showing at one point a darker area about the size of a pin's head. They contain a clear fluid and the dark spot proved to be the invaginated single scolex of the intermediate form of *Taenia solium*."

On January 6th the eyes were examined and the following report made: "The pupil reactions and all movements are normal. The left optic disc (D) is woolly at the edges, the blood vessels more engorged than usual. About a disc's diameter from the temporal side in a horizontal direction there is a small area of retinal depigmentation (P), a patch of choroiditis (C), fibrous bands with shallow opaque detachment of the retina leading downwards to a large subretinal cyst over which the vessels are stretched. The cyst shows a clear and well defined edge, is bluish in the outer portion, while the central area is hazy and opaque in which three or four dots can be seen. The cyst extends into the vitreous up to 5 D. The appearance presented is one of chorio-retinitis with a subretinal cyst due to the presence of a cysticercus."

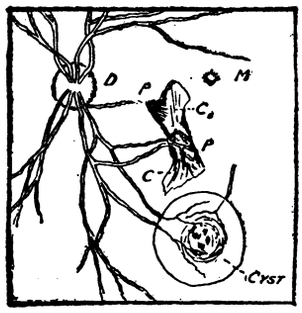

Diagram of left fundus. D=Optic disc. P=Retinal depigmentation. C=Choroiditis and fibrous bands. Cyst=Cysticercus cellulosae. M=Macula.

As there is no evidence of the patient harbouring a *Taenia solium* now, and no history of his ever having acted as host to such, it is presumed that he must have ingested extraneous segments or ova. And as the digestion and dissemination of such is usually accompanied by constitutional disturbance, it is further presumed that the attacks of abdominal pain, vomiting, and fever were resultant to such dissemination, soon to be followed by painful muscles. In substantiation of this presumption is the fact that no nodules made their appearance prior to this illness in October. Up to the time of invaliding from the service he has received treatment by calcium salts and potassium iodide, and later by intravenous injections of novarsenobillon.

I am greatly indebted to Major Hood, R.A.M.C., for the pathological reports, to Captain Bell, R.A.M.C., for removing the cysts, and to Captain Kumar, I.M.S., for the ophthalmic examination.

British Medical Association.

PROCEEDINGS OF SECTIONS AT THE ANNUAL MEETING, NOTTINGHAM, 1926.

SECTION OF MEDICAL SOCIOLOGY.

C. J. BOND, *C.M.G.*, F.R.C.S., President.

PRESIDENT'S OPENING REMARKS.

THE PRESIDENT said he regarded it as a great privilege to preside over the Section of Medical Sociology for two reasons: first, because the subject of discussion—namely, "The effect of fatigue and monotony in industry," was a factor of increasing importance in the health and welfare of the industrial population; and secondly, because it was very desirable to enlist the interest of the medical profession (including medical officers of health and general practitioners) in the recent advances made in this field of industrial physiology and psychology.

This Section provided an excellent opportunity for bringing before the notice of their medical colleagues, as well as the public generally, the important work which was being carried on in industrial life by the Industrial Fatigue Research Board, the National Institute of Industrial Psychology, and by other societies and welfare workers interested in industrial hygiene.

A sound system of industrial psychology and physiology must be built on two principles: first, that every normal human being should strive to obtain some sense of satisfaction from energy expended and work done; failing such requirement, effort became reduced in volume or was diverted into other channels. The actual doing of the work itself must provide a fuller sense of satisfaction. If industrial toil were less exhausting to mind and body, more stimulating, more health-giving, more interesting, then the growing demand for higher wages and shorter hours would be less insistent and greater benefit would be conferred on the worker. Consequently, a discussion of the factors in industrial life which tended to promote or to diminish the attainment of this sense of satisfaction must be of great importance. Among these factors the questions of monotony and fatigue had a very important aspect. The second principle was that the industrial problem was essentially an evolutionary one. It was largely a problem of adaptation to the industrial environment. If the worker was not fitted by nature, or had not been fitted by training, for his particular occupation, then he had not become adapted to his industrial environment. This opened up the important problem of vocational selection and vocational guidance in industry. In fact, it was not too much to say that the fitting of the work to the worker and the worker to his work was one of fundamental and growing importance, not only to the future of industry in our own country, but to the future of industry in the world.

DISCUSSION ON THE PHYSICAL AND MENTAL EFFECTS OF MONOTONY IN MODERN INDUSTRY.

OPENING PAPER

BY

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MONOTONY and fatigue are two aspects of a problem that affects the happiness and health of hundreds of thousands of workers in our civilization. It is not so easy, as mere separation on a notice of meeting would imply, to mark off two clearly defined fields of inquiry, and I think it is safe to say that in talking about monotony we shall find ourselves dealing simultaneously with some of the questions which will come up for discussion this afternoon. For although in our minds we can separate the more or less crude conceptions of fatigue and monotony, yet, when dealing with facts, and with situations in industry, it is often impossible to define clearly the responsibility due to either of these two factors, and frequently the remedies which we propose for one are directed to the relief of both. In work on these subjects we are to some extent handicapped by the long bridge from the laboratory to the factory. In other sciences data which at first lack sharpness respond to the refined treatments of the laboratory, but in dealing with human beings so many of the essential factors vary, when conclusions are sought in the midst of work, that in proportion to the extent by which we are forced to depart from objective controlled measurement, the possibilities of forming a clear opinion dwindle away.

The overlapping of work on fatigue and on monotony is explained by the fact that all evidence leads us to treat monotony as in some ways a special case of fatigue. To a limited extent we are justified in treating fatigue objectively. It has results which under suitable conditions can be expressed quantitatively. When work of any kind is done feelings of weariness, of disinclination for further work, and of desire for rest become prominent after a time. Muscular work causes diminished capacity for further activity, a decreasing rate of output (when the first slight stimulating effect of fatigue is past), an accumulation of waste products in the tissues, and finally increasing nervous inco-ordination. These effects can often be translated into terms of quantity. Physiological changes are not so obvious after mental work, but the general effects on rates of output and on accuracy of work are comparable with those following muscular activity.

Monotony is more elusive. It has no immediate physiological results distinguishable at present from those of fatigue—indeed, if we look on monotony as a special kind of fatigue this is not to be expected. It is not universal in its incidence under any given set of conditions, and it is not necessarily relieved by any particular remedy. In all

discussion of monotony it is important to remember that we are dealing with subjective factors, and that so long as the control which we can establish over them is liable to the complications—environment, individual differences, and momentary attitudes—which affect all human beings, our deductions are effective only in a general sense.

With this limitation it is possible to make broad distinctions, since to most of us fatigue and monotony do in fact connote more or less clear sets of ideas.

It seems possible to illustrate by a rather homely example the way in which monotony, or its synonym boredom—is separated from fatigue. At the end of a university boat race the two crews finish in a condition of fatigue which would horrify a factory inspector or an industrial psychologist. They recover rapidly, but as they pass the post the limits of exhaustion have been very nearly reached. During the race they have performed seven hundred repetitions of a movement that they have made probably thousands of times before. Yet no one would imagine that these men have been conscious of the monotony of their labour. They have had to preserve a determination to drive themselves up to the threshold of complete exhaustion; they have had to remain keenly aware of many factors, such as alteration in the rate of striking or of the development of roll in the boat, to which no training can make reaction automatic. They are tired out, but they have not been bored.

These same men in practice for the race, however, have certainly suffered from the monotony of training. Besides physiological staleness there are periods in training where long spells of practice are accompanied by intolerable boredom, even when, owing to long use, hardly any fatigue accompanies the exercise, and the men land quite fresh in the physical sense.

We have variations over this whole range in industry. There are exhausting jobs—physically as well as mentally—which are not found to have that peculiar colour of monotony, while there are others so light that in the hours worked there can be no generally fatiguing effect, and yet the workers are keenly affected by monotony; if they persevere, they develop in time the symptoms of ordinary mental fatigue.

From the theoretical point of view the problem of monotony was first studied by Munsterberg in America. He defined monotony as a "subjective dislike of uniformity," and he put forward evidence that in repetition work the workers tended to defend themselves against this feeling by paying attention to minute differences between each repetition of the working cycle. By various laboratory tests, in which successive series of similar and different stimuli were applied to many subjects, he claimed to have distinguished between people in whom each experience in a uniform series facilitates a reaction to the succeeding ones, and those in whom the uniformity of the successive experiences has an inhibitory effect on the response. The former respond with less effort to each stimulus, the latter with an increasing effort as the series proceeds. He found evidence, by a general inquiry into the behaviour of all his subjects towards monotonous work, that those in whom this inhibitory effect was most marked were the ones who most disliked uniformity of work.

Although this theory was tentative, subsequent work has shown it to have elements of truth, and probably the best working conception of the mechanism behind feelings of monotony is the one which we owe to Professor Myers, who looks on monotony as a danger signal of central nervous exhaustion. In the structure of the body there are certain material limits—reserves of fuel, balances of acid and base, resistance of synapse and end-plate—which set a term to activity. These limits are always guarded by earlier nervous inhibition, which training, or the stress of some overwhelming necessity, can push nearer to the point of physiological exhaustion.

When a muscle is contracted voluntarily, impulses are sent up afferent fibres to the nerve centres, which tend to block further impulses to contraction. This is in the nature of a protective device, and in the typical ergograph tracing the growing effect of these impulses is seen in the successively smaller contractions, which dwindle finally to nothing. The muscle itself is not essentially less capable of work, and the neuro-muscular apparatus is still efficient, for if the load is lightened effective contractions can again be obtained voluntarily. The blocking is therefore more central in origin, and the appearance of fatigue is directed only to one special set of conditions. Alter the conditions, and the inhibition disappears. The blocking is a safeguard, acting far in advance of the real limits of capacity for work.

By an analogy, which at all events is justified by introspective evidence, we may see in this dislike of uniformity a similar protection. There is competition continually going on for our attention; mental processes begin and cease—mostly involuntarily, though all of us develop powers of selection. While one process is occupying our attention others tend to be inhibited. The balance, however, is always shifting, and sooner or later one process gives way to another. When monotonous mental work is being done the competition of other processes is most severe. There comes a time when they break through into consciousness, and, by their own tendency to inhibit rival processes, make the continuance of the first process impossible. If it is necessary for any reason to keep these distractions out of the mind, feelings of monotony arise.

If we now examine a little more closely the behaviour of our boat crew under different circumstances it will be obvious that their boredom under training conditions did not depend ultimately either on uniformity of work or on its continuous repetition. The real difference between practice and racing was one of interest. Under the hectic stimulus of the race the crew has an aim, and everything is willingly subordinated to the object of reaching the post first. Fatigue, the anguish of driving on an exhausted body, matter nothing. During training, however, this object is remote. The daily routine creates an illusion of permanence; the race day is too far ahead for preparation to be stimulated by its prospect. There is a sameness about the long practice paddles, about the advice of the coach, which the crew finds infinitely depressing. There are times when nothing but a complete holiday will restore their poise. Uniformity and continuity of work, without the close incentive of competition, have temporarily destroyed interest, and the work is found more and more monotonous.

Now these features are increasingly obvious in the industrial situation, for there will be no going back from the development of invention and organization which has in the last century revolutionized production on the large scale. By dividing the operations of the work, by specializing the functions of the worker, production becomes more rapid and goods cheaper. At every point in the industrial process small jobs are being split off, to be performed by a new machine, or by a hand which, because it now does one operation instead of two, develops a skill which changing work would not permit. In the shoe industry the original work done by the village shoemaker is now divided between scores of operatives, using special knowledge and the skill of years on one fraction of an operation. The original working cycle is split up into many small work cycles, repeated with a minimum of variation hundreds, perhaps thousands, of times in the day. In some trades variety is demanded of the manufacturer, in others efforts are made further to standardize both operation and product, because the manufacturer believes that variation in either causes waste of skill and loss of productive power. With this tendency to division and to specialization the possibilities of interest and expression in work decline.

Repetition is, of course, not a new problem. Even the bootmaker made one boot after another; domestic work is often a rather uninspiring routine, and in hoeing a twenty-acre field a large number of very similar movements are made. But, through the logical extension of a process that began as soon as men ceased to provide all things for themselves, many more people are busy nowadays with repetition work, and the average length of the working cycle becomes progressively shorter. Two hundred years ago there was nobody living who was faced with the necessity of performing a two-second operation all day long for years on end. There are many in that position to-day, and to that extent we have a new situation.

It is not only that repetition destroys the possibility of interest, though any experience has only to be repeated often enough for further repetition to become irksome. Only while there are possibilities of new discriminations, of new reactions in ourselves, is it possible to attend with pleasure to the repetition. When once our favourite poem is sufficiently familiar to be quoted without shock in the morning newspaper leader something of its attraction has gone for us.

But the tendency of modern industry to deal with material as so many identical samples also removes the elements of interest from work. When the bootmaker finished his boot there was character and history in the making. Problems had been faced, particular difficulties overcome, which remained associated with the product. There was the possibility of an almost personal relation to the product. Because the modern worker deals only with one process, the range of difficulty is limited; in a short time there are no surprises, and his own contribution to a piece of work is overlaid at a later stage by the labours of other hands. All that is left is the necessity of passing a standard and of achieving output. Although derived interests do arise in connexion with work there is no longer the individual and personal response which was once possible. Work is becoming a price that is paid for leisure.

With increasing uniformity of material there is a steady pressure towards increasing continuity of work. The pictures which those unacquainted with industrial life draw of repetitive processes usually fail to allow for the fact that work is rarely continuous. Dr. Vernon of the Industrial Fatigue Research Board made an inquiry into the conditions of fifty apparently continuous jobs spread over boot and shoe making, tin canister making, laundry work, and packing operations. The working cycle varied from under one second up to as much as two minutes, with an average length of under four seconds. By making time studies of the work of various operatives, the number and duration of the breaks was analysed. Dr. Vernon examined only those jobs which seemed noticeably regular. Stops occurred for many reasons. Work had to be carried away or fetched; machines had to be stopped for cleaning or adjustment; there were waits when new supplies were not forthcoming. In the most continuous work—handkerchief-folding—there was an average of three breaks in the hour, totalling four and a half minutes. In other jobs there were breaks of as much as eleven minutes in the hour. Over the whole group workers who habitually sat at work got four breaks in the hour, which they spent walking or sitting, while standing workers got five breaks. There is, however, a tendency for these stoppages to be eliminated, although by affording opportunities for change of posture, for walking, and for conversation, they offer a welcome relief from the rhythmical inevitability of the work. Such unproductive time is from one point of view waste, if a skilled producing agent is performing small transport services, but it would be well to weigh against machine-like efficiency the human cost of increasing the continuity of work and the likely oppressiveness of its monotony in these circumstances. Output does not entirely depend on productive time.

Although on very uniform and very continuous repetitive work a higher proportion of workers will suffer from monotony than on more varied and interrupted work, there are still people who are not bored by work of this kind, and people who, even on the most varied work, maintain a steadily depressed attitude to life, and complain bitterly of monotony. It is safe to generalize and say that the actual temporal or material conditions of work do not make it monotonous. Monotony is a reaction, not to particular selected features of work, but to the whole circumstances of its performance. Its appearance is conditioned, not only by the industrial environment, but by personal relations of all kinds and by the circumstances of life in general for the worker who feels "fed up."

The theory of monotony as a warning symptom of central nervous exhaustion, consequent on the effort to maintain some mental process in the face of strong competing interests, is capable of being brought into close connexion with the operative in a factory. All industrial work involves the maintenance of certain attitudes of mind—to the work itself, or to the people engaged in the work. The worker feeding a dial machine, or counting screws, is able to perform these operations with a minimum of attention after a time. It is not generally possible to concentrate on anything else, however, without detriment to the work, or even sometimes danger, and there are consequently voluntary restrictions on freedom of movement, necessities of behaviour, and inhibitions of normal impulses (such as looking up at a sudden noise), which have to be preserved. There is a perpetual holding of oneself in check. If there are no incentives powerful enough to strengthen the workers in these efforts, then sooner or later the special kind of fatigue which lies behind monotony will set in.

It is often extremely difficult to decide to what extent the monotony of work is oppressive. Suggestion always operates among groups of workers engaged on similar processes—a new-comer will suddenly open the eyes of a group to defects or conditions which had not affected them before. A worker genuinely affected by the dullness of a job sometimes destroys by her complaints the attitude of acceptance which others have managed to achieve. Recently, in a factory where the work involved was the counting of certain forms, and the sorting from them of a very few defective specimens, and where there was a periodic shifting of the workers from branch to branch, there was among new-comers a strong antipathy to the work, for lurid stories of the conditions in the counting office were circulated in the other offices of the firm. The new-comers were usually pleasantly surprised, for the compensations had not achieved the same publicity as the drawbacks. But among the old hands there was a good deal of complaint of the monotony of the work, in spite of short hours of work and very high pay. It was difficult to decide whether this tendency to complain of monotony arose because long continuance at the work reduced all to a state of boredom, or whether, as there seemed some reason to believe, suggestion from the few who really found the work intolerable—and however good the conditions there are always some who hate such work—produced a general reaction against the work. There was a fixed quota of output, not unduly high, and many opportunities for breaks in the work, so that the conditions were not oppressive. There are likely to be many cases in industry where the oppressiveness of monotonous work will only be felt when suggestion has undermined resistance.

The mental effects of monotonous work vary from person to person. In nearly all repetition jobs in which monotony is felt opportunities are afforded for reverie. Probably there is no opportunity for thinking of a systematic kind, owing to the slight attention which must still be paid periodically or continuously to the work; but a vague, loose series of associations floats through the field of consciousness. To some workers there is an attraction in work which does not require close concentration. Others fall into an attitude of passive acceptance. The day slips by, and output piles up, while fragmentary pieces of experience are caught up, turned over for a few moments, and allowed to drift away again. There are workers to whom it had never occurred that objectively dull work was boring. If there are no standards of criticism towards aimless mental activity of this kind the worker is contented.

But increasing intelligence, and especially increasing education, have their effects. Among the girls on the counting process there were many to whom the limited scope of the work added to its burden. "Any fool could do this," they said, and they also in their work found opportunities of reverie. But their dreams were not altogether happy. Because at bottom tendencies were failing to find expression in the work, reverie became a means of escape, which is never adequate so long as the worker is conscious of the discrepancy between fancy and reality. These girls realized that their full powers were not being used. By way of reaction many of them said that though they once read books they had ceased to do so now. They seemed resentful that this should be so, and projected the responsibility on to the work. They felt, as one of them said, as if they were becoming "turnips," that they were not so intelligent as they used to be.

Reverie appeared by no means unpleasant, except in so

far as purposeless fantasy seemed undesirable. The girls felt an inertia, which seemed to be due, not so much to uniformity of work, as to the possibility of reshaping the world, which can be realized in fantasy. When the mind habitually turns away from externals the workers find relief in the easy play of ideas which goes on concurrently with work. It is not surprising if years spent in this way slowly destroy among the workers the wish to effect changes in themselves or in their environment. There is an easier path to a kind of half release which prevents efforts to a more positive satisfaction. Among these counters, who had all had secondary education, there were some who realized this vaguely, and added a slight feeling of guilt to the combination.

But there are more sinister effects of excessive reverie. Unless monotony is relieved it may be pushed, in limiting cases, to a point where there is a failure of inhibition, which allows the release of repressed unpleasant memories from the unconscious. This is liable to happen when central control is weakened by fatigue, and the peculiar circumstances of unlimited time for reverie and for unsystematized association, which monotonous work provides, set the stage for the development of neurosis. Even among normal people on monotonous work there are signs of maladjustment. Unreasoning fears are displayed of quite safe pieces of machinery, used thousands of times without accident; anxieties are more than usually obvious about output, about the opinions of fellow workers, about health; others admit to a feeling of being trapped, or "as if the day were leaving them behind"; while some girls on the counting process had a feeling that they were being watched, which was not justified by facts, even though some of their work was checked. The feelings of "guilt" also are in this class.

All of these tendencies may be the beginnings of psychopathic lesions. They do not occur in all people; they are always put forward apologetically as something rather stupid and not worth mentioning by those who experience them. In most cases, even after a long time at the work, the acquirement of interests outside the work and a generally healthy attitude to life offsets their beginnings. But in a few cases the symptoms develop to the point where psycho-therapeutic treatment becomes necessary.

Even when the stage of genuine psycho-neurotic breakdown has not been reached the presence of people with such tendencies has a noticeable effect on the atmosphere of the workshop. The internal dissatisfaction of a worker whose powers are not being used is sometimes not consciously seen at its true value, but spreads itself in resentment and criticism of the whole system. Such people grow irritable, the ordinary social amenities disappear, the perspective of affairs vanishes, and sometimes a tendency to aimless mischief arises. Thus there was a case where, out of detestation of monotonous work in a very poor environment, a crew of men handling fragile sheet material at a conveyor extracted an undoubted pleasure and relief from periodic destruction of some of the material. When conditions were improved the spoilage was reduced to insignificance. The protest of such workers is not always foolish, because it comes by way of reaction to the monotony of the work, and the mere fact of investigating their complaints adds something of interest to their work.

The only way in which physical effects can be attributed satisfactorily to monotonous work is by the comparison of groups of workers. This has so far not been done, though I believe an investigation on these lines is proceeding. The physical effects will not be connected with monotony, prima facie, for in those cases where monotony is felt to be most oppressive, the lesion that occurs will be functional and in the nature of a defence against continuance in the work. We have only to remember the case of miner's nystagmus to see that this is a possibility. It was found that the eye twitch which characterized this disease was functional in origin, and to some degree its occurrence was a method of unconscious self defence against the discomforts and dangers of the pit.

One of the obvious ways of preventing the development of boredom is to stop work. It was pointed out earlier that by increasing the continuity of work there was not necessarily a gain in output, and one of the tendencies noticed in workers under these conditions is the taking of unofficial rests. Here again the counters before mentioned provide us with an example. Time study showed that, although counting was found dull and monotonous, it actually occupied less than two hours out of the six-hour day which was worked. There was a traditional, but unofficial, allowance of ten minutes away from work twice a day, whenever it was most required. But analysis revealed the fact that even with the slowest workers at least forty minutes of the day went in odd seconds and minutes of complete rest from work. With the fast workers even longer time was taken. Out of the total about two-thirds was taken in the afternoon spell. The feelings of monotony are most oppressive in the afternoon, and, as is usual when work consists of short repeated cycles, it was found that, although the actual speed of counting did not greatly fall off, increasing amounts of rest were being taken between repetitions towards the end of the day.

It has been thought also that the work curve can, in certain circumstances, provide evidence of monotony. This curve shows the rate of working at various times in the day, and in its usual form shows a rise from the start to a maximum at about the third hour of work, followed by a decline to the dinner hour. The afternoon curve rises rapidly at first, and then declines more or less sharply as the afternoon wears on.

Laboratory curves of work found to be monotonous by the subjects very often show a depression in the middle of the spell. The workers dash at the work at a pace which cannot last. Boredom causes a decline in speed, until, overestimating the time that they have been at work, a spurt begins because they anticipate the end of the spell. They finish strongly.

Wyatt has shown in continuous addition and comptometer work that this tendency to slow down in the middle of a spell is most clear in those people who find the monotony of the work most distasteful. It was found by Miss Burnett, in an experiment under conditions very close to those obtaining in industry, in which work was done with and without rest pauses, that the depressed curve was given preponderatingly by the more intelligent subjects—who were also the most bored—and especially on those days when, through the absence of rest pauses, the tendency to monotony would seem to be most marked.

From our inquiry it will be seen that any method of reducing the uniformity of work will be a step in the right direction, so long as the necessity of keeping a balance between too much change, with its irritating effect on piece workers and its depressing effect on output, and too little, with the danger of monotony, is realized. Any method which we can use to increase the interest or the incentive to work will be effective. Boredom is not felt, or at least has no chance of developing into serious nervous exhaustion, if the worker feels that, though the work is dull, it is worth doing. What makes it worth doing may be anything—from a high wage to a young man in the same factory. It may be pride in the organization, pride in one's own skill, or personal liking for the company the workshop affords. With a good factory atmosphere the plea of monotony is not put forward on work where other conditions would at once produce feelings of resentment and boredom.

In order to increase interest in work, short talks on the relation of each worker and his process to the general scheme have been suggested. Wherever it is possible some method of giving the worker an interest in output is desirable, and the change of outlook is often most marked when this is done. Miss Burnett's experiments were designed to illuminate this point among others. Her four subjects worked for two periods of three months, first on time rates and later on piece rates. The work was identical in both the periods. During the piece-rate period the girls worked harder, found much greater interest in the work, showed an almost complete absence of the monotony curve, and achieved increases of output which ranged from 9.3 to 17.9 per cent.

The value of rest pauses and of changes of work is also marked. The effect of breaking up the working period is to allow the prospect of stopping work to be an

incentive to continuing for the time being. Change of work, if that is possible, is more desirable than rest, for there comes a complete temporary breakaway from the attitude which has become wearisome. There may be opportunities for collecting together into a definite period various subsidiary operations, fetching and removing work, which would otherwise be done sporadically. Or it may be necessary to specialize the work of a group of people still further to get the required conditions. The National Institute of Industrial Psychology had a case where a group of girls were employed on a process which involved opening certain parcels, checking the contents, performing a punching operation on the contents, and remaking the parcels. The average time per parcel was thirteen minutes under ordinary conditions, but under supervision, not working at an exorbitant rate, two workers averaged eight minutes over a long period. Every one complained of monotony. There was much congestion and litter in the room, and between each parcel and the next a journey had to be made to the store shelves. By dividing up the work process, so that one team of girls did the preliminary opening of the parcels while the distribution and collection of work went to two inspecting and punching teams, not only was output increased by 10 per cent., even when rest pauses were inserted, but by having the three teams change functions at intervals there came a break to which all looked forward. Although each job involved more repetition than the old complete cycle, yet three repetition jobs done for an hour each proved permanently more interesting than the former longer and more varied process repeated less frequently. Here also we had an example of the environmental influence. As a result of the change in organization the room became tidier. There were fewer people, since with a 10 per cent. increase in output some could be moved to do other jobs. There was less moving about, and the possibility for the first time of developing rhythm or swing in the work. It became obvious that a part of the reaction against work in this room, which was so severe that only half-day shifts were operative, was due to the congested, irritating, and untidy conditions of work.

There is one more step which can be taken to reduce the incidence of monotony: there is still the possibility of selecting workers for the more dull and repetitive work by diagnostic tests. It has often been stated that intelligent people are more likely to suffer from monotony than the unintelligent, and it is quite true that, *a priori*, we should expect those who are most capable of dealing adequately with new and unexpected situations to suffer most in work which makes demands for no initiative. Miss Burnett found that of the four girls, the two most intelligent, as indicated by a simple "directions" test, found the work most monotonous and furnished the most objective evidence of monotony. But the stage has not yet come for the preparation of norms above which entry to a monotonous job will not be recommended. There must be time for the collection of more data, and valuable results may be forthcoming when the figures of labour turnover on repetitive jobs are analysed, with respect to intelligence, at the conclusion of the experiment on vocational guidance now being carried out by the National Institute of Industrial Psychology.

Specific tests of capacity to tolerate uniform work have been suggested. Except for Munsterberg's tests quoted earlier, which have not been much developed, most of these take the form of long uninteresting tasks in which the rate of output is measured continuously. There is some slight evidence that an erratic performance, with a widely varying rate of output from minute to minute, is an indication of the future liability of the subject to monotony. In addition to these special tests any method of selection which guides people into work for which innate dispositions and aptitudes fit them will, *pro tanto*, reduce the possibilities of disharmony, and so minimize the effects of monotony. Some of the worst sufferers are those who, through lack of dexterity or other disability, feel themselves on the verge of failure at their job, and, struggling against something which they do not realize as inevitable, grow disheartened and depressed.

I have tried in this paper to show how monotony depends on the interaction of many factors, of which perhaps the most important are personal ones. Since there is no doubt that many of the determining conditions are bound, under the present methods of production, to increase their influence over the general body of workers, it is important to recognize the results when we see them, and the ways in which monotony may be combated. If, finally, there is a gradation of interest, then suitable people must be steered into the most exacting work, for the general social welfare suffers while the wrong person fights against the uncongenial job. If the costs of improving monotonous work are economic, the losses through its continuance are not only in human values. One fears to preach to the converted, but it cannot be too strongly emphasized that mental attitudes are vital factors in production.

DISCUSSION.

Miss MAY SMITH (Industrial Fatigue Research Board) said that complaints and criticisms of monotony were usually made by highly educated people who went through a factory as observers, or in some instances as investigators. The besetting sin of the investigator was to put himself in the place of the worker, and then judge that work as it would affect him were he doing it. It was necessary to see the work as it really was to the worker. The word "monotony" meant one tone, and represented absence of stimulation; it was frequently attached to "repetition of movement." Repetitive movements must either be studied as such, in which case their problems belonged to the psychology of habit formation, or they must be put in their complete setting, which setting would include at least the repetition work, the varying amount done as the hours go on, the opinions of fellow workers and authorities about that work, physiological changes, emotional changes, and the collective life of the factory. Workers on one process frequently stigmatized as monotonous some other process, when to the observer there was nothing to choose between them. In itself, monotonous work could not be said to be detrimental to the health of the worker as such; as in so many other industrial problems, it was a question of relation—that is, of the effect of a given type of work on a given type of person. It was useless to criticize or attempt to assess a process regardless of the person who was to work at it. It was now comparatively easy to measure a person's general intelligence or neuro-muscular equipment; it was impossible to measure objectively the emotional make-up. A worker of average intelligence and skill engaged on routine work in an office or factory where the general atmosphere was dull, and where there was nobody in whom she took any interest or for whose approval she cared, might react in one of four ways: she might become a bad timekeeper, seize every opportunity for leaving the work, and become just as unsatisfactory as she could be without losing the job. She would probably be called "difficult," and be frequently in trouble. Secondly, in a person of similar intelligence and speed but of lower vitality boredom might quickly lead to sensations of tiredness, which in turn led to attention to some part of the body. That part which she was using might come into consciousness, and she would feel a pain and complain that her eyes ached, her head ached, that she had rheumatism, or that she suffered from indigestion which nobody could cure. It was rarely the happy and well placed people who had a sequence of sick leaves every year. The boredom acted as a negative agent, weakening resistance. Thirdly, the worker might carry on for years with gradually diminishing interest. Here the monotony was related to the general conditions of the work rather than to the actual repetition of movements. She would complain that the work got on her nerves; she would be irritable, and would probably have some form of "nervous breakdown." Breakdown was not infrequently equivalent to "fed up." Fourthly, the worker might get interested in the work, and might laugh if asked about its monotony; or she might accept it and compensate outside. Finally, there was the way out via the day-dream. This reaction was by no means universal, nor were its effects simple. Some people

could day-dream quite happily and carry on their monotonous work efficiently. The content of the day-dream could rarely be elicited, but it was usually of a compensatory type; it allowed of the expression of activities and emotions not normally expressed in reality. Others found that the day-dream interfered with their work; they tended to oscillate between the work, which did not occupy them fully, and the day-dream. Others, again, looked upon the day-dream as something to be opposed, and resisted it, wasting in the process valuable energy; they tended to have psycho-neurotic symptoms of a serious nature. Occasionally the day-dream, instead of being pleasant and controllable, became the master, and the subject became more and more self-centred and a victim of fantasy. In these cases the work was looked upon as a refuge from the unpleasant character of the day-dream.

Major T. KNOWLES (Supervisor of Messrs. Boots' Welfare Centre) said that the monotony of modern industrial processes was a subject of constant discussion, and visitors to some firms would remark of the work, "How monotonous! I couldn't do it; it would kill me." But what was monotony? Monotony was surely a question of individual preference, and it was impossible to generalize and say that such and such a thing was monotonous. If everyone found the same things monotonous, how monotonous everyone would be. Was it possible to find interest in stamping boxes every day? His inquiries tended to show that the girls found much of interest in the work. No work was unskilled, and there was a definite pride in the way the work was done and in the speed of the work. Where girls were working in teams there was the desire to play a part in the group results, and where these results were posted the pride in individual skill and in the collective skill of the group was accentuated. In addition to the interest which the work itself created, there was the interest created by companionship and surroundings. It was said that there was deadening effect on the mental faculties of these workers, and a lack of opportunity for self-development. But leisure was the time for self-development, and Major Knowles would support any movement which removed the monotony from leisure and offered to the workers opportunities for development. He would claim that work need not necessarily provide the development, but it must provide the means for that development; and it was only by what had been called monotonous repetitive methods that this could be secured. Girls who had been for some years on repetitive work took their part in the mental recreations that were offered, and the non-vocational culture classes were made up largely of girls of this type. Finding it unnecessary to absorb their evenings at classes in shorthand, book-keeping, or that vague subject commercial practice, they were free to attend the housewifery, cookery, needlework, and leatherwork classes. To show the absence of detrimental results in repetitive work Major Knowles quoted the experience of an office department. In this particular office department there was a staff of two hundred girls, one-third of whom were engaged in adding machine work, the other two-thirds were employed in ordinary office work. The percentage of sickness amongst those engaged in repetitive work was about one-half of that for the rest. The girls on repetitive work were happy and healthy; they resented any effort to change their work; they were playing their part in the social, educational, and recreational work, and to arouse artificial discontent by constantly suggesting that the work was injurious was a futile thing to do.

The wise employer realized that his responsibility did not cease with the weekly pay envelope. Repetitive methods or any other methods would be harmful if the working conditions were not good. The employer should take every precaution, in time and motion study, ventilation, rest pauses, and the provision of suitable apparatus to ensure safe and easy working; and welfare work in its medical, educational, and recreational aspects must co-operate.

The problem of monotony, said Major Knowles, was one of the many problems of industrial management, but they should be somewhat slow in their judgement on these problems. There was a new spirit in industry which would in time remove the suspicion and consequent opposition that existed to-day. It was not by rules and regulations that they would succeed; statutory methods must fail. They must secure the atmosphere, and, above all, be moderate in their statements.

Miss SLOCOCK (Superintending Inspector of Factories) said that in endeavouring to get examples of what were generally considered the most monotonous occupations, or rather processes, she was at once confronted with the fact that in one sense there was no such thing as monotonous work. It was rather the reaction of certain human beings to certain work carried on under certain conditions, not necessarily repetitive work or work carried on for long spells. The question of character and temperament played such a large part that what appeared monotonous to one person might not prove in the least so to another. Inquiries showed that it was repetitive work of various kinds that was generally considered to be monotonous. It was probably the absence of *creative* aspect in any work that brought about the sensation of monotony. This aspect was well expressed by an old collar maker in the West of England who said: "Nowadays it is difficult to take any interest in one's work when one only does a small portion and never sees the finished article. In the old days when you made the whole collar you felt satisfied when you turned out a good one, but nowadays the collar when finished belongs to no one." It seemed impossible to get any very definite information as to the adverse effect of repetitive work on the mental and physical health of workers; but there were certain factors which had an important bearing on the subject. Thus it was customary to draft the new young worker on to the most monotonous job and to promote her as soon as opportunity offered to work requiring more intelligence. If the time spent on the monotonous work was not too long it was scarcely likely to affect the physical health, but if unduly prolonged it might affect the mental capacity of the worker and make her less adaptable to other work. Secondly, the shortened working day of eight to nine hours and the week of forty-seven or forty-eight hours had doubtless mitigated to a very large extent the fatigue which would result from longer hours of monotonous work. Under modern conditions and shorter hours the workers appeared to be brighter and more alert, even when performing monotonous jobs. Thirdly, automatic feeds were now eliminating much monotonous work. The tending of such a machine and keeping it supplied with material was a very much more interesting and less monotonous job than the continuous feeding of small parts or sheets into the machine. Fourthly, it was undoubtedly the environment in which the work was done rather than the work itself which affected the mental and physical condition of the workers. The mental atmosphere of the factory, if it was friendly and interesting, might soon compensate for lack of interest in the job. Constant nagging by an overanxious foreman or forewoman and bad hygienic conditions, on the other hand, might soon create such a feeling of strain and worry that the most interesting work became irksome and burdensome, and the workers lost heart and health. Lastly, while scientific investigation into vocational selection, methods of work, the elimination of wasteful movements, the adoption of labour-saving appliances, and rest pauses and hours of work had helped to show how monotony could be counteracted, there was real need for warning as regards overspeeding. Work carried on at too high pressure was probably far more fatiguing and likely to affect the health adversely than work at the worker's own pace spread over a slightly longer period. Alternation of employment was not generally popular, and even young workers on unskilled monotonous work appeared to have an affection for their own particular job.

Miss K. DOWDING, of the Chiswick Polish Company, said that the inevitability of mechanical industry was now undisputed, but that highly organized methods brought new problems for the psychologist and physiologist, one of which was this new form of monotony. She used the term "new form of monotony" advisedly, for it was only reasonable to suppose that monotony and its ill effects had been present in connexion with the work ever since the

discovery that a subdivision of labour increased the sum total of work produced by any given number of men. Hand spinning, for instance, was now looked upon through very rosy glasses as one of the "old crafts," but to sit and spin alone would be indeed monotony to our modern girl.

Miss Dowding thought that there was very little real monotony felt by girls in well organized factories to-day. There was a type of girl who was constitutionally or emotionally unable to work either with machinery or on piece-work, because her natural rhythm was of a leisurely type. There were other girls who were truly mechanical and loved machinery, becoming peculiarly attached to their own particular machine, and others whose activities were excited and kept elated by piece-work. It was in greater care in the choosing and placing of the workers, and the more thoughtful provision and arrangement of their working environment, that the prevention of the mental and physical ill effects of repetitive production could be looked for. Correct placing in the first instance or transference in the early days determined frequently between the drifter and the contented artisan. Correct placing had its effects upon the whole group of workers. Nothing was easier than for a discontented worker to turn a pleasurable job into monotonous drudgery for a whole group of workers. This suggestibility of the workers made the whole problem of monotony so difficult. It was a most contagious complaint, and they should be extremely careful before they labelled monotony as an urgent industrial problem. Miss Dowding had been unable to collect evidence of any serious deleterious effects arising from repetition work, save in isolated cases of unsuitability which were capable of readjustment. In factories with good conditions it was easier to find instances of keen resentment and genuine distress at a suggested transfer. The whole question was largely one of the attitude of mind of the worker. It was the general feeling of being absorbed into some vast impersonal "thing" which was the foundation of the irksomeness of factory work—whether repetitive or otherwise. It was only by attacking this impersonality that the "dead level" of work could be altered.

In a paper which she was unable to read through absence, Professor WINIFRED CULLIS submitted that the word "monotony" now definitely carried with it more or less descriptive colour. To speak of a job as monotonous did not mean only that it was repetitive, made up of a series of efforts which might or might not in themselves be unpleasant, but that the general effect was an unpleasant one—in other words, it connoted an unpleasurable reaction to repetition. The discussion dealt with the repetition of actions which, though not sufficiently arduous to bring into play the type of protection associated with heavy muscular work, yet could produce a state of exhaustion quite as serious, or even more so. This kind of fatigue or boredom which came from repetitive work might be due to fatigue in certain nerve centres concerned in the performance of the action; or, as had been suggested by C. S. Myers, the fatigue might arise from the fact that the successful performance of a certain act necessitated the suppression of other actions not compatible with it. These inhibited mental processes became more and more difficult to suppress as fatigue from that inhibition set in. Investigation had shown that individual differences were very marked in reference to reaction to repetitive work. In the laboratory tests those subjects who gave the best showings on the findings of the intelligence tests were the most variable workers on the findings of the experimental tests. The introduction of rest pauses always had a beneficial effect; there was less fatigue, and the average output was increased quite definitely. Group working might counteract the particular desires or inclinations of an individual member of the group, and the fatigue of repetitive work might be lessened by paying special attention to the general arrangement of the work, and more particularly to the adjustment of the machine to the worker. In fact, the requirements were to make the times of work such as to be consistent both with the health of the worker and the prosperity of the industry; to introduce rest pauses under expert advice as to the period and duration, since these differ from industry to industry; to give sufficient free time to the worker to undertake activities of a different kind; and to give the individual such an education as would enable him to make an enlightened and stimulating use of his spare time.

Dr. J. STEWART MACKINTOSH (Hampstead) said that the issue was ultimately a biological one. The inhabitants of this country had passed successively through the hunting, pastoral, and agricultural stages, and the industrial era was at least as great a revolution as those which had preceded it. The simple traditions, whereby communities attached to the soil through many generations maintained their health, proved unserviceable to the huge, uprooted, and floating populations of the industrial districts. A new and more complex tradition must be devised by which physical and psychological adjustment to new conditions might be effected. They had to ask themselves the searching question whether they were eliminating the elements in their national composition which had made them great, or whether they were still going to maintain the quality of the British people by adapting the industrial machine more to the man and the man less to the machine.

Dr. J. JENKINS ROBB (Birmingham) agreed that it was most difficult to separate monotony from the question of fatigue. Both seemed to him interdependent and interrelated in their complexity. He feared that there was a distinct danger in the overemphasis of the question of psychology in industrial conditions, and in too much being claimed for it might lurk a factor akin to psycho-analysis. Psychology was not an exact science, and therefore its claims, so far as labour conditions were concerned, should be carefully watched. In reading the council's reports he felt they were in the most initiatory stages, that some of their tables referred to very small groups, the smallness of the group making conclusions unsafe. Judgement and conclusive evidence must be based on large experience properly correlated. Monotony was not so apparent to the less educated, an argument against such labour, though thoughtful workers, he found, resented it. In his opinion much of what was termed neurasthenia was so caused. He would like to know the relation of monotony to sickness benefit, for in looking into this question in a large group of organized workers in a friendly society's report, he found that in this section sickness was now costing more, and last year showed that income from sick rates did not meet expenditure. Taylor's motion study had for its object increase of production, and even Taylor's figures showed that while production went up to a great extent, wages made a comparatively small advance, and the percentage of rejected was high. So the present-day worker was suspicious of any system or plan which meant observations with a stop-watch in hand so that he might be speeded up; for to him it meant, as a rule, a relative drop in wages; it bred discontent; and discontent in work was twin brother to monotony.

Dr. J. LOCKHART (Nottingham) objected to the frequent use of the term "neurasthenia" in certificates. When the patient was only vaguely ill the panel doctor, whose certificate alone was valid for benefit, had to put something down. He used the word "neurasthenia"; and the label, once applied, took months to unstick. Medicine was a clinical problem; if industrial medicine was to be any good it involved co-operation with the doctor outside. Dr. Lockhart desired that the Ministry of Health should make this co-operation official.

Dr. CHRISTINE MURRELL (London) believed that the element of compulsion produced monotony. She hoped that the development of machinery would in time remove monotony to the machine. The testing of vocational capacity was of the utmost importance.

Dr. C. FORBES (Aberdeen) said that monotony appeared, at the present time, to be an essential part of industry. It might be anticipated that the progress of invention would gradually replace by mechanical devices the more monotonous processes now carried on by human beings.

In the meantime welfare work was to be encouraged, aiming as it did at neutralizing as far as possible the effects of monotony in work. While many workers employed in monotonous work did not find it irksome some undoubtedly did, and, either on account of intelligence, education, or of temperament, were broken in health and happiness by routine. These should be eliminated by vocational tests and given more varied work to do.

Sir THOMAS LEGGE (Home Office, Whitehall) thought that welfare work would gradually bring back some portion of the interest in work that existed in the mediaeval guilds. In the guilds there was comity between employer and employed; the sick were cared for, good work was important, and pride was taken in the work. Trade unions and employers should have the same aims nowadays. Competition, which was absent in the guilds, was producing monotony, though complaints of monotony had not been brought before him much by the workers themselves. There were, indeed, many more urgent conditions that required to be got rid of before monotony was tackled.

Dr. BRACKENBURY (London) said that Sir Thomas Legge was thinking more of the physical effects of monotony; they should think also of the mental effects. It was curious that nearly all the speakers had spoken on female mentality. Was there not also a mentality of men? He would like to see communal pride, as well as individual, in the products of labour—pride in the finished products in which the workers had taken part. There should also be artistic pride in the products, and the development of this would be helped by the nature of the surroundings, an artistic environment for the worker. And, most important of all, work must not be separated from the rest of life. A proper attitude towards life in general should be instilled into the minds of the worker.

Dr. H. S. BEADLES (Romford) said that he, like others, had started as an idealist; but with thirty years' inside experience of many of the large factories of most types of industry, he wished to warn his hearers against too much interference with the life of the worker, particularly outside the factory. Having been asked by the Home Office to help in the formation of statistical records, he did not feel in a position to do so; and he noted that statistics were quoted in percentages on the result of as few as three cases investigated. Welfare departments had been of great help to the worker inside the factory provided they had been in suitable hands, but some of the superintendents of these were following the workers into their own homes; the interference involved in this was seriously resented by many of the employees.

DISCUSSION ON THE PHYSICAL AND MENTAL EFFECTS OF FATIGUE IN MODERN INDUSTRY.

OPENING PAPERS.

I.—W. LIONEL HICHENS,

Chairman of Cammell, Laird and Co.

I HAVE no pretension to expert knowledge on the subject of industrial fatigue, and I cannot even claim that degree of practical knowledge which comes from daily contact with workshop practice. But I can claim to be keenly interested in the subject, since I have been a member of the Industrial Fatigue Research Board from its early days, and have followed its activities closely.

This has been called the age of science, and the importance of research and the application of science to industry is widely recognized. We realize the importance of an exhaustive research into the properties of coal or of iron and steel, but we are not perhaps so fully alive to the need of research as applied to the human factor in industry. And yet the human factor transcends all others in importance. It is not merely that we want industrial workers to be healthy; it is not merely that we want them to be wealthy—and in spite of all that is said to the contrary we do want that; we want them also to be wise and contented. And contentment must be based on the knowledge that their health and well-being are cared for.

"Industrial fatigue" is perhaps an unfortunate term, because it is both too wide and too narrow. It is too wide because it seems to imply that there are certain trades in this country which demand such strenuous physical exertion as to affect the bodily or mental health of the worker. Under the modern conditions of an eight hours day, and given good health and good training, I do not believe that this is the case. I do not deny, of course, that many forms of industrial work are physically exhausting if pursued too strenuously or for too long spells, but on the whole legislative safeguards are adequate, combined with the natural human instinct of self-preservation and the experience of ages, to cause all classes of workers to adjust their output so as to prevent physical or mental injury. During the early days of the late war a heavy demand was made on the workers in certain industries, and they responded magnificently. But it was found that after a time the workers were unable to maintain the pressure, and that a better output resulted from reduced hours of work. The instinct of self-preservation asserted itself before the health of the workers was seriously undermined. At the same time, it is obvious that some forms of work are more fatiguing than others, and they deserve study in order that the point at which fatigue begins may be postponed as far as possible, and in order that the well-being and efficiency of workers thus engaged may be improved. Again, it is undoubtedly true that fatigue—even where its direct consequences are not injurious—predisposes its subject to certain diseases. Hence I am convinced that the work carried out by the Industrial Fatigue Research Board is of great value, and deserves the widest public support.

I propose to indicate broadly some of the directions in which the study of the problem of industrial fatigue may be pursued with advantage. In the first place, it is obviously desirable to eliminate all unnecessary physical effort, and as far as possible to substitute machinery for hand labour. This is primarily, of course, a problem for the engineer, and it is difficult to overrate its importance. If the objective of industry is to be, as it should be, to pay high wages, this can only be done as the result of high productivity, and improved mechanical devices must necessarily play a principal part in the attainment of this end. But while, as I have said, the substitution of machinery for hand labour is primarily the work of the engineer, research workers engaged on the problem of industrial fatigue have also their part to play in studying the design of machinery from the point of view of the comfort and physical convenience of the workers. This is one of the problems that are now engaging the attention of the Industrial Fatigue Research Board, and the inquiry is likely to be fruitful in results.

Time and motion study is another important aspect of the industrial fatigue problem. Most people are familiar with the work that was initiated by Mr. Taylor and Mr. Gilbreth in America. We know how, as the result of a brilliant piece of investigation, Mr. Gilbreth reduced the motions involved in bricklaying from eighteen to five, and increased the number of bricks laid per man per hour from 120 to 350. We are familiar with Mr. Taylor's studies in regard to the rate of loading pig-iron. We know, too, that "scientific management" met with determined opposition in America when it was first started. But it is important to remember also that this opposition has died down, and that American trade unions are in general strong supporters of scientific management. Many of them, in fact, have their own efficiency engineers, whose task it is to educate backward managers, as well as workers, in efficient methods. And herein, I think, lies the main difference between America and this country. We are in no way behindhand in scientific research, but I fear that the attitude of trade unions to scientific management is less friendly here than in America, although I believe that the Industrial Fatigue Research Board, of which the chairman is a prominent Labour member of Parliament, has done much to break down earlier suspicions. But here is one of the ways in which employers and workers might with great advantage co-operate more closely.