate has been due to competition by different firms for a limited field of labour. In war-time there are numerous others, some of which are uncontrollable.

Lost time, whether in the form of sickness absence or labour wastage, is a very useful instrument to measure the sum total of the influences affecting the general well-being of an industrial group. Where there is contractual security the sickness absence is the better measure; in a comparison between two organizations, one with contractual security and the other with only relative security, 5·2% of the former compared with 12·7% of the latter left to seek another position in a given year; 0·3% against 3·8% left for health reasons, the former organization having a much more stringent medical examination; the sickness absence was 12 days per annum for the former compared with 6·0 days for the other.

It is impossible to fix standards, since there is a considerable range of variation from one organization to another, but where there is a sudden rise, or a gradual rise extending over some weeks or months, that rise should be investigated.

"Our sickness rate is 5 days per person per annum and the wastage rate is 13·6%." These figures symbolize in arithmetical form the resultant of all the conditions, material and psychological, that constitute the environment in which numbers of people, each differing from the other in body and mind, spend their days.

Chapter IX

GENERAL HINTS ON METHODS OF INVESTIGATING

Research workers, whether on the staff of a firm or acting as independent researchers, may spoil an investigation for lack of forethought. A problem presents itself usually because a practical difficulty has arisen, but it is often expressed vaguely, or in language that is ambiguous. The first necessity for the research is a clear statement of the problem, i.e. the various terms must be expressive of something definite. For example, a request for selection tests for salesmanship is too vague. It would be necessary to ask what kind of salesmanship; some selling really involves very little salesmanship. The qualities required to sell fashion-gowns may be quite different from those concerned with selling cigarettes. Salesmanship is an abstract noun and before beginning an investigation the abstract must be translated into something more concrete, e.g. temporary fashion articles, relatively permanent articles, individual selling (i.e. the shop or department specializing in appealing to individual tastes), routine selling, and so on. If the problem is concerned with routine selling, then a parallel study of a different kind of selling might help by contrast to elucidate the other. Again, the problem of "How are we to select foremen who will use their power wisely?" This is too general, because it implies that the difference between a good or bad foreman is ability to rule artistically, but there are other qualities. Secondly, it is useful to ask oneself: "What would be the ideal evidence to satisfy the requirements of the problems?" Since the ideal is an abstraction not even approachable in human studies, it is certain that one will have to be content with something much less; it is, however, just as well to know how far away the possible is. This realization would prevent many hasty generalizations. A statistician is reported to have required that a good sample should be "ten thousand times ten thousand". It is asking

a lot, but with that in mind even as a joke, a sample of ten will not be taken for more than it is.

The Data

The data for most investigations consist of:

(1) Records already in existence. Since they will not have been compiled for research purposes, they are unlikely to be the perfect medium for research. The recognition of this will save much waste of energy, since one will be thankful that anything useful exists, instead of lamenting that it falls short of perfection. It is important, however, to find out in what respect the records are defective, so that they are not assumed to be better than they are. Examples of research using already existent records are: all sickness absence problems, labour wastage, accidents, influence of environmental agencies.

(2) Output. The difficulties of measuring output are many. They will be discussed later.

(3) Material obtained by interview or by the use of tests, or by observation.

Some Examples

I. *Sickness Absence Investigations using Records.*[1]—(1) Some years ago there arose the problem of "Why do the omnibus drivers in London have a higher incidence of gastric disorders than other industrial groups?"

The view that they did was held by the trade union representative of the workers and by the men themselves. There were also many attempted explanations, one of which was the strain of driving in the congested London traffic. What, however, was lacking was evidence that such an occupational liability really did exist. It is quite useless to say that 6% or 10% of the sickness loss is due to gastric disorders in some organization unless it is known how much is the loss in other groups of workers, and how accurate are the diagnoses.

When Dr. Bradford Hill undertook the investigation he

[1] Bradford Hill, *Sickness Experience of London Transport Workers*, Ind. Health Res. Board, No. 79, 1937.

found that complete sickness absence records did not exist. This being so, he had to find out what useful material was available, so the next step was to scrutinize the records and diagnoses that did exist. After a critical survey he decided that a sufficient number of periods of illness of 15 days or more existed with diagnoses, both for omnibus drivers and conductors, to make a statistical study worth while. For a control group he took tramway drivers and conductors. He would certainly have preferred complete and detailed records.

This is mentioned to illustrate the difficulties of data. The result of this analysis showed that the busmen did in fact lose more time than the tramwaymen on account of gastric disorders.[1] The report is an excellent example of the difficulties and possibilities of such investigations.

(2) Suppose the problem presents itself in the form, "Has there been since the war any real increase in nervous breakdowns?" This sounds easy, till the next step is taken. What data will be needed? The answer is: a complete account of all sickness absence and the medical diagnoses for a large number of differing organizations for a number of years. Now the trouble begins. Some organizations do keep excellent sickness absence records complete with diagnoses that have been checked, but they are few in number. Then the diagnosis "nervous breakdown" is more vague even than gastric illness and does not mean the same thing to all doctors. At this stage the investigator either gives in or prepares for a life-work.

II. *Output Investigations.*—The answer to many industrial problems involves the use of output as data.

"Output", like its fellow "production", is an uninspiring word; it calls up few pictures in the mind and is dear to writers on industrial psychology and economics, as also to political speakers.

Those of us who, for convenience, must use it need to remind ourselves at intervals that it is a general term and symbolizes many concrete things, e.g. aeroplanes, tanks, rivets, books, suits and shirts, aspirin, clean clothes, scientific articles,

[1] Bradford Hill, *Sickness Experience of London Transport Workers*, Ind. Health Res. Board, No. 79, 1937.

speeches or lessons, also the things sold, the letters typed, statistics tabulated, policies framed, or the decisions reached.

Behind the output is an innumerable company of human beings, each with his hopes and fears, dreams and realities, all of which play their part in the final result.

Since output is the outcome of activity and the aim of the work, it is the obvious means of estimating the effect of material conditions, hours of work, hourly variations, etc. It is true that in the minds of some people to study output is to try to increase it at the expense of the workers for the profit of directors. Such a motive is not unknown, but it is no motive of a scientific investigator, whose sole object is to get the facts in so far as possible. It seems at first sight easy to estimate the hourly, weekly, or monthly output, but actually it is extremely difficult in many processes. It may be helpful to outline some of the methods that have been used:

(1) When the work is of a simple, repetitive type it has proved possible to count the number of units of work produced each hour of the working day. The counting was done in some processes by an attachment to the machine that would automatically register the number. In the process, for example, of "ripping" in shell-making, an hourly record of the number of shells handled was possible; in weaving, an instrument known as a "pick recorder" was fixed to each of the looms.

By such means it was possible to study the effect of the working day, days of the week, individual variations, seasonal variations, details of which have been given in a previous chapter.

(2) For various reasons a complete hourly output might be unobtainable because the process was too variable, e.g. in laundry work a hand-ironer does in the course of a day several kinds of articles, or even the same kind of article might require different treatment, so that she might produce fewer finished articles between 8 and 9 a.m. than between 6 and 7 p.m. Or the pressure of the work might vary, rush periods being followed by periods of comparative calm, as for example in telegraphy or telephony or selling.

In such cases some other measure must be sought, of which the following are examples:

(*a*) In an investigation concerned with the work of "dollying" (polishing the bowls of spoons or forks) one of the chief difficulties was that a dollier works on a great variety of articles, all of which require, to some extent, different treatment. The investigator decided to take coffee-spoons as the unit of measurement, and by timing the various other articles, to translate them into terms of coffee-spoons. It was found that one table-fork took the same time to "dolly" as 2·35 coffee-spoons, and one dessert-fork was equal to 2 coffee-spoons. This gave an approximate output figure and enabled hourly output to be studied.[1]

(*b*) When the above methods have not been possible, a useful, though not quite so satisfactory, measure could be obtained by using a sample.

It has sometimes been possible to arrange that at each hour of the working day the worker does a certain number of standard articles. In studying ironing and folding table-linen it proved possible to arrange that at each hour a fixed number —in the case of ironing, 5 shirts of a particular type, and for folding, 20 table-cloths—should be done. The average time taken for each group was calculated, and used as the measure for that period.

(*c*) An indirect method has proved useful when the machine plays a large part in determining the output. If one concentrates on that part of the process which is under the control of the worker, it is possible to get some indication of the cumulative effect of the work.

In calender work, i.e. placing and guiding articles such as sheets and table-linen to pass between steam-heated rollers, when the end is just passing through, the worker has finished with it and should get ready to place the next one in position. The interval elapsing between the workers taking their hands off one article and placing the next one was timed.

[1] Eric Farmer, *Motion Study in Metal Polishing*, Ind. Health Res. Board, No. 15, 1921.

In order that the measure should be reliable the following conditions must be realized:

(1) The articles must be of the same kind on all occasions.
(2) There must be a constant supply of work so that workers are not stopped for want of work.
(3) The same standard of work must be maintained.
(4) The selected articles must be in the same preparatory state.

The articles selected for calender work were sheets. The interval between taking the hands off one sheet and placing the next one was timed with a stop-watch for 20 successive sheets, as frequently as comparable sheets were being calendered. For example, the following is a part of a sequence of seconds obtained for one set of timings:

4, 5, 5, 5, 5, 4, 5, 5, 4, 4. The average is 4·6 seconds.

Then 4·6 would be taken as representing the work for that period, namely, at 10 a.m.; similar sequences were obtained at other hours. It was possible then to compare the variations hour by hour.

There was a tendency for this interval to increase towards the end of the afternoon.

Problems concerned with Improving Conditions

In the previous examples the output has been accepted; whether it was the best that could be obtained did not arise, since the problem was, with the methods adopted, to determine how far the output was affected by the passing of the hours, or other conditions.

(1) If, however, the problem should be one of improving the methods, then studies either of time or motion or both arise. Simple forms of these have been discussed. From the point of view of method, care must be taken to see that studies are made of various kinds of workers, not merely, as is the temptation, the best or the worst. Ordinary people are rarely interesting, but they are important if for no other reason than that there are many of them, and however excellent may be the initial selection and the general conditions, no place of work or even department will ever be composed of perfect

people. When all is said and done, a good average is all one should expect. Incidentally, it is perhaps worth mentioning that it is more courteous to stand up when timing someone who is standing, unless it is impossible.

(2) If the external environmental conditions are at fault, then special studies of the lighting, ventilation, temperature, etc., must be made. There are now excellent techniques for carrying out such researches. Problems of the adequate sample are extremely important here.

(3) If the problem relates to grievances or personal difficulties, then the personal interview under strictly confidential conditions is the chief method, combined with a sympathetic but critical observation of the relationship of management to the staff and of one group to another. Much can be learned about the human relations when conducting even ventilation experiments.

It is useful to learn the art of making oneself "passive" mentally, letting, as it were, the environment have full play; sometimes soon after, often some time after, a probable answer suggests itself, or, as it is sometimes expressed, "I had an intuition". Intuitions by their very unusualness tend to be overrated. An intuitive suggestion must be treated as data obtained by any other method, namely, critically analysed. If it should prove to be correct, well and good; it must be proved correct or false by objective standards. Even intuitions do not come without work; they usually represent the end of a period of considerable mental stress. The person who says he can "sense" the well-being of an organization as soon as he enters the door rarely subjects his "sensing" to critical test, nor does he balance his right and wrong guesses.

To return to the interview: the more obvious difficulties have already been discussed. If the object is to investigate grievances, discontent, or morale, a representative sample of the total staff must be interviewed; in a small firm it is possible to interview all. Often a beginning at least has to be made with volunteers, but there is the difficulty that self-selection of one type might take place. If a grievance were to be investigated it is unlikely that the contented person would volunteer.

Generally after a start has been made there is no difficulty in getting a good majority. Success depends largely on the

skill of the interviewer. Courtesy is essential, the courtesy one would extend to a social interview. There is a great difference in the amount of data that two people obtain from the same person according to the relationship established at the beginning. Since a judgment has to be made on the data, the final estimate may be very different. (In *Pygmalion*, Eliza contrasts the behaviour of Higgins with that of Colonel Pickering, "He treats me as a lady".)

It may be necessary to speak to a group for a few minutes in order to enlist their support. Since this might be sprung upon one without time to prepare, it is wise to practise thinking out a possible short talk beforehand.

Be clear as to the aim, and express it in the simplest and clearest language. Then mention such information as is necessary for a background, explain what you wish to do, i.e. interview, test, watch the work, or ask questions. As a mere matter of technique it is better not to ask those who are willing to help to "signify in the usual way", but those who are unwilling. That makes it easy to acquiesce, and only the strongly antagonistic will object. In most groups it is as well to avoid the use of the word psychology. Psychology is the science; the investigation is concerned with a practical problem, and hence a less solemn word is preferable.

Tests

Tests have been frequently mentioned in researches into telegraphists' cramp, accident, vocational selection, etc. It is impossible to do more than give a general idea of them, their function and value.

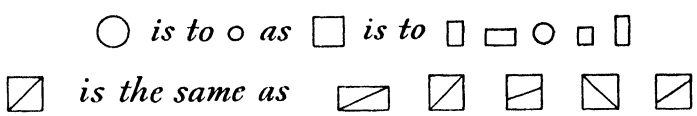
(1) The best known is the *Intelligence Test*, which is essentially a test of ability to recognize relationships, usually as expressed in words, that is, tests that depend on reasoning.

In the printed forms for group tests various alternative answers are given: the subject has to underline the correct one.

Late means the opposite of . appointment, early, behind, postponed, immediate.
Young means the same as . youthful, ancient, not baby, vigorous.
Black is to white as bad is to . evil, red, try, good, right.

These examples are simple: the questions increase in difficulty. The actual subject-matter varies, but the type is the same (of the published series the most familiar are: *Group Test No.* 33, published by the National Institute of Industrial Psychology, and the *Otis Group Intelligence Tests*, published by Harrap and Co.).

To avoid the over-emphasis on verbal facility the same basic problems can be expressed in spatial forms, e.g.:



(2) *Tests of Dexterity.*—These tests have not been so well developed or standardized as the intelligence tests. There is much ambiguity in the use of the words skill, dexterity, motor ability, motor capacity, mechanical ability. Professor Pear in a number of publications has tried to introduce some kind of order and differentiation in meaning since we do not need mere synonyms. Skill involves the "ability to be aware of and to correct faulty adjustment", and hence implies intelligence. Since skill suggests ability to do a relatively complicated thing easily and well, the word should be reserved for the higher grades of performance.

"Mechanical ability implies a higher degree of skill in that it has to combine a specific form of motor ability, e.g. manual dexterity, with a certain ingenuity in order to obtain perfection in the actual execution."

Motor capacity means a capacity to make fairly simple movements. An increasingly large number of industrial processes consist of repetitive movements requiring little bodily strength or intelligence after the learning stage. Some processes require the use of two hands, either performing a similar or different movement, others the co-ordination of the hand and eye, ear, etc.

Tests of Motor Ability, or Muscular Skill

The chief conditions of the test are that it should be:

(1) Of such a nature that it is not affected by previous experience (e.g. if the test were one of the meccano type,

a boy who had played much with "meccano" would have an advantage over a boy of equal age and perhaps excellent mechanical aptitude who had not had this experience).

(2) Convenient in form, and not require too long to administer.

(3) Sufficiently difficult so that all do not get full marks.

(4) Easy to mark and independent of personal opinion.

There are a large number of such tests, varying from simple movements to very complicated ones.[1]

Can Tests supersede Other Methods?

Enthusiasm for tests has sometimes resulted in extravagant claims for them. A test seeks to define a general impression, to supply details in a vague pattern. It is well known that there are considerable individual differences in all kinds of abilities and aptitudes; it is also known that different jobs require different degrees of ability or aptitude. By means of tests we are able to assess more adequately than by any other method "how much" people differ. Tests are not, and probably never will be, infallible, but they represent an improvement on other methods. As Professor Spearman expresses it, "they are not a substitute for, but an addition to, any information obtainable otherwise. Whenever this further information is adequate to act upon, the testing can be spared altogether and reserved for more dubious cases."

In testing, a situation is standardized and controlled for a particular purpose.[2] For example, if by a general impression we are assessing intelligence, we may be measuring it by brightness of eyes in one person, general appearance of aliveness in another, good vocabulary in a third, and something vague in another, and yet be unaware of the change of measuring-rod. If an intelligence test is used, the test remains the same measure for all.

[1] Long and Pear, *A Classification of Vocational Tests of Dexterity*, Ind. Health Res. Board, No. 64, 1932.

[2] Alec Rodger, "The Use of Tests in Vocational Guidance", *Occ. Psychol.*, XIII, 3, 1939.

In the course of these discussions it has often happened that it has been necessary to group people as being alike in some one characteristic. If by means of an intelligence test a group of people have been classified as high, medium, or low intelligence, that information is extremely useful for some purposes; for example, for teaching purposes in the army or in a training centre it is an advantage to teach people together who are as nearly alike in intelligence as possible. If, however, the people were to be classified for mechanical ability, they would be differently grouped; some of those in the A group for intelligence would be A for mechanical ability, but some of the A's for one would be C's for the other. If the same people were classified according to degree of emotional balance, the group would be different again.

We all know this, and yet there is a great temptation to assume that because a person is in one group for one quality or characteristic he will be in the same class for another entirely unrelated characteristic. A very common form of this is to assume that a highly intelligent man cannot be emotionally unbalanced. "Oh, he's not that sort of a man, he's very intelligent", is the reply when it is suggested that a highly intelligent person is suffering from some psycho-neurotic disorder. All that can be assumed is that if he is highly intelligent and is neurotic the probability is that he will be of the obsessional type, but it is only a probability.

Reference has already been made to the assumption that those people who belonged physically to the long-thin type would be alike in other respects, e.g. temperament, efficiency; and that the opposite short-thick type would be like one another but different from the other group. So far there is no evidence of any such relation. Many industrial problems would be easier if it were so. Unfortunately, a classification once made can so easily become an end, instead of merely a means to an end. Classifications are useful, but they represent a grouping of people alike in one respect, or two or several respects, as the case might be, but they must not be interpreted beyond these respects. As our experience grows we tend to

make a number of private classifications. When people affect us in the same way we tend to think they have something in common, namely, that they are alike in other respects.

An unusual example may help to make this plain. A student-saleswoman classified customers according to their behaviour when shopping, into prowlers, slinkers, deaf-mutes, unspeakables, unwitting sinners, and the godsends.[1] Most of the groups are obvious, but perhaps two need a little explanation. "Unspeakables" were those who arrived a minute before closing time and remarked coldly, "Oh, you're shutting already; what a nuisance!" Or those who demanded their rights on all occasions, e.g. string to a parcel when it was unnecessary and when other customers were waiting. "Unwitting sinners" were those who started with one assistant and, having put her to a lot of trouble, made up their minds to have one of the first things and then got another assistant to make out the bill while the first was looking for more things; the first girl then loses her commission. Usually the assistants are very careful to forestall such actions, but it is not always possible to be sure in a rush period.

Would an "unspeakable" be unspeakable in all or any other relation? and the "godsends" considerate in a different setting? We have no means of knowing, but if meeting an "unspeakable shopper" in another setting, we assumed she would behave badly, we should be letting a classification go too far. Or if we assumed that an unknown customer who resembled one of these types in appearance would actually behave accordingly. It is easy to see the mistake in this example, but it is one very frequently committed.

A closely connected mistake depends on assuming that a word that is common as a description of two groups necessarily means the same thing. For example, industrial processes are often classified into mechanical, i.e. repetitive, and others; workers are classified into those doing mechanical jobs and the others. Because mechanical is common to both classifications it is assumed that workers doing mechanical jobs have become mechanized.

Nothing is further from the facts. Personally, although I

[1] Margaret Leiper, "A Student as Shop Assistant", *Journ. Ind. Lab. Management*, July 1935.

have been in contact with hundreds of industrial workers, I have never met a mechanized human being. If all who are classified as mechanical workers were classified according to any quality, physical or mental, they would be found to vary within wide limits.

Miss Mellis,[1] after considerable personal experience of workers, writes: "The doing of the same or similar tasks, of working in the same business, under the same management or supervision, does not produce a sameness of workers. Anyone who observes or deals with workers in a factory, or workers anywhere, sees that they retain their individuality during working hours and do not cease to be definite persons when they clock in."

Working out the Data

Wherever numerical data are obtained the working out involves statistics, and the mere word seems to paralyse some people mentally. It is easy to forget that figures are symbols only, and are of value in so far as they represent facts. Five hundred men might be represented by drawing 500 men, but the figure is much more convenient. The science dealing with the representation of reality by figures is statistics; originally statistics meant "describing the important characteristics of a state by means of the written word", and only after some time came to imply "the art of describing such characteristics by means of numerical data".[2]

If, as is probable in most investigations, numbering is necessary, then the rules of numbers must be kept, that is, statistics must be used and interpreted according to the science of statistics. This is not the place to discuss the details of statistical method. Although a considerable knowledge of Mathematics is required for the more rarefied realms, the ordinary research worker can get along very well by the use of simple arithmetic and common sense.[3]

[1] M. M. Mellis, "Industrial Psychology", *Journal of Institution of British Launderers*, XX, 6, 1939.

[2] G. Udny Yule, *The Function of Statistical Method in Scientific Investigation*, Ind. Health Res. Board, Report No. 28, 1924.

[3] Bradford Hill, *Principles of Medical Statistics*, London, 1939; E. G. Chambers, *Statistical Calculation for Beginners*, Cambridge, 1940.

When the would-be investigator has considered the many snags, and realizes that there are probably many more of which he knows nothing, he may be tempted to seek a more mechanical job. Having, however, done a lot of spade-work —made the preparations, in fact—then is the time to dismiss them temporarily to the recesses of the mind and go all out on the adventure.

Chapter X

ORGANIZATIONS CONCERNED WITH INDUSTRIAL PSYCHOLOGY

It is difficult enough to estimate the influence of a body of knowledge in one's own country, and still more difficult to estimate it in a foreign country. The relation between what is known theoretically and what is expressed practically can never be reliably assessed. In our own country scientific researches into industrial physiology and psychology have been conducted by the Industrial Fatigue (now Health) Research Board since 1918; and over eighty reports and numerous articles have been published by investigators, relating to such topics (among others) as hours of labour, rest pauses, the effects of fatigue and boredom, the effect of different lighting, heating and ventilation conditions, selection tests, time and motion study, industrial sickness. The national Institute of Industrial Psychology has for practically the same period been working at investigations in factories, stores and offices, trying to show that by the application of scientific methods there will be an improvement in health and output; it has been the chief centre in this country for vocational guidance, and by lectures, practical classes and demonstrations, and the publication of a Journal, has done much to spread the available knowledge. Yet at the outbreak of war it was evident that the majority of those in charge of production were entirely ignorant of the knowledge that was available. More than twenty years seems required to put scientific knowledge to practical effect.

If this is true of our own country, how is one to know what is the real position in foreign countries? The actual published research work is known, but how far that work is applied cannot be known. Probably the only convincing demonstration would be for the Government of a particular country to apply on a large scale the findings of some particular research.

The following accounts have been taken from articles written by visitors from the different countries and published in this country, most of them in *Occupational Psychology* (the

Journal of the National Institute of Industrial Psychology); and from a memorandum presented by Professor Cyril Burt to the British Psychological Society, and recently printed in an abridged form in *Occupational Psychology*, July 1942. This memorandum deals with the military work of American and German psychologists, including the industrial applications. They cannot claim to be complete and, with the exception of America and Germany, refer to the pre-war period.

The two most important countries from the point of view of publication in Industrial Psychology are America and Germany, and most of the other countries of Europe have been influenced by them.

Most of the countries of Europe have organized centres for vocational testing, sometimes in connection with university laboratories, sometimes founded by private societies and later subsidized by the Government; e.g. France, Spain, Holland, Austria, Hungary, Norway, Poland, Switzerland, Sweden, Finland.

Also in several countries some of the industrial organizations have established their own laboratories, notably in Hungary and Holland.

Tests for the selection of air pilots have been developed in most countries having large armies.

Italy

In Italy there is the famous psychological department connected with the Universita Cattolica del Santo Cuore in Milan under Professor Gemelli. There, on the industrial side, work has been done in selection tests and methods of work in cotton and silk mills, packing problems and staff selection for shoe factories, conveyor bands and allied problems, as well as tests for pilots of aeroplanes. Other laboratories work for private firms and companies.

The Italian Air Ministry had laboratories at various large centres where every year about 10,000 individual psychophysical examinations were conducted. It is said that the work of industrial psychologists was understood and applied by leaders of industry and national organizations as well as by those of the workers.

The Italian State Railways in Rome insist on a psycho-

technical method of staff selection. Other towns also have vocational guidance centres.

Italy was famous before the present period for the work of the scientist Borelli, for the first doctor to study industrial disease, Ramazzini, and in the 19th century for the pioneer work on Fatigue done by A. Mosso.

Spain

Spain has had a well-developed system of testing. At Barcelona in 1918 the Bureau of Apprenticeship was modified and became the Institute of Vocational Guidance, which made surveys of occupations and did extensive job analyses. The movement in Spain was under the control of the public authorities and not, as is more usual, under either private or academic direction.

In 1922 a Government Act incorporated the Institutes of Madrid and Barcelona. There were 5 departments, devoted to vocational guidance and educational psychology, industry and commercial psychology, physiological and industrial health and mental hygiene; and particular study was devoted to the young learner.

In 1933 it became compulsory for all drivers in the public service to be tested.

Alexander Chleusebairgue says, "Psychological testing of drivers is the most essential and efficient means of securing greater safety on the roads", and that "analysed results of the work in Barcelona show that some 6-7% of adult persons completely normal in every other way are nevertheless quite unfit to drive a vehicle owing to defective co-ordination of their responsive movements, particularly when a series of different responses has to be made".

Tests are also used for the selection of police officers for newly recruited local forces.

Advertising and markets research has also received support from the trade and business communities in Catalonia.

Russia

Morris S. Viteles[1] spent some time in Russia studying industrial-psychological methods in various centres of that

[1] Keller and Viteles, *Vocational Guidance throughout the World*, 1927.

country. He expected from the Russian writers to find considerable differences in development from that taken in America and Europe, but was struck by the fact that the resemblances were more striking than the differences.

I. *Vocational Selection.*—The most extensive use of psychological methods was in the transport industries. In Moscow there was a central laboratory, with numerous branches throughout the U.S.S.R. for the testing of locomotive engineers, firemen, train dispatchers, station agents and others. The tests are standard batteries with a few modifications.

Tests are also used for the selection of tramway drivers, drivers of lorries, taxicabs and other vehicles. During the year 1934, 23,000 applicants for training in driving were examined at the psycho-technical laboratories in Leningrad by a staff of eighty workers including physicians, technical assistants, psycho-technicians, and others.

At the psycho-technical laboratory of the Scientific Institute of the Moscow Traffic Bureau over 100 men and women who wish to become chauffeurs are examined each day. Even pilots for river transport are tested. The tests include a standard intelligence test, one for practical intelligence, and a reaction time test.

There is an elaborate system of vocational guidance for adolescents who are divided into (1) those judged to be qualified to proceed to train for a profession; (2) those suited for semi-professional work of a technical nature and office work; and (3) those whose careers should be in the semi-skilled trades of the Soviet manufacturing plants. Some progress has been made in selection tests in the chemical trade and in the textile and electrical industries.

The methods adopted follow the lines of other countries, chiefly America and Germany.

II. *Training.*—As might be expected from their professed political views, in contrast with England and America where considerable emphasis has been placed on individual differences, the Russians do not look upon individual characteristics as unalterable endowments, but stress the plasticity of human traits. "The task of industrial psychology is to bring to fruition the latent abilities of workers", writes Spielrein.

Much of the training for younger workers is done in factory apprentice schools and in technical trade schools. A system of State technical examinations is arranged so that a worker can raise his occupation rating above the one he had and so obtain promotion in the occupational hierarchy. As in other countries, the foreman or a fellow-worker really has the responsibility for much of the training.

Detailed specifications for 60 jobs have been prepared in Leningrad, and these will be used to form the basis for training workers. A study of furnace-men in steel plants involving a psychological analysis of their methods of work has led to systematic training programmes, at least in outline. In an aeroplane plant rest pauses have been followed by increased output, improved feelings, and reduction of energy output. Changes of illumination, temperature and ventilation, the influence of the moving belt, and the effect of speed and rhythm of work are being studied. The work of Gilbreth has formed the basis.

Viteles sums up the most significant trends as follows:

(1) Extensive use of mixed groups or "complex brigades" of psychologists, time and movement study men, physiologists and, if the investigation demands it, economists, sociologists and biometricians.

(2) Close co-ordination of practical field studies with laboratory research.

(3) Centralized planning of research and practice.

Germany

There was a psycho-technical laboratory at the Charlottenburg Technical High School (under the direction of Dr. Molde), and similar ones at Leipsic, Munich, Frankfurt, and other industrial centres.

The larger firms availed themselves of the services of these institutes, for example Siemens, Osram.

Later an institute known as the Orga-Institute was established in Berlin for the study of vocational guidance and selection, the adaptation of factory machinery and office appliances to the workers of them, time and motion study, fatigue, and advertising.

Considerable attention has been devoted to transport problems, for which vocational testing is taken seriously. The tests used are those for mechanical skill, spatial relations, attention, and other psychological factors. "Much stress is laid upon the manner in which the boy or girl attacks the problem presented and the behaviour while solving it."

Since in many respects the army is a number of industrial occupations, military psychology is closely related to industrial psychology.

Military Psychology in Germany.

What America did in 1917-18, Germany has been copying and steadily developing for over ten years. Systematic testing was introduced into the German army in 1927 under the regime of the Republic. Every Army Corps of the German Army now has a psychological laboratory attached to it, under the general direction of the psychological laboratory of the War Ministry in Berlin.

The central laboratory is concerned primarily with co-ordination and research; but it also collects information on the probable reactions, military, political and civilian, in potential enemy states. Its main sections deal in turn with: (1) job analysis and adaptation of machinery and equipment; (2) characterology and personnel selection; (3) training; (4) morale; (5) propaganda and psychology of foreign nations; (6) the conduct of war.

Army.—The number of psychologists employed by the army has steadily increased. In 1935-36 the staff of the central laboratory included 84 psychologists, and that of each of the 15 local laboratories 4 psychologists and 4 military officers as advisers. Since the reintroduction of compulsory service, however, these numbers have been more than doubled; and in October 1937 the training and status of the military psychologist were determined by law. A newly introduced academic degree of Army Psychologist is now obtainable after four years' study of psychology with special reference to military problems. After receiving his first army appointment, the psychologist is then required to undergo two further periods of formal military service lasting for three months,

preferably in one of the special arms—air force, artillery, tank-transport, anti-aircraft, anti-tank, or the like.

The chief but by no means the only duties of the psychologist are to test and examine men (*a*) for rank as commissioned officers; (*b*) for the more specialized services.

(*a*) *Selection of Officers.*—The psychological examination of intending officers seeks to cover four main fields, and comprises an "analysis" of (1) "intelligence", i.e. intellectual abilities and knowledge; (2) "action", i.e. strength of character, interest in work, conduct in various situations; (3) "expression", i.e. emotional stability and reactions, judged chiefly by external manifestations; and (4) "life-history".

The examination lasts for two days, with a free day in between. Verbal and non-verbal tests of intelligence, tests of technical aptitude, and tests of manual dexterity are given on the first day. Some of the tests are group tests, but most of the tests are administered individually.

Tests of temperament, will, character, and resistance to fatigue are also introduced. Some of these, like many of the tests of intelligence, are modifications of tests originally devised in this country and in some cases discarded. The chief grounds for rejection, we are told, were: (1) lack of will power; (2) lack of poise; (3) egocentricity or introversion; (4) general temperamental weakness. The psychological tests are supplemented by more specifically military tests of the sample type.

In the first, the examinee is required to give the standard commands to a company of soldiers; he is then required to translate an official instruction into a form intelligible to the ordinary private. In the second, he himself has to carry out a series of disconnected orders, demanding not only quickness of uptake and accuracy of memory, but also physical agility and endurance. In the third, his own capacity for improvising procedures in an emergency and getting them carried out is systematically tested; and the whole task is made more exacting by noises mimicking bombardment, and other distractions.

Considerable attention is paid to the observation of expressive movements. The candidate's voice, speech, literary style, and style of conversation are studied, and his hand-

writing analysed. The life-history of the candidate is considered even more important than his achievements at the examination. Here a major source of information is the party record of each man.

(*b*) *Selection for Special Services.*—The work on job-analysis in the army and on methods of selecting men for technical arms (air force, transport, tank units, etc.) appears to follow somewhat more closely the lines adopted by psychologists in this country and America. The branches most frequently mentioned in the recent literature are motor-driving, tank-driving, flying, shooting, range-finding, surveying, sound-detection, radio-operation, and messenger-work. Dr. Pryns Hopkins was told that over 40,000 men had been given specialized vocational tests in the course of a single year. Both aptitude tests (usually embodied in a realistic form which gives them the appearance of work samples) and sample tests —the latter often applied under conditions of stress or distraction—are employed, and are in general preceded by character tests. It is stated that psychological tests were of special importance in building up the Luftwaffe. The fact that Germany, only a few years after military aviation was re-introduced, was able to create an enormous air force with such speed has been attributed very largely to the way the psychological laboratories selected and sent forward the best human material at the outset.

Belgium

A few Belgian firms are applying tests in the selection of their employees. An influential engineering firm has been experimentally applying tests since 1923 for the admission of apprentices to the technical schools and for the selection of women workers and of boys for certain mechanical work.

A firm engaged in Colonial trade employs a panel of expert medical men and psychologists to select employees who are likely to prove adaptable to the climate and conditions of colonial life, to maintain the necessary self-discipline, initiative, and tactful relations with the natives under their charge. Some tests are used for estimating character and temperament,

rather in order to see how the candidate behaves than to get a fixed rating.

France

In 1918 l'Institut Lannelongue for Social Hygiene arranged to devote a part of its resources to the study of the workers and to the possibility of the application of time and motion study. In particular it investigated the factors affecting production, so that the best output might be obtained without sacrificing the physical or mental health of the workers.

The development of vocational guidance was partly due to the problem of the re-education of handicapped soldiers after the war. At the Practical and Normal School for the Occupation Re-education of Handicapped Veterans, Bordeaux, under M. Gourdon, the problem was first contemplated seriously. Later, in 1921, at the Paris Chamber of Commerce a trade school was established, where a series of tests for the various trades was used.

In 1928 l'Institut National d'Orientation Professionnelle was founded, and its activities were guided by three directors: J. Fontegue, H. Laugier, and H. Pieron. It aimed at providing for the training of vocational guidance experts and promoting the researches into the psychological and physiological reactions which relate to occupations.

The psycho-technical laboratories have specialized in the selection of workers for industry, particularly in regard to transport. J. M. Lahy, Directeur d'Etudes à l'Ecole des Hautes Etudes et à l'Institute de Psychologie de l'Université de Paris, has a special laboratory for the testing of omnibus drivers and for railroad workers in the Gare du Nord. Henri Laugier, Professor at the Sorbonne, has a special laboratory for testing railroad workers in the Gare Saint-Lazare. His laboratory is also concerned with general studies of the application of psychology to various aspects of work: for example, accident-proneness, the requirements of different classes of work, selection of apprentices.

Sweden

In 1932 the Psychological Laboratory of the University of Upsala began to collaborate with the Swedish Naval Board in

dealing with improved methods of selecting recruits. Tests for the examination of applicants were constructed, and since 1934 these tests have been used in the entrance examination at the naval station of Sweden.

Towards the end of 1934 the Board of the Royal State Railways also asked for tests for the subordinate jobs. The success of these led to the order that no applicants for subordinate jobs were to be admitted without having passed the tests. Later tests were devised for applicants for the special training courses arranged by the Board for posts as officials of the railways. The tests were not devised to establish a rank order but to assist in eliminating the unsuitable. By means of a job analysis the requirements of the work were determined and then tests devised for some of the abilities and groups of abilities that seemed most important. The tests included intelligence tests, a reaction test of an analogous type, attention and memory tests.

Czechoslovakia

The organization connected with industrial research was Masaryk's Academy of Labour. Standardization of production has received special attention. At the Psycho-technical Institute studies of the requirements of different occupations have been made, and selection for railway employees, tramway employees, and chauffeurs.

America

The work of American psychologists in connection with industrial studies is well known. Mention has been made in an earlier chapter of the work of Taylor and Gilbreth, work that has been copied, adapted, and criticized by most countries in the interval between the wars.

Many of the universities have courses in psychology, including the industrial application, of which probably the best known is the Graduate School of Business Administration of Harvard University. Since the outbreak of war industrial psychology has been recognized as important for placing young entrants in appropriate jobs or appropriate training centres. At Boston and elsewhere another group is instructing foremen and supervisors in the special tasks which their

positions require (leadership, giving and superintending orders, training and rating the men under them, maintaining morale, etc.). For the rest, the numerous activities of American industrial psychologists—vocational guidance, vocational selection, time and motion study, and study of rest pauses and fatigue—are going forward in war-time as they did in peace.

After the war, one of the most serious tasks that the industrial psychologist sees looming ahead is that of "rehabilitation", restoring the physically and mentally disabled to a satisfactory place in the life of the community. In America during the past twenty-five years the Federal Board of Vocational Education has issued a number of bulletins, surveying what has and what may be accomplished, outlining practicable programmes, reporting the results of extensive follow-ups, formulating general principles of training for those engaged in occupational therapy, and suggesting methods of vocational guidance to psychologists who may assist in such work. A systematic study of over 6,000 disabled cases, placed in over 600 different occupations, has definitely shown (1) that the adaptability of the physically handicapped is far greater than would otherwise be supposed, and (2) that the kinds of occupation in which such persons can be successfully placed (often after treatment or training) are much more numerous and diverse than had previously been assumed. It is emphasized, however, that far more investigations are needed into methods and possibilities, and that, if the situation is to be met when it arises, such investigations should begin at once.

A well-known industrial psychologist, Dr. Morris Viteles, has been invited to join the Office of Production Management as adviser. Dr. Fernberger acts as consultant for one of the sections of the National Defence Research Committee. The Occupational Analysis Section of the U.S. Employment Service has rendered assistance to various defence industries by undertaking (1) comprehensive job-analyses of trade-requirements; (2) constructing aptitude tests for the selection of trainees and other entrants; (3) constructing tests of acquired trade-knowledge and trade-skill for classifying experienced workers. Dr. O'Rourke's work on the selection, classification, and training of employees for the U.S. Civil Service is also important.

In America, one of the most important problems of the moment arises out of the fact that very shortly women will be called into industry on a rapidly increasing scale; and accordingly the sub-committee on learning and training has been requested to study more particularly the construction or adaptation of tests of trade aptitude for the selection of women for different types of work.

Canada

Vocational guidance and the necessary research into occupations have absorbed more attention than any other branch of industrial psychology. In 1925 a free public employment bureau was formed which gave vocational advice by psychological methods.

In 1935 the Ontario Vocational Guidance Association was founded, and in Montreal there is a psychological institute to provide a consultation service on psychological problems.

In Toronto University the Department of Psychology has for several years provided advice for a limited number of people as part of its graduate training programme, and has conducted research into the selection of nurses and the placing of girls in factory work.

At Toronto and McGill courses of lectures in industrial psychology have been given for a number of years. Since 1932 industrial psychology has been recognized as a field of graduate specialization. As a result, there has been a gradually developing interest in the subject, and various organizations have introduced intelligence tests; tests have also been adapted for the examination of drivers, and one organization has introduced a systematic plan of employee interviewing.

Australia

The Australian Institute of Industrial Psychology was founded in 1917 and owes much to the work of its honorary director, Dr. Martin of Sydney University.

Its activities include vocational guidance, selection tests for various business firms, and research work, including the standardization of an intelligence test suitable for use in that country, tests for the engineering and clerical work problems

connected with fatigue, accidents, movement study, etc. In what is called the "Worry Clinic" the Institute gives special advice and assistance regarding psychological difficulties and psychological illness.

New Zealand

Vocational guidance started in 1913 under the auspices of the Christchurch branch of the Y.M.C.A. By 1931, organizations outside the Y.M.C.A. entered the scheme, and then the Christchurch Chamber of Commerce was responsible for the creation of a Boys' Employment Committee, representing educational, economic, agricultural, and social welfare interests; later, girls came into the scheme. Other centres followed this lead, and in 1937 a national scheme was introduced, to be administered jointly by the Education Department and the Department of Labour. Canterbury University College established a psychological and educational laboratory in 1920. At Victoria University College there is a psychological clinic and lectures in industrial psychology are given.

Japan

In 1921 a Department of Industrial Psychology was established at Tokio as a section of the Japanese Association for the Promotion of Industrial Harmony, which had been started in 1917. Its endowment was approximately £800,000, one-third of the sum being contributed by the Japanese Government, the remainder by certain industrial and commerical firms. The objects of the new Institute include (1) psychological research; (2) the provision of training courses for factory managers; (3) the investigation of problems in factories, including those of vocational selection, time study, and problems of fatigue. A certain number of researches have been published on the lines of those of the Industrial Health Research Board into hours of labour, etc., in various industries. More recently special attention has been given to research in the selection of aviators at the psychological laboratory of the University of Tokio. The laboratory had a generous grant from the Government for the purpose of devising tests.

ORGANIZATIONS CONCERNED WITH INDUSTRIAL PSYCHOLOGY IN BRITAIN

I. Industrial Fatigue (now Health) Research Board, formed in 1918 as direct successor to the Health of Munition Workers Committee, for the purpose of continuing the work of that Committee under the auspices of the Medical Research Council.

At the time of its formation the Board was confronted with special problems of fatigue arising from the long hours that were worked during the war. As time went on these became of less importance, so in 1928 the word "health" was substituted for "fatigue".

The main problems that have occupied investigators since the last war refer to Hours of Labour, Environmental Conditions, i.e. Lighting and Vision, Heating and Ventilation, Noise, Vibration, Dust and Toxic Vapours, the Physiology and Psychology of Work, Vocational Suitability including Accident-Proneness, Sickness Absence and Labour Wastage, and Psycho-Neurosis in Industry.

In 1920 a special Scientific Committee for Industrial Psychology related to the Board under the Chairmanship of Professor Cyril Burt was formed.

II. In 1919 the National Institute of Industrial Psychology was formed as a non-profit-making scientific body "for promoting the study of the human side of labour and for putting into practice the results of such knowledge". It undertakes investigations relating to the application of Physiology and Psychology to the problems of industry.

It publishes a journal at quarterly intervals, now called *Occupational Psychology* (formerly the *Human Factor* and before that the *Journal of the National Institute of Industrial Psychology*).

III. The Institution of British Launderers in 1934 appointed a full-time research worker in Industrial Psychology. Since the laundry trade is made up of a large number of small factories, it formed an excellent field for research.

In the *Journal* were published articles on Time and Motion Study, Selection Tests, etc., as they affected the laundry trade.

IV. The Universities encourage research work in Industrial Psychology, and some of them, notably London, Cambridge, and Manchester, assisted in research by giving laboratory accommodation to investigators of the Industrial Health Research Board and by organizing lectures.

V. The London School of Hygiene and Tropical Medicine appointed a Professor of Medical Industrial Psychology in 1931, and the subject forms part of the curriculum for the Diploma in Public Health.

VI. The London School of Economics organizes courses of lectures in Industrial Psychology as part of the ordinary curriculum.

VII. The University of London awards a Diploma in Psychology, and Industrial Psychology is one of the accepted applications.

VIII. The Universities of Edinburgh, Glasgow, and St. Andrews have lectures in Industrial Psychology as part of the curriculum.

CONCLUSION

It will be clear to anyone who has arrived thus far that the human problems of industry are great, and that no one of them is within measuring distance of complete solution; in short, that what is begun does not end.

The preceding pages have presented a rough outline of the background and of the more immediate questions. A short historical survey mentions some pioneers in this field, pioneers who worked apparently in vain because of the urgency of other things. The general environmental conditions outside the body, namely, lighting, temperature, ventilation, noise, hours, that affect for good or ill the body, and through it the mind, have been presented from the point of view of the most recent research. Then follow the more immaterial aspects, namely, the group, the mental atmosphere, the effects of people in authority, since these play their part in determining conduct and thought; and then the effect of emotion acting as an environment to reason and intelligence.

The same environmental conditions, however, do not affect all those subjected to them in the same way, so the importance of individual differences is brought out in investigation concerned with selection and guidance, temperament, accident-proneness, sickness absence, failures to adapt themselves to the work environment.

Evidence is brought forward showing that sickness absence and labour wastage are measures of the well-being of an organization, and a short outline is given of the organizations concerned in some way with industrial psychology in this country and also abroad.

For the most successful work all the circumstances, outer and inner, must be in harmony. The lighting, heating, and ventilation should be suitable for the work, with a margin for individual variations. Such dirt or discomfort as is there should be inevitable, the necessary consequence of the work and not due to neglect. A factory or office can be really attractive, many have a beauty of their own, but others doing

the same work can suggest a slum in all its squalor. Human relations will never, or at least in the immediate future, be perfect, but those responsible should realize their responsibilities and pay attention to the mental atmosphere, the effect of groups, their inter-action and relations. The symptoms of group disease, grievances and discontents, increase of absence, should be realized for what they are, diagnosed, and treated. Many a strike with its heavy toll of suffering might have been avoided if the causes had been studied at an early stage; when a strike does take place, both parties to the strike should feel that they have failed.

Both guidance and selection can prevent the worst misfits. Neither of course should be final; the boy or girl becomes the adult, and the kind of work suitable for a beginner cannot satisfy the older. Far more opportunity for promotion should be arranged. Where organizations have many branches, in this country or abroad, there should be a chance, and it should be known that there is, for the humblest beginner to aspire to the heights. It is tragic when in any organization a competent person can say and believe, "I see nothing but the same old drudgery until the end". The ill-health, inefficiency, and unhappiness associated with emotional difficulties should be diagnosed adequately and treated. In the immediate future some very urgent and difficult problems will demand attention:

(1) Thousands of young people will be leaving the Forces. Some definite plan for placing them in the most suitable work is needed, and the methods of the industrial psychologist should be tried. It would need extensive research to deal with the large numbers, but that need not prevent the attempt.

(2) Many civilians, as well as many of the Forces, will be mentally as well as physically incapacitated, but the sooner those who can be restored to normal activity are restored, the better. Numbers of industrial organizations will have to carry on with a lower standard of efficiency from many of the employees, but if more use is made of the available knowledge the worst consequences of this could be minimized. Still further application of all we know about methods of work and training will be needed. In short, the chance for those

in some form of executive positions to do work of the utmost value is greater than ever. And those who are in such positions should be there because they can and will do the job.

(3) Since the fear of unemployment has darkened the lives of many during the last 20 years, it ought not to be impossible to arrange that no one who is willing to work should be exposed to this fear. But there should not be substituted the dead hand of maximum security in one organization or department. Security of tenure has been accompanied in some organizations by an unforeseen rigidity, unable to adapt itself to the novel or unexpected. A prospect of a pension at sixty, if one survives 40 years of work in the same environment, may sound like salvation to some, but to others doom.

Security of work for all is a worthy incentive, but work with prospects not of mechanical rigidity but of vital development.

In conclusion, here are two quotations relevant to the discussion, one from a philosopher and the other from a business man:

(*a*) "Rigid maxims, a rule-of-thumb routine, and cast-iron particular doctrines will spell ruin. The business of the future must be controlled by a somewhat different type of men to that of previous centuries. A great society is a society in which its men of business think greatly of their functions" (Alfred North Whitehead).

(*b*) "If those of us engaged in industry were to give to this branch of science (i.e. industrial psychology) the same sympathy and support as we have given to the mechanical side of trade, vast new fields of knowledge would soon be explored. And I believe we should get, again, a new mental adjustment of the mass of the people to our new-formed liberties, our swift-moving lives, and that, therefore, the world, physically, mentally, and perhaps spiritually also, would be the better" (Sir Frederick Marquis).

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