

THE HUMAN FACTOR IN INDUSTRY.

By SENATOR SIR JOHN KEANE.

[*Read on Thursday, 23rd January, 1941.*]

I first thought of giving to this paper the somewhat tautological title of "The Human Factor in Life". I do, however, ask you to interpret industry in its widest sense as covering not merely factories and organised business but human relations in all professions and individual occupations.

Almost all the real difficulties of life arise from temperament, prejudice, stupidity, lack of understanding and the vast interaction of these elusive indeterminate factors. It is on account of this very elusiveness and lack of any fixed standard by which to measure human behaviour that many doubt whether the human factor is capable of any systematic or quasi-scientific treatment in the day to day dealings of life. These people say: Human nature is ever the same and unchangeable; free will cannot be brought within the ambit of any general code of conduct!

This generalisation, for it is nothing more, will not stand examination. Except in so far as they live by the same natural laws and have common appetities, human beings differ in a very wide degree. Moreover, even in the respect of these common appetities the differences are very wide. Some will live where others will starve, some remain resolute where others despair, some forge ahead where others fall back; in fact there never was a greater mistake than to think that equal opportunity will mean equal achievement.

These differences in the human element are well illustrated by the analogy of trees in the vegetable world. Trees all have common characteristics in their generation growth and reproduction and yet, like human beings, they are affected by climatic and environmental conditions. In their economic uses these distinctions are even more marked. Some timbers are light and inflexible; others pliable and tough, some hard and resistant to wear, others weather proof, others germ proof and in their commercial uses the degree of substitution between different kinds is very limited.

It is the same, though at first sight less obvious, with human beings. In the mass, in groups, as individuals, they respond according to certain general principles which, within fixed limits, are capable of systematic application. This whole science of human behaviour is known as psychology, which some deride as no science at all, which others study for the sake of special sensation, for which others make fantastic claims, but which only a few pause to examine on its merits to see what practical good it does contain. The present examination is confined to the more practical aspects of human conduct as applied to normal healthy beings. My remarks have no concern with the

abnormal or subnormal or the mentally deficient. These are the province of the medical psychologist.

The earlier workers on this field of practical human endeavour mainly, I might even say merely, aimed at increased output with a view to greater profits. Taylor was one of these pioneers and his methods were called those of scientific management. He concentrated on the work of greater output through the training; the appeal to pride or ambition, or greater reward of the worker, and close attention to physiological and environmental conditions. A famous case was that of Schmidt, a worker in the Bethlehem steel works, who in the handling of pig iron attained and maintained for three years a daily output of $47\frac{1}{2}$ tons over a previous average of 12 tons. It was found that only one man in every eight was capable of this. The size of the loads, the means of carrying, the introduction of rest pauses and strict adherence to instructions were the main reasons for this high output. Then another man, Gilbreth, produced by similar methods with redesigned scaffolding and equipment a phenomenal increase in the bricklayers' output. No doubt, if workers would co-operate in both training and selection and in the elimination of those below standard these rates, which were double those then existing, would be possible in industry to-day.

After the last war the problems of industrial health, disease and fatigue led to the establishment of a body known as the Industrial Health Research Board. This is an official body and studies both through research and under working conditions these special problems. Some of you may have seen their reports. In the main, its investigations and their results can be classified under five main headings:—

- (1) Hours of labour.
- (2) Environmental conditions—(a) lighting and vision, (b) heating and ventilation, (c) noise, (d) vibration, (e) dust and toxic vapours.
- (3) Methods of work—(a) physiology of work, (b) psychology of work.
- (4) Vocational suitability—(a) vocational selection and guidance, (b) Accident-proneness.
- (5) Industrial sickness—(a) sickness absence and labour wastage, (b) psychoneuroses in industry, (c) statistical inquiries, (d) specific industrial disease.

Later, following along the ideas of Taylor and scientific management, there has grown up a professional body of industrial advisers or efficiency experts who claim to diagnose, treat and cure industrial ailments. Their main claim—and certainly a very compelling one in business—is to give more profit, and they undoubtedly do so. But their very directness of approach and their somewhat ruthless methods often leaves in their train human discontents which have to be set off against any immediate financial gain.

The Bedaux system is another example of this rather limited approach to better output. This is a system of payment by results in which all production is evaluated in a common unit, the B. The output of 60 Bs per hour represents the standard rate of working and the payment per B is so adjusted that at 60 Bs per hour the worker gets his hourly rate. It is usual to guarantee this minimum. For output higher than 60 Bs a bonus is earned, the ratio is usually so set that the average employee works at a rate of 80 Bs per hour.

The system has the advantage of providing a common unit of measurement for various types of output. It is, therefore, useful for management control purposes. From the worker's point of view the system is one of payment by results with rather complicated terminology. The system has been widely adopted.

These efficiency experts or industrial advisers would not, unnaturally, resent the suggestion that their methods took no account of the human factor. No successful reforms they would assert could do this. At the same time they could hardly establish the claim that their approach to industrial problems was based on principles of human psychology in which the profit factor was but an incidental. The first body to adopt avowedly this line of approach was the National Institute of Industrial Psychology. It was founded after the last war by Dr. Myers, Professor of Psychology at Cambridge University, and its first President and active supporter was the late Lord Balfour, better known to us all as Arthur Balfour. These two very names indicate that the inspiration behind the movement was rather more academic and philosophical than hard-headed and profit-earning. The Institute is an incorporated body, but it has no shareholders and makes no profits. Its methods are those rather of the Industrial Health Research Board than of the early and quick-profit efficiency expert. Its aim has always been to apply to working industry certain established physiological and psychological principles. In practice this takes a variety of forms, among them segregation of workers according to ascertained individual or group intelligence, training and selection by special tests, vocational guidance based on personal and natural aptitudes, the need for incentive in all employment, methods of work, environmental conditions and a whole array of relevant considerations. In spite, however, of this scientific background practical results can never be ignored for the Institute lives by the fees it earns and has to persuade its clients that the ultimate benefits of a wider outlook will be reflected in better earnings. It is, therefore, no small achievement to have harmonised theory with practice and to enjoy to-day the growing patronage and confidence of industry. Here are the names of some among the many hundred firms that have used the Institute :—

Bovis Ltd.
David Brown & Sons (Huddersfield), Ltd.
Chivers & Sons, Ltd.
Creamola Food Products Ltd.
General Post Office.
Harrods Ltd.
Harwood Cash & Co.
Hudsons Bay Company.
Inland Revenue Staff Federation.
Imperial Chemical Industries Ltd.
W. & R. Jacob & Co., Ltd.
Lewis's Ltd.
Joseph Lucas Ltd.
J. Lyons & Co., Ltd.
Harry Peck & Co., Ltd.
Pilkington Brothers Ltd.
Rowntree & Co., Ltd.
Shell-Mex Ltd.
Standard Telephones & Cables Ltd.

The work of the Institute falls into three main groups: (a) service to industry proper, (b) vocational advice to young people about their careers, (c) education and research.

The demand from industry may arise in a variety of ways. It may be caused by some special trouble such as excessive labour turnover, or from undue sales resistance, or unduly high percentage of spoilt work in a certain department. Or there may be general discontent and a bad spirit, rising costs and declining profits.

The more usual first step by the Institute is, in the absence of any definite symptoms, to make a general survey of the business and report where it appears that its services might be of use. Then if its services are engaged an investigator is appointed to make a systematic study of the problem. This will probably take time. It will be necessary for him to absorb the atmosphere of the business and especially to gain the co-operation and confidence of both management and employees. A detached, unbiassed attitude on any such inquiry is most important. His work is supervised and, where necessary, directed by the higher staff of the Institute and, in due course, his report is approved by the Institute and forwarded to the management. In all probability he will have to supervise its execution, and this ensures from the outset a sense of responsibility and a knowledge of practical limitations.

I cannot attempt to give more than a few illustrations of the many and varied problems that are encountered in the course of these investigations. The selection of workers in various grades forms a large part of the Institute's work. Experience has long since proved that it is most wasteful to engage operatives haphazard without any attempt to discern their natural aptitudes and then allow them to pick up their job somehow or anyhow in the actual workshops.

I now propose to show how this selection is done in the case of certain chemical process workers. The methods are given in detail so as to indicate the scientific background of the work. The first step is to ascertain the special qualities needed technically, known as the "job analysis". After consultation with the manufacturing staff, foreman and process workers, the following list of the qualities required of process workers was compiled:—

- | | |
|---|--|
| 1. Energy | Steady physical exertion. |
| 2. Dexterity | General handiness in manual work. |
| 3. Accuracy | Avoidance of error, <i>e.g.</i> , in the use of instruments. |
| 4. Time sense | Accurate judgment of the lapse of time; also punctuality or keeping to a time-table. |
| 5. Disparate attention (including spatial memory, or sense of location) | Attention to a number of contemporaneous processes. |
| 6. Judgment | Ability to distinguish between satisfactory and unsatisfactory conditions, <i>e.g.</i> , in tests. |
| 7. Intelligence | Ability to grasp the principles of the work and to apply these in particular cases. |
| 8. Alertness | In observation and decision. |

9. Memory for instructions	Spoken or written.
10. Understanding of figures	Simple arithmetic.
11. Mechanical ability	Understanding of working of plant.
12. Cleanliness and tidiness	In work and person.
13. Thoroughness and application	Attention to and observance of details; carefulness and concentration.
14. Reliability or dependability	In carrying out instructions and doing the job; includes honesty.
15. Self-confidence (includes a certain amount of initiative)	Readiness to accept and to exercise responsibility.
16. Equanimity	On normal occasions and in emergencies.
17. Co-operativeness	In the general work of the building.
18. Interest in the work	Keeness to do the job well.
19. Experience	Not, of course, to be looked for in the applicant.

On the basis of this job analysis a test battery was drawn up, the core of which consists in a test analogous to the process. In this the testee has to attend to five different tasks distributed in different parts of the test room, a situation in many ways analogous to the manufacturing shed where the process worker has to attend to anything up to a dozen different processes, maintaining each in the right state of temperature, pressure and so on, and adding the right quantities of the right materials at the right times. The five parts of the analogous test are:—

1. Filling twelve jars in succession with coloured liquid up to marked heights on the jars.
2. Regulating the flow of liquid through an upright jar so that it is always maintained at a certain height.
3. Filling in succession three jars containing yellow liquid with blue liquid dripping in at a fixed rate, until the mixture is of a green similar to the green liquid in a standard jar.
4. Watching for the illumination, at intervals of two minutes, in different parts of the room, of small black boxes with scales and fixed pointers only visible when the lamp inside the box is alight, and taking down the reading of the scales.
5. During any available intervals working out simple sums in addition, subtraction, multiplication and division.

The test battery is completed with a number of shorter tests—a test for bodily dexterity and control, in which the subjects transfer wooden blocks from one pile to another with a pair of tongs; tests for judgment of colour, viscosity and turbidity, and tests for memory for instructions, memory for spatial position, and for alertness of observation. Arrangements are made for a special observer to devote himself solely to making observations of the subject during the administration of the tests, while a second person gives the instructions and supervises the subject when necessary. The observations are given a large part in the total assessment of the applicant's suitability. The tests are, of course, given individually, and the total time taken with each recruit is one and a half hours. Dr. W. G. Hiscock, Works Manager

of Grangemouth Branch of Scottish Dyes Ltd. (I.C.I. Ltd.), reported, in 1938, before the Royal Society that process workers since 1934 had been selected with the aid of these tests. No workers had been discharged for unsuitability. "The follow-up results and general experience of those who achieved the highest marks (750 or higher), both in the case of boys and men, show that they are, with few exceptions, the most suitable." In the early days of testing some applicants were taken on, although they obtained less than the determined pass mark. These have either been discharged as unsuitable or found not suitable for process work and have been transferred elsewhere.

Training is another important section of the Institute's work. Here are example of results.

Chocolate Factory.—Originally training of a new worker took approximately 18 months and cost the firm about £31. After the introduction of vocational tests, and the reorganisation of the training scheme along the lines of industrial psychology, the training period was reduced to 3½ months and the cost per worker to less than £5.

Women Solderers.—In a factory engaged on war-time production one department was concerned with the manufacture of air-tight shell fuse cases demanding a large amount of very careful hand-soldering of seams. It proved difficult both to obtain and to keep experienced solderers and, in the early stages, the weekly output of the department was only 1,000 good cases together with several thousand rejects. At one time it seemed that the maximum output which could be hoped for was 10,000 good cases per week. However, the works director decided to instal a systematic training scheme and to initiate certain other changes (some proposed by his own staff, some by the Institute). These measures collectively caused the number of rejects to decline and the output of good cases gradually to rise until, after several months, it was 20,000 a week. Obviously this result could not be attributed solely to systematic training, but those concerned are agreed that the training school has played a major part in the department's rapid progress. It is noteworthy that the foreman in charge is now much in favour of a training section separate from the production departments.

New methods of work are constantly being introduced. Here is an example of an investigation into breakages in a restaurant which has attracted a good deal of public interest. The Institute's services were engaged in a restaurant to find means of reducing the amount of china broken. Data were collected showing the locality of each breakage, the nature of the article broken, the cause of the "accident" and the time of its occurrence. The lay-out of the service pantries was then re-planned, new equipment was designed, and various other measures were recommended to prevent breakages.

A comparison of the cost of breakages in one of the pantries during the four weeks before the alterations were effected with the cost of breakages during the sixteen weeks following shows that the Institute's recommendations have reduced weekly breakage costs for the clearing and washing section by 55 per cent. Previously the breakages occurring at this point amounted to one-third of all the breakages recorded in the restaurant. Hence, the improvement already effected represents a saving of just over one-sixth on the company's total breakage bill.

In a letter to the Institute the company said: "We have now had an opportunity of carefully investigating the Report submitted by the Institute, and would like to express our thanks for the great trouble you have taken in making such an exhaustive inquiry. There is no question but that, thanks to your advice and the very able assistance given by (your investigator), we have been able to tighten up the efficiency of our service and, so far as the handling of dishes affects our general profit, your recommendations have been of great value, and will quite definitely effect a saving in expense which will more than compensate us for the fees paid." Here are a few further cases.

Chocolate Packing.—A new bench was designed which was preferred by the workers and at which output increased by 10 per cent. Later a better packing method was devised which resulted in a financial saving of about £4,000 a year.

In another investigation it was realised that it is necessary that fancy boxes of chocolates should be packed as artistically as possible. But under the old system effort was wasted by the packer in discriminating between the chocolates, and in deciding which type to select. A new type of bench was constructed which enabled the workers to arrange the chocolates in such a way that their work depended rather upon rhythm of movement than upon a series of voluntary decisions. The workers were encouraged to use both hands in picking up chocolates, instead of picking up one at a time as previously. Under the new system the average increase in output was over 35 per cent., and in the case of one particular packer it was as high as 53 per cent.

Fruit Canning—Size of Unit.—In sorting black currants most of the workers were subject to boredom. Each girl was supplied with full tray of fruit; some spent the whole day over one tray, others managed to begin a second trayful. The workers seemed dispirited by their slow progress and the seeming endlessness of their task. The experiment was tried of giving only half a trayful at a time. This provision of smaller units counteracted the tendency to monotony. The result was immediate and striking—most of the workers practically doubled their previous output.

Rest pauses suitable to the work involved have also been found to have an important bearing on output. Good results have often been obtained when they are introduced to break up long spells of work. It is important that they should not be introduced haphazardly, but at times when fatigue would normally result in diminished work. This point can, to some extent, be determined with the aid of output curves. Rest pauses are particularly beneficial in repetitive monotonous work and probably the slowest workers benefit the most.

In a case in a tapestry works short pauses every hour had been in force to relieve eye-strain, but they were found to be too brief and frequent to be more than interruptions. The morning spell, which began at 8 o'clock, was, therefore, broken up by a fifteen-minute pause for "lunch" at 9.30 and a ten-minute pause for drill at 10.45. The afternoon spell was broken at 2.30 for ten minutes' drill, and at 3.45 for a fifteen-minute tea interval. The piece-rate earnings of a group of girls increased by an average of 10 per cent. after these changes were introduced. There was also a marked improvement in the workers' health, the time lost through sickness during the five months

of the investigation being considerably lower than in the corresponding months of the previous year.

In a third instance a ten-minute pause was found to improve the slowest kind of a group of labellers by 17 per cent., the middle kind by 13 per cent., and the quickest kind by 8 per cent.

Sometimes an investigation may be undertaken to discover the hidden feelings of staffs and workers about their job. Where possible this is done by a personal interview. Needless to say, such interviews must be strictly confidential and are only undertaken with the full consent and co-operation of the management and those concerned. It is often possible to find out by this method conditions to which workers are particularly objecting, *e.g.*, overtime without notice, slight inequalities in wage payment. Such conditions can be rectified. It is also true that complaints and grievances about working conditions may sometimes really be the reflection of some personal and private difficulty of the operative, and the interview affords an opportunity of "clearing the air".

In America some important work on these lines has been carried out at the works of the Western Electric Company. Experiments initially designed to determine the importance of environmental conditions such as lighting, rest pauses, etc., in fact were found to indicate the very great importance of the social relationships within the groups of workers taking part in the experiments. One of the results of this is that the firm now has a very highly organised personnel system in which frequent interviews with members of staff play an important part.

I have attempted to give you a condensed but fairly general cross section of the treatment of the human factor in industry. I need hardly add that investigators themselves must possess an almost angelic balance of qualifications. They must be technically expert in the principles of human behaviour, they must be tolerant and sympathetic towards all grades, they must also have the confidence to see through what they propose and overcome the unexpected difficulties that may arise in the course of execution. I know of no profession that meets so just a balance of theory and practice and affords a better training for the highest posts in industry. The Institute is constantly losing its men for better-paid positions in firms who have seen them work. But let there be no illusions. It is no soft option or sheltered spot for facile intellectualism. Virile and practical qualities must be backed by a high degree of training and natural intelligence.

Vocational guidance is the other main section of the Institute's work. The aim here is to counteract in some degree the tragedy of the life long misfit. Many parents and young people alike seem to have no conception of the risks involved in adopting quite haphazard and lightheartedly a career. In some cases the urge and enthusiasm may be so strong that no person's examination or advice would have any effect. But in many cases the family business is taken as the predestined career irrespective altogether of natural aptitudes. In other cases a whole range of professions requiring very different qualities are considered and one chosen at random. The result so often is a tragic misfit, who all his life is inwardly thwarted and baulked in his work and never realises the reason why. It must always be remembered that while there are some who relish variety and adventure, there are

others who like and are temperamentally suited for the dull job of the morning paper and the 8.40 train, the same seats for lunch and the small but certain scale increment ending in a pension however moderate. To find and marry the right person to the right job at the outset of the career is the aim of vocational guidance.

The normal procedure for a vocational guidance test is as follows: When a request for advice is received report forms specially devised for the purpose are sent to the parents and school authorities with a request for their return before the young person comes for consultation. Normally the latter then comes to the Institute with a parent or guardian. He is then given tests of intelligence and special aptitudes and is interviewed at some length by his adviser. It is the particular aim of the psychologist to put the young candidate so at his ease that both in the tests and the interview no mistake may be made about his possibilities. In making an estimate of his occupational suitability seven main points are taken into account: (1) circumstances, (2) physique, (3) general intelligence, (4) special aptitudes, *e.g.*, mechanical aptitude or manual dexterity, (5) attainments, (6) interests, (7) temperament or disposition. On the basis of the reports and of the information gleaned in the consultation the vocational adviser then draws up a report recommending some occupation and usually suggesting two or three alternatives. Considerable detail of the training, openings and means of entering that occupation is normally given.

The Institute is frequently asked to give vocational advice to older people and "misfits". It also deals every year with a number of younger children aged about 12-16 who come for *educational* rather than vocational guidance. The majority of those coming for *vocational* guidance are public and secondary school leavers, both boys and girls.

These are some of the follow-up figures for 1927-31: 1,310 young persons advised. Of these it was possible to follow up 639, who were divided into two groups:—176 students, *i.e.*, those at universities or other institutions; 463 already in employment. Those who had followed the Institute's advice were compared with those who had not and it was found that in the former group the successes were about 15 to 1. In the latter group they were about 2 to 1. During the year 1937-38, prior to the immediate effects of the international situation, it is noteworthy that the Institute advised some 1,300 young people in the single year.

For the past 13 years experiments in vocational guidance have been carried out under the Birmingham Education Committee. With these the Institute has been closely associated. In 1927 the Committee's first small experiment was made in senior elementary schools to ascertain the value of vocational tests as aids to choice of employment. Two groups of children, 162 "tested" and 166 "control" took part. Encouraging results led to a further much larger experiment involving some 4,000 children. The same procedure—using two groups, one of which is given vocational guidance on psychological lines—has been used. The careers of the children were subsequently "followed-up". A report issued this year relating to 1,091 of these children has indicated that those who were given vocational advice on psychological lines and adopted it were appreciably better placed than those advised by the more usual methods.

Other successful experiments have been carried out in Junior

Technical Schools on the use of tests in the selection of skilled apprentices for the engineering trades.

Finally, in this matter of vocational guidance I need hardly add that a body like the Institute could only, if there was adequate recognition of the need, deal individually with a small section of the public demand. Its function must be research, the introduction of new and better tests and the training of advisers in educational centres.

Lantern slides were shown at this stage.

I am afraid that this paper is longer than I expected. Indeed, I am surprised to find myself able to write so much on a subject about whose technique I know so little. But I hope I have shown you that the subject is quite within the understanding of laymen, and that the human factor in industry is a matter that deserves ever growing attention from those in industry and the professions, if we ever hope to eliminate waste, enhance efficiency, and turn to best account all the resources of our country for which we, one and all during our lives, are in part trustee.

DISCUSSION ON SENATOR SIR JOHN KEANE'S PAPER.

MISS STAFFORD, in proposing the vote of thanks, referred to the fact that Senator Sir John Keane was Chairman of the National Executive of the Institute of Industrial Psychology. She suggested that industrial psychology had not made any widespread appeal here possibly because our industrialisation was of comparatively recent growth. Of the older industries only one Irish firm, W. & R. Jacob & Co., Ltd., appeared on the list on page 3 of the paper.

In regard to vocational guidance, one of the difficulties lay in the case of so many boys and girls who were compelled by economic circumstances to get a job at once and to take any job available. A brief description was given of vocational guidance in the Dresden Labour Exchange in 1929.

"Scientific management" and "efficiency" methods must be harnessed to the service of man. The exponents of the new science of industrial psychology were confronted with the problem of reconciling the warring aims of human well-being with output and production, but it was now generally admitted that long hours did not give an increased output and employers had recognised the effectiveness of good working conditions in increasing output and production.

One of the main problems, however, was the sub-normal worker in industry, particularly in industry in which minimum rates of pay were prescribed by law. This was a question to which prominence was given when the Trade Boards Act of 1909 was introduced in the British House of Commons by Mr. Winston Churchill, who was then President of the Board of Trade. The method now adopted of dealing with this difficulty was given as an instance of the manner in which the human element had been taken into account in industry in industrial law.

It should be remembered that all social legislation was based on human necessities and that every code of Factory Law was designed for the purpose of securing the safety, health or welfare of the individual worker, either by regulating the minimum age of entrance to industry,

the hours of work, the fencing of machinery and by prescribing a minimum rate of wages not inadequate to the necessities of the worker and not disproportionate to the work done. Miss Stafford concluded with a reference to the International Labour Organisation, and quoted the statement of its present Director on the primary objective :—

“ To attain a higher standard of living for the entire working population, with increased production and enlarged and adequately distributed purchasing power.”

MR. E. K. EASON : The testing of persons before entry into industry is most valuable, and the recent developments in the British Army will register an immense advance upon former methods, but, so far, these tests are mainly for industry, and my interest in this subject lies in the office and not in the factory, in office machines of the simpler kind, and in clerical work. What we require in Ireland are methods applicable to factories with less than 50 workers and offices with less than a dozen.

Taylor's work was based on the assumption that a man's store of daily energy is limited. If, by eliminating wasteful movements a man was able to do the same work with less energy, he had energy to spare for more, or better, work. The elimination of unnecessary steps by machine or otherwise in work is a valuable aid to a better day's work.

The chief characteristic of the human element in industry is the ability to make mistakes and the certainty of them. The correction of mistakes can be a costly matter, and a difficult problem in a modern office. Their elimination or their cornering is a prime necessity of a good office.

The Senator has referred to rest pauses. In my opinion, no office worker should be on the same job, without a break, for more than an hour, especially if that job be the operation of a machine, and if it be an electrically operated one I would limit the day's work on it by any one operator to four hours.

There is no clerical job which can be done automatically in the best way by anyone simply walking into it, and knowledge twenty years ago is ignorance twenty years hence. All skill, clerical as well as physical, is the result of constance practice, and there is no other way of attaining skill.

Taylor analysed a job, and suggested an ideal sequence for the movements. Office jobs can equally provide an opportunity for a sequence. Modern office require methods which involve collaboration. Every combination means team work and team work requires an understanding of the whole performance by each of the members of the combination.

The question is not whether it will make more profits, but what is the right way to treat the human worker in industry.

COMMANDER COOTE, while congratulating Sir John Keane for airing this subject in Ireland, pointed out that his paper principally dealt with increasing production rather than improving the welfare of the workers.

There should be a definite and distinct dividing line between the functions of a production manager and a labour manager. The happiness and contentment of the worker should come before improved methods of increasing production.

In a report of the Industrial Research Board the following illuminating statement appeared to counteract the idea that increased wages was the solution :—

“ On the evidence of the workers themselves, the following order of preference was given for desired conditions of employment : (1) Security of employment, (2) comfortable working conditions, (3) pleasant companions, (4) good supervision, (5) opportunities for promotion, (6) high wages, (7) opportunities to use own ideas, (8) work which needs thought, (9) short hours, (10) work needing no thought.”

John H. Patterson, the pioneer and father of industrial welfare in America, gave six “ big ” points to employers of labour, of which the first is : “ Treat people well and they will treat you well. They will not instantly respond but they will in the long run. Be square with them.”

As Sir John Keane made no mention of what was being done in Ireland to deal with “ The Human Factor in Industry,” it might interest him to know that such work had been undertaken by the Civics Institute since 1914. At the present time there were 19 students under training to take up work as labour managers, housing managers, rent collectors, hospital almoners and play leaders—all work dealing with the “ Human Factor.” Quite a number of firms already had labour managers.

He had two constructive suggestions to make :—

1. That all factory inspectors should be required to hold a Social Science Diploma and be appointed by the Department of Public Health, and not as at present by the Department of Industry and Commerce.
2. That there should be a Department of Social Service to deal with all problems connected with the human factor in life, and to co-ordinate the work of the various societies which endeavour to help them.

Other countries have such organisation and centralised control. It was time we did the same.

MR. SMURTHWAITE (Messrs. W. & R. Jacob & Co., Ltd.) : It is with great pleasure that I accepted the invitation to listen to the splendid paper which Sir John Keane has presented to-night.

The National Institute of Industrial Psychology with which Sir John has been so intimately connected is not a body of theorists, but a live practical body of men, who, since the last war presented to the world of industry many results of close research, which not only has increased production, but done much to alleviate the conditions of employees.

Mr. Ernest Bevin, the British Minister for Labour, early realised that all work and no play makes Jack a dull boy, and the idea that the longer a man works the more he produces is wrong, for the human being will always spread his energy over the number of hours he works. He will tune his mind and body. Research in work curves has shown that there is a general slowing up when long shifts are worked. To-day the men and women in our factory are producing and earning higher relative wages in a 45-hour week than they did in a 52-hour week. Heating, lighting and environment conditions not only mean better production and higher wages, but also a higher contentment between employer and employee. Monotony and boredom are often forgotten when a man is happy in his work. No man can give his best or be content if he is working in a poorly ventilated, heated or lighted factory.

Work curves show that Rest Pauses will also help production, while the worker leaves his work less tired. We keep very careful charts on the cost of living figures relative to the purchase of goods, but is there not

another cost of living that we should investigate and chart just as carefully—the cost of the lives of men and women who could be so much happier, healthy, willing to work and to give of their very best if we examined more closely the conditions of their work. True co-operation can only be accomplished by investigation into the many points put forward by Sir John in his paper to-night.

MR. CASE thanked the President for giving him an opportunity of expressing his appreciation of Sir John Keane's paper. The President had told him that the meeting would be interested to hear whether Messrs. Guinness used the principles of industrial psychology in their brewery. Apart from the welfare work which the Company carried out for their men, there were three instances in which industrial psychology had, at any rate, played a part:

First:—The recent application of deep ray therapy in their medical department, the considerable expense of which had been deliberately incurred with the intention of lessening the suffering of the men and shortening their absence of duty.

Secondly:—The examination papers set to the candidates entering the service had been changed and widened from year to year so as to select men of the varied attainments required in different branches of the Company's work.

Thirdly.—The interview between the Directors and the candidates for examination, to which the Directors attached very great importance. After all, examinations came comparatively seldom, while life might almost be described as consisting of a series of more or less successful interviews, and it was, therefore, most important that men should acquit themselves well in this respect. A story of a successful *viva voce* examination was told as an illustration.

MR. SPARKHALL BROWN: As a teacher I am naturally most interested in that part of the work of the Institute of Industrial Psychology which deals with vocational advice, and I would like to draw attention to two factors which, it appears to me, must limit the value of the tests as a means of assessing the abilities of the testee and of judging of the type of employment for which he is best suited.

The first factor I have in mind is nervousness. It is a well-known fact that there are many candidates who, for temperamental reasons, cannot do themselves justice, even at a written examination. When faced by a personal test and interview of the kind given by the Institute, such boys would be reduced to a mental state which would almost certainly obscure their real talents. There are, of course, certain types of employment in which nerves are a severe handicap, and it might be said that the test has succeeded to the extent that it has revealed this weakness. But this would be a merely negative result. There are many positions for which such a candidate might be well suited; in fact, nervousness, especially in a young person, is often the accompaniment of a keen intellect, which, however, is not likely to be revealed in such circumstances. Again, lack of confidence is a natural affliction of youth, but one which, in most cases, passes; the victim will probably "grow out of it" in a few years, but this will not be much consolation if he has been led to choose a career which does not give scope for his abilities.

The second factor which tends to limit the value of such tests arises from the fact that, between the ages of 15 to 17, at which the tests are

generally applied, and, say, 19 or 20, many boys undergo a change—mental as well as physical—which is positively startling. It may be of course, that some of the qualities revealed at 20 are present, in a latent state, at 15, but it seems unlikely that even a scientifically-planned test could reveal which latent qualities would develop most. A study of the candidate's ancestors would be more likely to be fruitful in such a case.

Apart from these considerations, one cannot but question whether it is possible, by means of a few simple tests, to measure a quality so indefinable as intelligence. Undoubtedly, a simple scientific test can be devised to measure the ability of a candidate to carry out routine work of a special character, but, in applying tests of this kind in making clerical appointments, there would appear to be a risk of eliminating the type of individual who might make only a moderate routine worker, and yet might develop into a brilliant executive.

MR. BLYTHE: I think that Sir John Keane and the Institute are moving along the right lines, and it is a pity that in this country work of the kind has not tried more. As far as clerical work is concerned, there is a rough test for the capacity of the individual. But for factory workers there is no test generally. Operatives are chosen haphazardly, and they are left to pick up their knowledge as best they can. If all the men in a job were as good as one or two of the best generally are, very good results would be got.

Vocational guidance of young persons is very difficult. As Miss Stafford said there is first the difficulty of getting a job. In many Dublin trades a boy will not be accepted as an apprentice unless his father was in the trade. If some system of testing were adopted, if it were possible to arrange that the boys who shall go into such and such a trade are the boys who have the greatest aptitude for it, it might be possible to get agreement with the Trade Unions to open the closed trades. While I know nothing about welfare workers I have seen a great deal of that work done by the Trade Union officials, and quite well done.

PROFESSOR SHIELDS said that Sir John Keane introduced for our consideration in a most interesting way a subject dealing with the effects of work on the worker and the influence of the worker on the work, emphasis being placed on the latter aspect rather than the former.

Before the introduction of machinery for industrial uses the significance of the human element was apparent, and during the long period in which the Guilds exercised a control over industrial organization, the worker was regarded as a brother in the economic family of which his employer was a member, and his material interests and social welfare were adequately safeguarded. With the adoption of machinery on an extensive scale, and especially on the installation of large scale plants, more than ordinary attention was devoted to industrial technique and the machinery employed, and the relative importance of the human factor was pushed more and more into the background. During the nineteenth century many managements failed to realize that unsatisfactory working conditions and overwork tended to sap the physical strength of a large body of workers. This is all the more significant where female workers are mostly employed.

At the beginning of this century, the American scientific management experts led by Taylor, Gilbreth and others adopted a different approach to industrial problems, and stressed the necessity of more systematic selection and training of workers rather than providing for their comfort

and general welfare. Their practical investigations formed a vantage ground on which subsequent studies were based. During the last Great War, the committee known as the Health of Munitions Workers' Committee was appointed to consider questions of industrial fatigue, hours of labour and physical efficiency in munition workshops and factories. Its memoranda, 21 in all, exercised a powerful influence on public opinion and administrative action, and made a considerable addition to the scientific knowledge of various problems relating to working conditions. Their investigations were continued by the Industrial Fatigue Research Board, afterwards called the Industrial Health Research Board. As a result of the special studies on the health and efficiency of munition workers and other allied problems, the Police, Factories, Etc. Act, 1916, was passed by which the British Home Secretary was empowered to make general and special welfare orders with reference to matters not included in the Factory Acts. This provision was included in the British Factory Act, 1937.

The human factor in industry may be examined from so many stand-points, such as the effects of natural and artificial lighting, fatigue, rest pauses, ventilation, temperature, vibration and noise, that time will not permit more than a mere reference to one aspect, that of industrial accidents. The various factors concerned in accident causation may be included under two main headings: those dependent on the worker, and those resulting from external influences not directly under his control. Those dependent on the worker may be the result of either nervous or muscular co-ordination in relation to the speed of production, or fatigue or malnutrition; while those depending on external circumstances may be due to poor conditions of lighting, temperature, humidity and ventilation, defects of machinery and absence of guards.

THE PRESIDENT, before putting the vote of thanks to the meeting, said, he would like to join with the previous speakers in the discussion in thanking Senator Sir John Keane for his paper. A paper from a person as qualified as he is to speak on the human factor in industry or business must rank as an important contribution to the records of our Society. He (the President) could not help thinking, however, that Sir John had dealt with only one side of the picture. One must realise that the most vital factor in industrial efficiency is the human factor: the quality of the manual workers and the quality of those who direct their work. Accordingly, of no less importance to industry or commerce or even to government administration is the proper selection of those who filled the places at the top of the organisation.

There is a case here for university men in business. University education gives a wider outlook and a power of understanding the bigger problems. Frequently one sees the top positions filled on the hereditary principle—sons succeeding fathers and grandsons succeeding grand-parents—without any thought as to the efficiency of the successors or their training to occupy directing positions. Success or failure of business and other organisations depends as much on the directing force as on the workers. Perhaps on another occasion Sir John Keane might consider presenting a paper dealing with that side of the human factor in industry.

SIR JOHN KEANE: I frankly admit that there are certain difficulties in the vocational guidance tests. With regard to one difficulty mentioned, I think the danger of nervousness is greatly exaggerated. Examiners

are very highly trained. A vocational guidance test takes about four hours. It costs about three guineas to undergo the test. The urge to get a job is, of course, a great limitation. That is why the Public School boys have more choice in selecting a career. I venture to suggest that some of to-night's observations have been somewhat academic. The work of the Institute is essentially practical. It must take a business as it finds it.

Commander Coote referred to humanistics. It is kept in view, of course. The Institute does aim at the humanistic side as far as it is desirable in practice. You must put up a scheme with which the Management will be satisfied. There was talk about rest pauses. In the opinion of the Institute rest pauses must be guided by the work. The duration of the pauses depends on the nature of the job. The system is now being adopted in the British Army in the promotion of recruits.

Two or three speakers have asked why there has been no work done in this direction in this country. The reason is, firstly, because our industries are very new; secondly, because our industries were started under very sheltered conditions and in some cases are monopolies. Until there is competition and conditions of free trade obtain the opportunity will not be found for vocational guidance.

I was very interested in what Mr. Smurthwaite had to say. From his knowledge he put the Institute's case far better than I was able to do.