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**MENTAL HEALTH PROBLEMS
OF AUTOMATION**

Report of a Study Group

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WORLD HEALTH ORGANIZATION

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1959

**STUDY GROUP
ON MENTAL HEALTH PROBLEMS OF AUTOMATION**

Geneva, 10-15 November 1958

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MENTAL HEALTH PROBLEMS OF AUTOMATION

Report of a Study Group

The WHO Study Group on the Mental Health Problems of Automation met in Geneva from 10 to 15 November 1958. The meeting was opened by Dr M. G. Candau, Director-General of the Organization, who welcomed the members of the Study Group and the representatives of the International Labour Office and of the United Nations Educational, Scientific and Cultural Organization. He indicated that the task of the Group was to discuss the possible dangers of automation for the psycho-social foundations of human behaviour and for the mental health of the individuals who are working in more or less automated factories or offices, and to suggest ways of preventing these dangers or at least which points should be further investigated in order to make reasonable planning possible in this respect. He also pointed out that this topic belonged to a wider area of interest to WHO, that of the impact of technological and social change on the mental health of mankind. In this context he drew the attention of the Group to the meeting of the Study Group on the Mental Health Aspects of the Peaceful Uses of Atomic Energy,¹ which had already considered certain psycho-social problems of technological change.

Dr A. T. M. Wilson was elected Chairman, Dr C. M. Arensberg, Vice-Chairman, and Mr A. Lucas, Rapporteur. The draft agenda was adopted.

1. Scope of the human impact of automation

The term "automation" is used increasingly to designate certain new forms of mechanization of work which are progressively giving to automatic devices functions previously carried out by human beings. Numerous attempts have been made to give an adequate definition of the term but none has proved satisfactory in every respect. One of the first users of the term has pointed out that "automation is really the practical expression of a technical approach, a sort of philosophy of working". It has also been said that automation "started as the nickname

¹ *Wld Hlth Org. techn. Rep. Ser.*, 1958, 151

for a technological problem of much narrower scope than its current use would lead one to suppose" and is properly speaking not a technological term at all.

The Study Group agreed to describe automation in the terms of the United Kingdom report on the subject¹ as "the coming together of several relatively independent streams of technical progress", and noted that three different types of technical innovations are usually considered together under this heading. These three types can be characterized, again in the terms of the United Kingdom report, as:

"(1) the expansion of the scope of mechanization by transfer devices that link machine tools in automatic production lines and by advanced techniques of material and product handling and of assembly;

(2) the rapid development of techniques of automatic control over manufacturing processes and the application of these techniques to an ever-widening range of industries; and

(3) the rapid and automatic processing of an increasing range of technical and business information by the electronic digital computer, with a consequent extension of automatic control to complex manufacturing operations and commercial offices."

In other words, a differentiation is made between transfer automation (also called Detroit automation), control automation, and computer automation. The first type would seem to follow the general principles of the assembly line. The second type which is essentially based on the automatic feed-back of information into a mechanical system, can be conceived as a development of engineering devices of the sort represented by the so-called fly-ball governor in the steam engine, but it has become eminently more applicable since the introduction of electronics. The third type goes even further in replacing certain functions of the human being, in so far as it acts increasingly according to the functioning of the human brain. It can therefore be used in fields of activity which until now were only to a very small extent mechanized. A typical use is for the recording, co-ordination and analysis of information in the administrative field.

It is probably correct to say that this third type of automation introduces the most revolutionary change into the mechanization of work, while the second is less new to human experience, and the first far less so. Therefore one might be tempted to reserve the term "automation" for the third type. On the other hand this would hardly be adequate since the different types can obviously overlap and, at least in some respects,

¹ Great Britain. Department of Scientific and Industrial Research (1956) *Automation*, London

all three types represent a single trend in mechanization towards a systematic redistribution of tasks between man and machine in the production process, based on growing knowledge of their relative capacities. In this sense, the term "automation" has acquired a right of citizenship and this right is the more legitimate since all devices brought together under this heading have a rather similar meaning for the human beings who come into contact with them. In fact, while automation is often thought to be "de-humanizing" the production process, it is considered on the other hand to relieve humanity from a great deal of drudgery and strain such as resulted from the introduction of earlier types of mechanization, particularly those in which hard physical effort was replaced by the repetitive work of the assembly line.

It is a moot point whether the introduction of automation should be considered as a remarkable acceleration of traditional technological development or as a new step in what has somewhat loosely been called "the industrial revolution". The term "revolution" is often used to designate a fundamental change which takes place suddenly. The opinion might be held that automation, at least of the second and third types mentioned above, constitutes a fundamental change and that it has been introduced with a certain suddenness. It could also be held that in these respects it can be compared to events like the invention of the Spinning Jenny and the steam engine, the advent of electric power and the introduction of the assembly-line method.

As regards the mental health aspects of this phenomenon, it is difficult to separate the concomitants of automation, as it has been defined above, from those of related technological developments such as the industrial uses of nuclear energy and the adoption of new management techniques, e.g., operational research, which depend in different ways for their development and application on automation technology. However, the importance of automation, again as regards its mental health aspects, is not limited to the technical and economic fields alone. Although its influence in these fields is real enough, it has, so far, been relatively restricted. The application of automation techniques in industry and business seems to be subject to certain limitations, and it is unlikely that they will make a very widespread impact on economic activity for a considerable period of time.

On the other hand, at the subjective level—especially among a generally uninformed and therefore susceptible public—automation stands for technological change in the widest sense, for the broad sweep of rapid innovation which is modifying industrial and business practices to a very considerable degree. It is in this symbolic form that "automation" is a very real generator of anxiety reactions among workers, but even more so among the general public which, being less closely associated with the advances of technology, is much more prone to respond imaginatively

to the possibly fanciful descriptions of new developments published in the general press.

It should also be said that, both at the subjective and at the objective level, far too many loose statements of an emotionally charged nature are being made. While some overstress the beneficial and hopeful aspects to a point where one might consider that automation is about to build a human paradise, others take the role of Cassandra and describe the changes to be expected in terms which are unduly alarming and pessimistic. Even quite responsible authors have been known to state that "it is perfectly clear that this [automation] will produce an unemployment situation in comparison with which . . . the depression of the thirties will seem a pleasant joke". Others go even farther in their pessimistic appraisals and certain popular literature warns humanity against the industrial hell towards which it is inexorably moving.

This type of statement is to be deplored, and should be counteracted with factual statements based on precise observation. Nevertheless, even on the strength of what is known at present and what can be reasonably inferred, it would be difficult to deny that where automation is introduced it is likely to lead to an important transformation of human existence in the biological, psychological and social spheres. It can also be taken for granted that the computer type of automation in particular will considerably affect human beings who are more or less psychologically unprepared for changes of this kind. It may, in fact, be less harmful mentally for manual workers to have to accept new forms of mechanization which are only an extension of what they already know, than for office personnel to encounter a development which to some extent seems to menace their status by bringing it nearer to that of the machine operator.

The human impact of automation will be of a twofold nature. It will affect the physiological and psychological functioning of the individual, thus influencing social structures; it will also induce a number of social and cultural changes which will have a repercussion on the individual.

This is not an entirely new problem. The need to consider industrial change and its consequences over a period of time has been shown by studies carried out in the nineteenth century and the first half of the twentieth. Since the immediate and obvious benefits of industrial development, in terms of the satisfaction of human needs, were found on occasion to be counterbalanced in the long run by certain disadvantages, these disadvantages were studied with a view to minimizing or preventing them through recognition of their nature, mobilization of professional and public interest, and initiation of effective social action.

It is the need to evaluate the less obvious aspects as well as the long-term aspects of social change which provides the justification, if this is required, for a study of automation. At the moment this type of industrial development affects directly only a very small fraction of the work-

ing population of industrial societies, and according to most economic predictions this fraction is unlikely to increase with any rapidity. Nevertheless, the certainty that developments in this field will ultimately affect a very much greater proportion of the population makes it necessary to study the concomitants and results of automation, even though only a small number of fully developed examples are at present available. Some of these—the automatic telephone exchange is perhaps the best known—seem to have arrived without creating much public interest. The first examples of fully automated industrial production have aroused very much more public attention. However, the process of automation is likely to make its biggest initial impact not in the factory but rather in certain types of office work involving in particular the handling of data and papers. The best-known example of this is probably the work of certain large insurance companies.

There can be little doubt that certain conditions of society are required if technological advance is to lead to greater satisfaction of human needs and an increase in the proportion of human beings who achieve anything like their full potential. These conditions of society depend not only on economic and social institutions, but also on such factors as community structure, work organization and the relationship of the family role of the individual to his working role, i.e., the relationship of the part of his life spent as a citizen and as a parent to the part spent in an industrial job.

Where mental health is concerned, it is the effect of technological change on interpersonal relations in the smaller units of society—the family, the working group, the recreational group—which is likely to be of particular importance. These smaller units of society are, of course, greatly affected by social events and changes of different kinds and varying extent: for example, changes in the geographical distribution of industry; movements of working populations between rural, suburban and urban areas; introduction of advanced production techniques in less developed areas; migrations of workers from one country to another; changes in the occupational structure of national communities and, with these, changes in the patterns and possibilities of careers.

In considering mental health problems, attention must be devoted not only to the relatively small proportion of a population which shows those signs and symptoms of ineffective functioning of personality which are recognized as psychiatric illness, but also to the much larger proportion of individuals whose mental health varies above that level. The adaptability of human beings is great, and most individuals maintain themselves in adequate mental health by an active search for the minimum social and emotional requirements necessary for this purpose and by active adaptation to changes in their social situation within the household or family, within the working group, and within the one or more recreational groups of which most people are members. The pattern of social

relationships, of social conditions, is highly individual; further, changes in the character of the opportunities and the conditions in any one of these three areas will affect relationships in the two others. A worsening of the situation in any one of them may therefore be offset by an improved adaptation elsewhere. Nevertheless, the extent of adaptive effort required is likely to show considerable differences between individuals. Where the adaptive effort is beyond the resources of the individual the minimum level of social requirements for mental health will not be reached and a clinically recognizable state of ill health will appear.

One striking difference between this century and the last is that the worker is now increasingly becoming an important asset and there is likely to be a corresponding increase in the attention devoted to what may be called his psycho-social "maintenance". This "maintenance" will include attention to those aspects of his social environment, both within and outside the factory, which are of importance to the protection and promotion of mental health. This presupposes a changed attitude on the part of managers. Indeed, as will be pointed out later, a new type of general manager seems to be emerging in many industrial societies.

In considering how to evaluate the social consequences of automation, certain differences between familiar forms of highly mechanized industry and full automation should be considered. As has been noted earlier, there is evidence that some of the problems of repetitive work and of isolation in repetitive jobs are diminishing rather than increasing with the rise in the level of mechanization. Also, from the few examples available of fully automated plants, there is evidence that automation may lead to a sharp decrease in the existence of monotonous and repetitive jobs with low skill levels. The two possibilities most widely accepted are either that automation will lead to a "de-skilling" of the labour force, or that it will diminish labour requirements, while demanding a much higher level of skill from the reduced labour force, but there is no evidence that either of these developments is likely to occur in practice. The examples considered by the Study Group show that the matter is much too complex to permit such generalizations. Similarly, with regard to shift work, which is widely regarded as likely to increase with automation: although the economic basis for this opinion is clear, there are at least some instances in which the introduction of automation has in fact reduced shift work in industrial plants.

The Study Group does not mean to suggest that automation will inevitably lead to improved conditions from the point of view of mental health, but merely to emphasize that the conditions which will be associated with automation will not necessarily consist of the repetition, in an intensified form, of the familiar social repercussions of industrialization and mechanization. The difference between automation and highly mechanized production of the assembly-line type is not merely a quantitative one.

In considering the available data and experience, the Group has repeatedly observed that automation must be considered both as a source of possible improvements in mental health and as a source of new types of strain which will require full consideration and fully planned preventive action.

2. Mental health consequences of strain among individual workers in automated plants

The introduction of automation has certain psychological repercussions on those involved, and in some cases these may set off reactions affecting mental health. Two types of reaction can be distinguished: first, emotional reaction to the introduction of an essentially new technological method and in particular to the anticipation of possible consequences of the innovation; second, the reaction of the person who, confronted by new working and living conditions, is exposed to physiological and psychological strain.

These reactions are related to the fact that a change is occurring—because change requires a certain adaptation, and the capacity for this varies from one individual to another. Nevertheless, it may be assumed that in the new working and living conditions there are also intrinsic factors which have more or less permanent consequences even after the immediate effects of change have disappeared.

As already mentioned, although the Study Group has paid special attention to those aspects of automation which may have an unfavourable effect on mental health, it has also noted that in many cases and situations the new techniques may be advantageous for man. There are instances of good adaptation to new installations, and cases where the adaptation of personnel to their new working conditions has been well prepared.

A first series of problems is raised by the hopes and fears which automation appears to have inspired in many people. When certain fundamental psychological needs are not met, there is a likelihood that unreasonable hopes will be placed in machines which are represented as capable of rapidly improving standards of living. On the other hand, lack of appreciation of the changing character of the public's needs may arouse the fear that the new machines will rapidly lead to saturation of demand and thus to less employment.

Inadequate knowledge of the problems involved in the financial management of industrial undertakings and of present limitations to the supply of automated installations may induce the belief that their use will quickly become general and bring about catastrophic changes in working conditions almost overnight. If, added to this, the worker feels that he is dependent upon the goodwill of the undertaking employing him, he is

liable to feel increasingly insecure in his employment and uncertain of his means of subsistence. This fear may even obscure the fact that the creation of new machines will also mean the creation of new jobs, higher living standards, increased opportunities for the invention and manufacture of new machines, and posts for qualified maintenance staff and technicians. The fears of the individual will obviously be all the greater the less he feels safeguarded by the economic policy of the undertaking employing him, or of his country, and the less he trusts in the protection and support of his trade union.

Other fears are more directly connected with personal concepts of the new machines, their complexity, the effort of adaptation that they demand, and the work rhythm they impose. This anxiety has certainly been fostered by the monstrous character which a certain type of literature has attributed to the new machines. It is evident that the more the power of the machine as compared with human ability is exaggerated, the greater will be man's fear of being crushed by the machine. In some minds the new machines are also associated with the destructive robots of science fiction and the cinema.

The foregoing paragraphs refer to psychological strain induced by anticipatory fears about possible consequences of the introduction of automation. Such fears are mainly concerned with social and economic changes which may affect the individual and his family. They are to a large extent based on justified or unjustified expectations and are therefore of a more or less imaginative nature. There are, however, certain factors deriving directly from the nature of the work in automated undertakings which create physiological and psychological strain on the individual. Some of these are considered below.

The new machines call for readaptation on the part of workers who have previously been accustomed to more manual tasks. This readaptation is made necessary by such characteristics of automation as reduction of manual work and increase in perceptual activity, less personal contact with the machine and its products, and increased responsibility.

Until the introduction of automated machines, most industrial work called for considerable manual effort on the part of the operators. For most workers, such expenditure of energy is still considered as the essential factor in productive activity. The value of work is thus often measured in accordance with the muscular energy expended; however, with the new machines this muscular work is tending to disappear and because of this some individuals feel that they are merely an unimportant extension of the machine and consequently that their activity is of less significance. In certain over-conscientious individuals, this sense of relative loss of significance may even induce guilt feelings.

On the other hand, the predominantly perceptual activity called for may give rise, in those accustomed to great physical activity, to a feeling

of idleness difficult to endure. Elimination or reduction of direct contact with the machine or its product also renders the work of the operator more abstract in nature. This more abstract relationship with the work is not necessarily traumatic for everyone. On the contrary, for some it may even provide satisfaction. For others, however, it may be difficult to tolerate because it increases their sense of anxiety.

Work in an automated factory is frequently characterized by an increase in the responsibility borne by the operators. They must in fact ensure the proper running of sometimes very large and extremely costly groups of machines; moreover, any mistakes they make have repercussions involving a much larger volume of production by reason of the increased capacity of the machines. The responsibility thus entrusted to the operator may be more or less well tolerated, according to the particular case and environment, and certain operators may prefer jobs where any errors they may make will have less serious consequences.

More specific aspects of work on automated lines have been analysed with special care by the Study Group: the need for increased attention with or without motor discharge, the solitary nature of the work, and its impersonal character which reduces opportunities for initiative.

As to the first, it would seem that work under automated conditions often requires a high degree of attention on the part of the operator, and this in itself may cause nervous strain. Most workers in factories are conditioned to accompany an increase in attention by an increased preparedness to go into action. To the extent that motor activity is reduced in automated lines, there is a risk that situations may develop more and more frequently in industrial plants comparable to those imposed on the pilots of modern aircraft. Operators may have to watch for the appearance of signals which, often separated by very long time-intervals, are intended to bring about certain reactions to critical incidents. This appears to apply especially in the chemical industries, and may cause a particularly heavy nervous strain, since the operator must keep alert for hours on end every day in order to react almost instantaneously to alarm signals varying in perceptibility and only rarely set off.

In this case, the nervous strain will clearly be all the greater since the person concerned cannot offset his vigilance by any motor activity. Another negative factor in this type of work is that the number of indicators which the operator must watch is sometimes very large. The less rational the grouping of the indicators themselves, the greater will be the fatigue. Important also is the unnecessary perceptual burden which may be caused by the presentation to the operator of information which is neither necessary nor even useful to him and which is, for example, solely for the use of maintenance personnel. The position in which the operator must remain may itself be an intolerable factor of constraint if he cannot change it periodically, for example, by being able to work seated or stand-

ing with the same ease of control. In general, all environmental conditions are of very great importance. Temperature and humidity, sound-proofing and lighting may have important repercussions on vigilance.

It should also be emphasized that besides the conscious attention required of the operator for supervising a given phase of the production process, subliminal attention is often required of him which, if not in itself a factor causing excessive nervous strain, is in any case of a nature to prevent rest. Although not experienced consciously, it inevitably leads to increased muscular tension and fatigue and, in the psychological sphere, to a feeling of discomfort and even anxiety. If this is not relieved it is likely to produce strain on the total personality and in some cases even permanent "tension states" which can provoke neurotic and psychoneurotic disorders.

It has been found that the normal result of introducing automation into a factory is to reduce the number of workers per unit area. Moreover, if the operator is responsible for the close supervision of data grouped on a control panel, he may be prevented from communicating with others and this will add to his solitude. Laboratory experiments and certain wartime situations have shown the depressing effects which excessive isolation may produce. The absence of social contacts is in fact something which, by reason of his very nature, man cannot endure for long. The extent to which he is affected is directly proportional to the difficulty of the situation he has to handle, and the importance of the decisions he may have to take. The operator may suffer all the more if absence of social contacts is not compensated for by frequent sensory stimuli or by major physical or muscular activity.¹ This feeling of isolation may be heightened by various factors, including the frequently high noise level in automated factories. Again, machines are sometimes placed in such a way as to prevent easy movement from one working point to another. The placing of the machines may also not always be favourable to communications between maintenance personnel and working personnel, but even supposing that such communication is possible certain workers may be affected to a varying degree by the absence of contact with other persons in the same occupational group. Reduction of contacts with supervisory staff raises similar problems even if, in many cases, such relations are established on a new footing and interchanges of a purely technical nature tend to outweigh strictly disciplinary relations.

The degree of "personalization" and the amount of initiative involved in the task are also subject to variation, in proportion to the automation of the work. In certain cases the operator may feel that his presence in

¹ Recent experiments have in fact shown that complete sensory deprivation, unaccompanied by any other strain, will, if prolonged, lead to psychological disturbances and even provoke hallucinations.

a plant where most operations have been completely automated is almost incidental. This situation may arise in particular where automation is insufficient and where one or more operators have been retained on an assembly line, working at higher speeds than before and repeating more and more mechanically operations that are less complete. It is, however, tending to disappear as automation increases. Furthermore, the degree of "personalization" of the work depends on the conditions governing the selection of personnel. If personnel is chosen at random the feeling of anonymity will probably be increased; if, on the contrary, careful selection is made the worker chosen will be more likely to have a feeling of personal worth and pride. In certain cases the worker will experience a feeling of "depersonalization", which may be either a matter of temperament or due to separation from former workmates. A "personal" attitude to work arises, in fact, primarily from a concordance between the desires of the worker and the activity entrusted to him. Thus a manual worker will be able to express his personality in operations bringing him into more direct contact with material and in so far as he can make the most of his manual dexterity. Not only may transfer to an automated installation bring about a break with a team of workmates to whom the worker was deeply attached, but it may mean an end of team-work for him. It may equally mean joining a team in which he may not feel at home, and which he will have difficulty in accepting.

The extent of all the reactions discussed above will depend on the adaptability of those concerned. It is well known that great differences between individuals exist in this connexion, for cultural reasons as well as because of individual characteristics. Human beings differ not only in capacity for tolerating change but also in degree of resistance to change.

Individual differences are largely a matter of age. The fears aroused by the automation of production processes are all the stronger the less the persons affected have been accustomed to change, the more fundamentally their new activities differ from their old ones and the smaller their opportunity of acquiring the necessary additional training, either because they are too set in their ways to extend their capabilities, or because the training facilities provided by the firm are inadequate.

As regards cultural differences, it should be remembered that populations with a long experience of technological change are generally less inclined to resist it than those for whom the introduction of mechanization means a complete turning away from traditional, that is, rural, patterns of living.

Incidentally, the strain imposed on the individual by automation is not limited to machine operators but frequently affects technical supervisors and managers as well, since they are also faced with new responsibilities for which they were not originally fitted and to which they must be adapted.

3. Mental health repercussions of social change through the introduction of automation

Apart from its direct effects on the mental health of the individual worker, the introduction of automation is likely to affect him indirectly as a result of the accompanying social changes. The Committee does not consider it appropriate to enter into a discussion of social changes as such. It is, however, convinced that a stepping-up of industrialization such as that brought about by automation has repercussions on the family through increased mobility, frequent absence of the father or of both parents from home, less emotional involvement of the family in the breadwinner's activities, and a number of other factors which have been held responsible for that social disorganization which, according to many authorities, is an important cause of mental ill-health.

Economic and other changes will affect the location of industry, not only in individual countries but within and between continents. While the increased value and importance of the employee in both highly mechanized and automated production makes it probable that industrial concerns will be willing to situate their factories or similar units in areas where workers are available, it is unlikely that this will be possible in every case. A considerable problem of movement of workers can therefore be expected, not only from country to country but also between urban, rural and suburban areas in individual countries. Movements of the latter type are likely to be complex in character and, to some extent, to represent a reversal of the drift towards the towns which has, for many decades, been a feature of some industrial societies.

From the mental health point of view movements of workers may be regarded as almost as likely to increase as to reduce the possibility of providing the minimum social requirements for mental health. The common difficulties of adaptation to migration or movement are well known and will hardly be greater in the future than they have been in the past. Indeed, with the growth of knowledge of how adaptation may be facilitated the problem is not so much one of adding to such knowledge as of putting it into practice. This does not mean, however, that cultural and language barriers are not likely to cause serious difficulties of readaptation.

Related to the location of industry is a further group of problems—the provision of housing and leisure-time facilities. As a result of the changes in working conditions outlined in the previous section it is probable that the workers concerned will show a definite need for a different type of social environment from both standpoints. Mental health workers have often criticized living conditions in large blocks of flats, particularly where quietness, playing space for children, and recreational opportunities for grown-ups are concerned. Despite the economic advantages which

permit such structures to provide better physical accommodation for more workers, the restricted movement and the absence of adequate opportunities for domestic hobbies represent a serious handicap. In some instances groups of workers have refused to move into such buildings from accommodation which was physically less attractive but socially more desirable. It is, however, interesting to note that these consequences have, at least in one case, been avoided by preliminary sounding of workers' wishes as to accommodation. This is one of several groups of problems in which effective planning will require increased collaboration between the architect and the mental health worker.

It has earlier been suggested that there is no inevitable connexion between automation and an increased need for shift work. Nevertheless, it is probable that increased shift work will sometimes accompany automation, and it is this aspect of changed industrial organization which at first sight appears to present the most serious difficulties from the point of view of mental health.

Despite the fact that, in most surveys on the subject, a certain proportion of the workers interviewed have ascribed a positive value to shift work, such surveys in general report a highly critical attitude towards it on the part of both the workers and their families. It is easy to see how different working and sleeping hours for members of the same family can upset the pattern of social relationships both in the home and in the community. It should, however, be said that in only a few examples—occurring, moreover, under the stress of war conditions—has this problem in the past been sufficiently marked to lead to any serious effort to offset it by altered community organization and more elaborate organization of social life.

An example brought to the attention of the Study Group illustrates another type of adaptation to shift work—that of a coal-mining community in which a group of workers accepted collective responsibility for manning a particular coal extraction unit and evolved a three-shift system with extremely flexible working hours. The amount of co-operation demanded for such adaptation to shift work is high; but it will probably be more easily obtained in the future, when the work will in any case demand teams with a high level of morale.

It must be remembered that automation may in the long run lead to a reduction in working hours.

Studies of the relationships between industrial concerns and the surrounding community, e.g., between a mill and the neighbouring town, have shown their intimate character. The three areas of man's activity, family, working and community life, may be said to have both supplementary and complementary aspects. It may be important to take this point a little further. To a certain extent individuals find it difficult to avoid strain unless there is some degree of similarity in the climate of

social relationships in each of the three main areas of activity. Conversely, however, there must be certain elements of contrast in the types of activity, in the types of motivation, and in the types of satisfaction appropriate to each area.

In the past the attraction of passive forms of mass amusement and recreation was in part linked to the drawn-out fatigue and boredom of monotonous and repetitive work, which seemed to create, not a reparative appetite for contrasting experience of an active and creative kind, but a need to continue the passive dependency of the work situation. Studies of the use of leisure-time by young people before and after leaving school have shown the relatively fragile character of the active, creative pursuits developed by education when working conditions are such as to inhibit sustained and active interest. It is probable that this particular source of difficulty will diminish in the conditions of the future and that active educational efforts will lead to a better result in a larger proportion of the working population.

The Study Group realized, however, the impossibility of attempting to consider the problems of leisure in a general way. The relationship between work and leisure is vastly different in different cultures and the idea of what can be considered a healthy employment of leisure time varies widely according to the social surroundings. The Study Group believes that the subject of the mental health problems of leisure has recently acquired such importance that it requires separate study.

To turn to another topic mentioned earlier in this section: in considering the effect of automation on occupational structure and workers' careers, the question of the distribution of demands for different degrees of technical proficiency and skill must be taken into account. The evidence at present available does not support any easy generalization in this connexion. Change in the distribution and the types of skill required seems more probable than any general increase or decrease in the average skill level of the labour force in automated units.

Examples from existing automated units are not numerous, but it is possible to discern some of the factors involved. They can affect occupational mobility in contrasting ways. First, the specialized character of work in automated conditions may limit lateral change of jobs (labour mobility) and promotion, though this possibility may well diminish with the spread of automation and particularly with increasing standardization of control panels and mechanisms. New groupings of skill are likely to arise. It is also possible that de-specialization may be effected by the provision of wider experience through re-allocation of tasks—a change known, in one form, as “job-broadening”. An example was discussed, occurring not in full automation but in highly mechanized units in a textile factory. Restructuring of the work organization and regrouping of tasks led to three types of job where twelve had previously existed. Although

a similar tendency is discernible in, for example, oil refining, it is not clear how far this simplification of the work organization and broadening of workers' skill will be possible under automated conditions.

There are certain to be significant changes in occupational structure and occupational mobility due to the increased valuation of the worker and his increased responsibility in the automated unit in terms of the equipment for which he is responsible and the material or products he handles. It has been suggested that in the fully automated unit each operative becomes to some extent his own supervisor. As far as this is true it is likely to raise the level of his ambitions and to increase his satisfaction in his work.

One discernible result of automation is the appearance of many more small offices within the production area of a factory and, conversely, the increasing appearance of automated machinery within the office area. This increasing similarity in the type of activities carried out in office and workshop will further bridge the gap between production and office workers. One effect of this may be that factory operatives in automated units will be given the same conditions of employment as white-collar workers: that is, increased security and a greater range of additional benefits. The bridging of the gap between office and workshop should lead to an improvement in industrial morale and hence to improved opportunities for the maintenance of mental health. However, as has been said earlier, this change may have an adverse effect on the mental health of some white-collar workers who see in it a menace to their social status.

For reasons which are complex and need not be discussed here, there has been for some years considerable difficulty in finding recruits for those professions, such as nursing, which offer personal service. It is, however, possible that those who prefer, or need, work in which personal contacts are important will in future take up these professions rather than work in an automated factory or distribution unit. The situation of the professions offering personal service will probably change further as obstacles to the re-entry into work of women in middle age grow fewer.

The increased expectancy of life, the improvement in the average level of health in the older age-groups, and the more widespread desire of older people to re-enter or remain at work will probably lead to changes of considerable importance to the working population. For both men and women not only may working life turn out to be longer but, because of the changing interests and skills of individuals throughout this longer working life, the proportion of changes of occupation in middle life may increase and the sex distribution in the older half of the working population may be altered.

There is reason to believe that the retraining of middle-aged or older workers has not yet been satisfactorily tackled, and it is therefore difficult to say what effect automation will have on the older worker. In so far

as retraining proves unacceptable or ineffective there is a possibility of an increase of the tendency—long ago recognized in the case of the returning emigrant and already obvious in certain occupations where possibilities of promotion are limited—to seek a change of career in middle life or to seek to become self-employed either in production or distribution.

Because of its mental health implications in the widest possible sense, it is perhaps important to mention the possibility, stressed at the International Labour Conference in June 1957,¹ that the high economic cost of industrial development and certainly of some types of automation may intensify existing problems of differentials between highly industrialized and less developed countries. As against this, however, economists point to the possibility of marked increases in the efficiency of productivity, and therefore of a lowering of costs, through automation. It would be inappropriate, however, to go into this matter here.

4. Mental health tasks arising from the introduction of automation

General remarks

As this report has several times pointed out, our knowledge of the mental health consequences of the introduction of automation is still insufficient. Moreover, the use of automative devices is only beginning and it is difficult to foresee to what extent and at what rate it will become more generalized and which new technical innovations will be added in years to come. Under these circumstances some may feel that it is too early to indicate the tasks to which the mental health problems of automation give rise, or to propose solutions for these problems. In the opinion of the Study Group, however, there is no need to be over-cautious in this respect. It is well known in public health and medicine generally that preventive and curative steps can be taken even before complete knowledge on all factors has been attained. It may be a legend that the cholera epidemic which ravaged London in 1855 was stopped by taking off the handle of the water pump in Broad Street. But even a legend can teach a lesson: though at the time nothing was known about the causation of cholera by the cholera vibrio, observation of the concentration of cholera cases amongst the users of that particular pump might well have made effective preventive action possible. Doubtless, similar possibilities arise in many other fields, including that of mental health.

In considering possible measures to counteract the mental health risks involved in automation, it is worth stressing again that there are many

¹ International Labour Office (1958) *International Labour Conference, Fortieth Session, Geneva, 1957. Record of proceedings*, Geneva

beneficial consequences of this technical innovation capable of offsetting certain of its undesirable effects. For instance, it is quite probable that automation will enhance the trend towards better wages which has accompanied industrialization. There is also every likelihood that improvements in the production process will make more goods available for distribution. Furthermore, it is possible that the installation of automated enterprises will lead to greater dispersion of working populations and therefore to more satisfying housing conditions. Something similar may perhaps result from a reduction in working hours which will not only allow for more leisure but also for the possibility of living in suburbs or garden cities outside the most densely populated centres. In other words, as in the case of the more generalized use of atomic energy, much of the strain which will result from the extension of automation may be compensated for by a general improvement in living conditions for the population at large and, in particular, for those who work in automated workshops.

Another point to be re-emphasized is the remarkable adaptability of mankind to new conditions. It has already been noticed that, when sufficient liberty is allowed, those who work in automated surroundings tend to develop solutions to their problems in a self-adaptive manner. It has been observed that those who are responsible for complicated machinery show a new pride in their activities. There are cases where a levelling of social differences has led to the growing of a new team spirit. Finally, some of the workers in automated enterprises seem spontaneously to find satisfying and compensating leisure-time activities.

Measures for the protection and promotion of the mental health of operators should be based on such self-adaptive tendencies. It should not be forgotten, however, that there are limits to the adaptability of human beings and that in any case adaptation should never go so far as to endanger the healthy striving for individual expression. The measures taken should therefore aim at a careful balance.

A general principle of paramount importance for all mental health planning in this field is the provision of information and education. The working person and his family should not be exposed to the impact of automation without being first carefully prepared for the new type of life which may be theirs. More about this will be said later. However, it should be made clear at the outset that it is essential to educate other groups of persons as well.

It is very important to obtain good co-operation from the press, and the radio and television services, since the way in which the public at large is informed will have repercussions on the working population. It is true that the function of the daily press is not primarily an educational one; newspapers are supposed to convey news and there is an old adage that bad news has more journalistic appeal than good news. However, much can be done by the more careful phrasing of headlines, which are

often of a more terrifying nature than the text which appears underneath them. Certain weekly or monthly publications, as well as popular books, could help to educate the public towards a reasonable and more adequate appreciation of the facts.

Education in this field is perhaps most important in the case of those holding key positions in organization and planning. Not only the managers and the engineers, but also trade union leaders and organizers and, last but not least, the medical profession, and specifically works doctors, should be given an opportunity to revise and develop their attitudes to the mental health problems of automation. It is urgent for managers and engineers to have at least some basic knowledge of the social and behavioural sciences. An effective and practical conceptual framework which they can understand and use will therefore have to be developed for them by behavioural and social scientists. Fortunately managers and engineers are becoming increasingly aware of the gaps in their understanding of the social and psychological implications of the introduction of automation. They realize more and more that the human element with which they are operating is part of the capital asset of an enterprise. Teaching on this point is already being offered in some technological institutes and has aroused great interest among young engineers. It may be said that nothing has done more to advance this trend than automation itself. Many managers and engineers feel that the most valuable result of installing high-speed automatic computers is not the direct labour saving, but the compulsion to reconsider imaginatively and intelligently the whole organizational structure of the plant. There is no doubt that a systematic introduction of the concepts of social and behavioural science can lead towards a reconsideration along more rational and productive lines of the whole problem of work and the human relationships connected with it in the modern world.

There is here a possible source of danger. The newer type of manager in industry may, on occasion, need to guard against a new form of paternalism, a new form of indirect control of life outside the plant, i.e., in the household or in the community. Although evidence on this point is inadequate, it seems most probable that, outside the place of work, different rather than similar social conditions will provide the best background for the development of mental health.

Measures relating to the place of work

Obviously a better consideration of the human element in industry will entail a great deal of thought on the adequate organization of the working process itself. This will be further considered in the sub-section on measures relating to the individual worker. However, it should be stressed that in general it is important to avoid mistakes in the physical

arrangements at the place of work (see section 2). It is undoubtedly possible to increase the morale of the operators by making their work as free of unnecessary strain as possible. If the nature of the work calls for relative solitude, perhaps accompanied by a great deal of noise, it may sometimes be desirable to arrange for shorter shifts and more frequent breaks during the working hours. Where constant attention is expected of the operator, it may be possible to lighten his burden by introducing mechanical safety devices. If the work of one operator is made less satisfying as a result of automation, it might be feasible to arrange for teams of operators to take turns at the different operations involved in the common task.

To prevent physiological and psychological strain, it is obviously essential to rationalize the distribution of dials and switches. Finally, it will often be possible to provide more comfortable working conditions by studying the design of plants, not only from the mechanical point of view, but from that of the human beings who operate them.

The Study Group noted with satisfaction that in 1959 the European Regional Office of WHO proposes to organize a training course for industrial medical officers and managers on the psycho-social environment in industry. As so many social issues are involved in a consideration of the mental health aspects of improvements in the industrial environment, the Group suggested that it might be desirable for WHO to deal with the question jointly with the corresponding services of the International Labour Organisation.

Measures relating to the individual worker

In the last sub-section, reference was made to the necessity of giving careful attention to the morale and the psycho-physiological stability of operators. One means of doing this is to keep the individual worker properly informed about developments in respect of automation in his place of work. Such information should be a continuing process because if it is given only at certain critical points it may increase tension instead of relieving it. It should if possible be given in a way which implies consultation. If the operator is not only told what is going to happen but is at the same time asked his opinion about it, and if he is invited to suggest how things could be done in a more adequate way, it will help him to conceive of change not as something which is forced on him but as something which at least to a certain extent he is choosing for himself. It will clearly depend on local circumstances who should be informed and consulted about what, and what would be the best means to use.

An example of this approach can be quoted from one enterprise where a new computer is planned to be installed in two years' time. The information and consultation of the people who will work it has already started.

The consequence of this is that the operators look forward to the installation of the new machine without any unreasonable fear and as a normal technological change.

Another example is that of a manufacturing corporation, with many scattered plants, which bought a computer to take over its entire payroll work. The machine was to do this work with the help of half a dozen operators in the central office, and of only a handful of the clerks previously dealing with the payroll in the corporation's individual plants. Profiting by the experience of a sister company, which had had a bitter strike as a result of installing a similar machine, the corporation did two things. It invited a full union delegation to its central office where they spent half the day watching the machine performing all its automatic antics, all its calculating miracles, in their presence. The union representatives asked the "programmer" and console operator hundreds of questions, and even gave the machine the entire union payroll to calculate. The rest of the day was spent discussing with the management precisely what would be done with each of the clerks affected. For the most part it was found possible, in this joint discussion, to plan the transfer to other jobs of the clerks who would be displaced. The provisions made were not perfectly satisfactory to everyone, but there was no mystery; everyone knew what was going on; there was no strike.

A third example occurred in the plant of a large electrical manufacturer, which made meters of all kinds, for use both in industry and in private houses. With ideas about automation in the air, the company decided to build machinery for automatically assembling the components of the meters. It set up a prototype shop, or automation laboratory, which functioned behind closed doors within the plant itself. Immediately, a wave of fear and resentment spread throughout the work force. The management then did the unexpected. They brought all the machinery under construction, together with all the mechanics, technicians and automation experts, on to the main floor of the factory in full view of any worker who cared to stop and watch or ask questions. The fear and resentment rapidly dissipated and were replaced by curiosity.

In imparting information on automation it should, of course, be taken into account "that even some of the less involved technological or economic innovations have latent cultural and social dimensions that need careful consideration if the success of these programmes is to be assured . . . Many programmes are rejected not because the people are traditionally minded, conservative, or 'primitive' but because the innovations, in all their ramification, do not fit into the total cultural setting of the community".¹

¹ Dube, S. C. (1958) *India's changing villages; human factors in community development*, London, pp. 132, 146

Procedures such as those mentioned above will be helpful not only because they dissipate fears and anxieties but also because they imply recognition of the operator, thereby reassuring him that his status is being respected. Where automated equipment is used, it is important to offset the possible fear of loss of status, especially among office staff, by giving full recognition to the importance of the individual worker.

As pointed out in section 2, there are four aspects of automated work which are likely to have an influence on the physiological and psychological functioning of operators and are therefore possible causes of mental ill-health: the increase of responsibility without action to provide relief, the need for a high degree of attention without adequate motor discharge, the solitary nature of the work, and its relative "depersonalization".

As regards the increase of responsibility without relieving action, mention has already been made of the possibility of choosing operators according to their individual interests and capacities. Some older workers are apparently well fitted for work which requires more wisdom and experience than skill and action, especially if care is given to their learning the job properly and their being psychologically prepared for it.

The problem of the tensions created in some people by the need to keep a consistent level of attention without adequate motor discharge may also be solved to some extent by a careful selection of personnel. Moreover, as has already been said, it will be helpful in many instances to shorten the working period. Another possibility is to arrange for work of this kind to be alternated with another job—or even with a combination of smaller tasks which may be relatively unimportant—involving physical effort. It may also be useful to provide opportunities for relaxation, perhaps by making a rest or recreation room available to operators during the breaks in their working time.

To lessen the risks involved in solitary work, much can be done by arranging for regular consultations within the team, and also by a system of flexible rotation. It may at times also be useful to have regular visits paid to operators on particularly solitary jobs in order to maintain contact between them and their fellow workers, and thereby to offset any social deprivation which they may be suffering. In planning such schemes care should be taken not to inhibit informal measures taken by the operators themselves to prevent solitude.

The risk of an occupation becoming increasingly "meaningless" is offset to some extent by the fact that the more an enterprise is automated the less will repetitive and apparently meaningless jobs be expected of the worker. Many engineers hold that wherever a worker is expected to carry out a wholly repetitive job, something must be wrong with the design of the machine or the production process. Whatever is exceedingly repetitive can probably be taken over by a machine, and the situations popularized by Charlie Chaplin in *Modern Times* are now becoming obsolete.

Clearly, the individual does not live only in his office or factory, although a large and highly important part of his time is spent there. There will be more about the home and general social environment in the next subsection. However, it may be appropriate to say something here about the use of leisure time, since activities in the different areas of human life are by no means unrelated. It has been said, in fact, that the relation between them can be both supplementary and complementary. Also, the type of working activity may influence the type of leisure activity, and *vice versa*. One point to be recalled here is that the more automated and, in a way, passive the work of a person becomes, the more it is necessary to provide him with opportunities for active, unmechanized pursuits outside the working environment.

Here again, self-adaptive solutions may be found. Some operators prefer to spend their leisure time in another and completely different type of work which, apart from adding to their earnings, gives them more opportunity for personal action. Others use it for reading both general and technical literature. As already pointed out, it would not be appropriate to take a paternalistic attitude and try to organize the worker's home and social life in general. However, it will be advantageous if he is offered opportunities to spend his free time in a way which is both satisfying and, from a mental health point of view, helpful.

It is hardly necessary to repeat at this juncture that no hard and fast rules can be laid down for every environment and that good care must be taken to provide leisure-time activities appropriate to the particular cultural or social environment of the workers concerned. Measures taken for this purpose will be more useful if the operator's family is enabled to participate in his interests and pursuits.

Measures relating to the social environment

What has just been said about leisure-time activities applies to quite an extent also to the work of the operator. A family will be less anxious about the possible psychological consequences of work in an automated enterprise, if it knows what is going on and shares the interests, joys and preoccupations of the worker.

The practice has therefore been instituted in some areas of allowing families to visit the factory and of allowing operators to show them what they are doing. This often leads to the family sharing the operator's pride in his performance, and allays to a great extent the social status fears with which operators' wives and children are often more preoccupied than are the operators themselves.

On the other hand, the family problems of the operator are never without influence on his happiness and his attitude to his work. In other words, proper mental health care will have to be provided for the families

of operators, and the importance of the use of social services and, in particular, of psychiatrists and psychiatric social workers cannot be overstressed in this respect. It is particularly important that they should be available at the planning stage and during periods of adaptation to change, rather than having to be called upon later to tackle the results of situations which could have been avoided.

Obviously the home atmosphere depends to some extent on housing conditions. There is unfortunately a tendency among architects to confuse the problems of factory building with those of building family accommodation. It might be said in passing that this makes it necessary for education in public health and in the behavioural and social sciences to be provided for architects. Certain problems relating to housing, as, for instance, that of noise in large tenement buildings call for investigation. It is particularly important that the operator of an automated plant, who is often exposed to a great deal of noise, should be able to get living quarters which ensure a reasonable amount of privacy and a low level of noise, especially during the hours of rest and sleep. The Study Group considers that it would be desirable for WHO to organize a meeting to study more fully the mental health problems connected with the home environment.

In modern industrial society there are, of course, many other family problems. As already mentioned, the increased introduction of shift work is likely to disturb the natural rhythm of family life, particularly when there are several members of the family engaged in industrial work. Special care must be taken to adjust the different working hours in a way which will allow at least a minimum of personal contact between the different members of the family at certain hours. It is probable that undesirable situations which may still result from this type of disorganization can be offset to a certain extent by establishing recreational centres where all members of the family can come together and meet their friends.

While the family is the principal social group, there are others which are of considerable importance. Mention has just been made of community centres. It would be easy to have more social facilities of a similar type, such as sports clubs, dramatic societies, debating clubs, philosophical and religious societies, and so on, especially if they fit into the local culture and are due to the initiative of the operators themselves. The trade unions may well take an interest in this sort of activity, which should help to stabilize the social structure and offset many of the undesirable consequences of industrialization and particularly automation.

One particularly useful contribution that could be made by the trade unions would be the provision of lecture courses and seminars designed to help operators of automated equipment towards a better understanding of what they are doing and why they are doing it. It is encouraging to know that opportunities of this type are already being offered in some places and planned in many others.

Final remarks

The Study Group notes with great interest the participation of ILO and UNESCO in its meeting, during which their wish for further co-operation with WHO in the mental health tasks arising from the introduction of automation has become increasingly evident. The Group wishes to record that it would welcome a strengthening of such co-operation, together with that of other bodies, which would lead to further joint study and action in this field.

5. Recommendations on research*Research needs and methods*

The human and social changes associated with automation are complex; but in due course it is likely to become a general development of widespread importance, and, for that reason alone, there is every justification for attempting to understand these changes. There is a particular need to take the fullest and most rapid advantage of opportunities to understand the impact of automation by studying existing plans and developments now taking place in this field.

Many international organizations, such as ILO and UNESCO, and many university and research groups are engaged in research on the impact of industrialization on communities and individuals; their work is also concerned with the results of technological development in different regions of the world and in different types of community. Automation must, however, be distinguished from the wider and more familiar concepts of industrialization or of technological development. There are relatively few case studies which describe in adequate detail the situations and experience of individual firms or departments which have undergone this particular type of development. It must also be said that, for the most part, even the small number of studies which are available concentrate particularly on technological and economic aspects. These are important in themselves, but for practical purposes it is important to give at least as full attention to the human and social aspects of automation; for neglect of those particular aspects in industrial planning in the past has given rise, on occasion, to distress and difficulty. This is still remembered, and can still arouse strong resistance to industrial change, even when it is of a fully agreed and highly desirable nature.

It should perhaps be pointed out that information on the phenomena and results of automation tends to be published in a widely diffused and heterogeneous range of publications. To a considerable extent such information has been collected and republished in the form of critical

reviews ; but nevertheless factual reports of particular interest often appear in specialist journals with a limited circulation, e.g., in technological publications which are not always seen either by general industrial managers or by specialists in medicine or social science. A means must therefore be sought of maintaining and increasing contact between industrial managers, technologists, and medical and social scientists, who can each make valuable contributions to the work of the others.

With regard to research directly and specifically concerned with the special problems of automation, the Study Group considers it particularly important that research workers planning to study the mental health aspects of the subject should be encouraged to begin by a determined effort to clarify their understanding of automation, and to define what is meant by it. To this end, they might take advantage of training courses and training schools set up, for the education of their own staffs, by firms with special experience of automation. These facilities can frequently be made available to interested groups and individuals from other organizations. Such preparation for research in this relatively new field would help to ensure that the design of studies, however simple or complex, took fully into account, on the one hand, the central and characteristic aspects of those developments which may properly be called " automation ", and, on the other, relevant aspects of the wider and sometimes contrasting background of technological and industrial change in general.

The Group stresses that great care must be taken to carry out such studies—as indeed any socio-medical studies which entail direct personal contact with workers and their families—in a manner consistent with their professional character. An approach which is felt by workers or families to be excessively official, or bureaucratic, or overformalized, is unlikely to elicit data which are either reliable or useful. Such data are most likely to be obtained by discussion of the relevant topics in the course of friendly conversations with a professional background, rather than by a long and detailed questionnaire of a formal nature.

Orientation and pilot studies

As with any new development, major research projects on automation cannot be effectively designed without a considerable amount of preliminary information. Because of the urgency of this need the Group recommends, as a first priority, that a series of orientation and pilot studies should be conducted, and that the existing facilities of socio-medical services should be extensively used for this purpose. The widespread existence of such services—and of related social research activities—makes it immediately practicable to extend their regular work to cover communities where automation is being developed, and to use their contacts with relevant firms, workers and families for these important preliminary studies. Apart

from additional time—and hence, perhaps, additional personnel—all that is required is the provision, perhaps through WHO, of a simple plan for recording observations.

It would be useful for these surveys to cover other members of the worker's family as well as the worker himself and, where possible, it would be helpful to obtain information from those in a position to observe changes, not only in the household activities of the families and workers under study, but also in their participation in community activities in general.

A second type of investigation which should have high priority would apply familiar epidemiological methods for assessing the health of workers and tracing the factors influencing their health to studies of the psychological and psychiatric implications of the new forms of working environment and the new demands made on workers with the development of automation. The incidence and distribution in suitably contrasted groups of various types of sickness, of other forms of absenteeism, of labour turnover, and of exchange of jobs within firms would be recorded. It is emphasized that interpretation of data of this kind involves an approach of a different nature from that needed for its collection. This observation is particularly relevant, as recent work has shown, to studies of labour turnover.

The Study Group considers moreover that particularly valuable information could be obtained from studies which follow groups of workers, families, or, indeed, communities from one point in time, before the family or community members entered automated work, to another, several years after this change. The importance of such "before and after" studies is emphasized as a necessary complement to more familiar types of study which compare groups of workers and families at the same point in time—for example, workers engaged on non-mechanized work, and those in whose work high mechanization or automation is predominant. In stressing the value of repeated and continuing studies covering a period of time, the Group feels that even the relatively simple orientation and pilot studies earlier recommended could often be repeated with advantage at six-monthly intervals over several years.

Further studies

Assuming that the orientation and pilot studies listed above can be speedily initiated, it should be possible before long to initiate, or improve the planning of, substantive studies of different aspects of automation related to mental health. In many cases such studies would of necessity involve collaboration between medical and social science workers, particularly if efforts were to be made to develop an effective psychiatric epidemiology in the field under discussion—a matter of very considerable importance, since it would permit a wide range of past experience in preventive medicine to be drawn upon.

1. *Individual, family and community adaptation to automation.* There are many groups of important topics in this field. These range from adaptation to shift work (where this exists or is extended), through alterations in the psychological "climate" with new types of job and of work organization, to formal and informal patterns of relationships in the family and community and the sociology and psychology of leisure in the new conditions of work. For both individuals and groups, the interaction of needs and opportunities at work, in the household, and in the community will be of particular importance.

2. *Occupational and social structure ; opportunities of advancement and career patterns.* Problems coming under this heading are of special interest to sociologists and, in a rather different context, of very considerable importance to mental health. In the latter connexion, the following examples may be cited : problems of choice of occupation in relation to the interests and potential of the individual ; problems of entry, selection and training in automated units ; promotion and lateral movement of both individuals and groups of workers ; the relationship of such questions to old and new forms of work organization, and to the changing occupational structure of the community. On the basis of such information as is available, it seems probable that, from the mental health standpoint, priority should be given to the study of career changes in middle life, and to the conditions needed for the effective retraining of workers in older age groups.

3. *Perceptual and other demands of characteristic occupations in automation.* Under conditions of automation there are marked changes in certain aspects of jobs and of work. There have been a number of special studies in this field, but there is need for further knowledge on the nature of the changed skills. Direct clinical studies are necessary, as well as more work of an experimental kind to clarify the relation of skill to job satisfaction. The effects of alterations in distribution of attention, or of "subliminal" attention, on many phenomena of medical and psychiatric interest need elucidation—for example, their effect on activities outside work and on sleep.

Reference was earlier made to the psychological strain undergone by operators who must pay constant attention to complex indicators. This strain may arise from excessive demands on the operator's perceptual capacities, conceptual capacities, or judgement, or, indeed, on all three. It would therefore seem necessary to determine more exactly not only the best design of indicator panels, but also the special abilities required for their most effective use. Means of recognizing and developing these abilities, and of developing methods of assessing the levels of tolerance for perceptual and conceptual strain in work of this kind, should also be sought.

One specialized problem of considerable importance is that of discovering how far the sharp diminution of physical effort in work under automated conditions will create a widening of opportunities for certain groups of the physically handicapped.

4. *Mental health aspects of work group and plant organization.* Recent studies of the factory or office as a social system have thrown light on the effect of certain types of team structure or work organization in increasing or reducing psychological stress. These could, with great advantage, be extended to working teams in automated plants.

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Mental Health Aspects of the Peaceful Uses of Atomic Energy				
Report of a study group	151	3/6	0.60	2.—
Mentally Subnormal Child (The)				
Report of a joint committee convened by WHO with the participation of United Nations, ILO and UNESCO	75	1/9	0.25	1.—
Midwifery Training, Expert Committee on				
First report	93	1/9	0.30	1.—
Nursing, Expert Committee on				
Report on the first session	24	1/6	0.20	0.80
Second report	49	1/3	0.15	0.60
Third report	91	1/9	0.25	1.—
Fourth report ("Public Health Nursing")	167	1/9	0.30	1.—
Nursing Education, Working Conference on				
Report	60	1/6	0.20	0.80
Occupational Health, Joint ILO/WHO Committee on				
Second report	66	1/6	0.20	0.80
Third report	135	1/9	0.30	1.—
Organization of Medical Care, Expert Committee on				
First report ("Role of Hospitals in Programmes of Community Health Protection")	122	1/9	0.30	1.—
Second report ("Role of Hospitals in Ambulatory and Domiciliary Medical Care")	176	1/9	0.30	1.—
Paediatric Education, Study Group on				
Report	119	1/9	0.30	1.—
Professional and Technical Education of Medical and Auxiliary Personnel, Expert Committee on				
Second report	69	1/6	0.20	0.80
Third report	109	1/9	0.30	1.—
Fourth report ("Post-graduate Training in the Public Health Aspects of Nuclear Energy")	154	3/6	0.60	2.—
Fifth report ("Introduction of Radiation Medicine into the Undergraduate Curriculum")	155	1/9	0.30	1.—
Sixth report ("The Foreign Student and Post-graduate Public Health Courses")	159	1/9	0.30	1.—
Seventh report ("Preventive Aspects in the Teaching of Pathology")	175	1/9	0.30	1.—
Psychiatric Nursing, Expert Committee on				
First report	105	1/9	03.0	1.—
Public-Health Administration, Expert Committee on				
First report	55	2/3	0.30	1.20
Second report ("Methodology of Planning an Integrated Health Programme for Rural Areas")	83	1/9	0.25	1.—
Public Health Training of General Practitioners, Conference on				
Report	140	1/9	0.30	1.—
Rehabilitation, Expert Committee on Medical				
First report	158	3/6	0.60	2.—
School Health Services, Expert Committee on				
Report on the first session	30	2/-	0.25	1.—
Water Fluoridation, Expert Committee on				
First report	146	1/9	0.30	1.—