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THE RELIEF OF MONOTONY IN INDUSTRY

By

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C O N T E N T S

	Page
Introduction	I
Chapter I	6
"A History of the Problem"	
Chapter II	15
"Methods of Relieving Monotony"	
Chapter III	20
"Factors Conducive to Boredom"	
Chapter IV	29
"Positive Incentives in Repetitive Work"	45
Chapter V	
"Experimental Conditions & Results"	
Chapter VI	51
"Discussion of Results"	
- - -	
Summary	58
Bibliography	62
Appendix	60
- - -	

I N T R O D U C T I O N

"Give us the tools and we will finish the job".

To win this war we must answer this appeal made by Winston Churchill, who emphasizes the fact that present wars are won or lost in the factories just as past battles were won or lost on the fields. For every well equipped soldier in the front line, we need a production crew of at least ten civilians in the factory, working at top speed night and day. If we could find some way of getting this army of civilians to work at their maximum speed at all times, our factories would produce material at such a rate, that President Roosevelt's plan of clouds of planes etc., would seem vastly underestimated.

The solution to this problem is not to appeal to the worker's patriotic instinct. England's war factories, after two and a half years of war, are still only producing 50% of their potential (1) If this is true in Britain, where the whole idea of war is nearer home, where the workers are literally producing material with which to protect their own homes, how much lower must be our production totals in Canada, where the war still remains something far away. This condition is due to the fact that management fails to realize that during this national emergency workers must be strained to

the limit to get maximum production, but if through ignorance of essential human needs, an attempt is made to strain them over the limit, as is done today, production must inevitably fall off.

To increase production the management must realize that the worker is human and not a machine. For his factory to produce to capacity, he must acquaint himself with their needs and do all in his power to satisfy them. The worker can only do his best work when he is happy and contented, if troubled by some feature in his environment his productive power will be decreased. Even though he may still try to work at his maximum speed, the irritating factors will work subconsciously to cut his capacity. It seems apparent therefore, that to solve this great problem, working conditions must be so improved that all employees will be happy and content while on the job.

The operative who is most dissatisfied with his work is the one who is employed at a monotonous routine task. Since one of the features of mass production is extreme specialization of labor, it is not surprising to find that most of our war work is routine work. Therefore, to increase production we must remove from the environment or the work, those features which tend to make this type of

employee dissatisfied with his job.

The significant feature of a happy contented person seems to be that he usually sings, hums or whistles to himself. With this in mind, I began a series of experiments to judge the influence of music on the production and state of mind of the worker. War production prevented this experiment being conducted under practical factory conditions. All plants approached maintained that they allowed no one on the premises who was not on the pay-roll. Therefore a monotonous task had to set up in the laboratory and such a procedure necessarily imposes a limit to the number of individuals that can be observed. Some of the results, therefore, cannot be regarded as conclusive, and must await confirmation from other investigations conducted along similar lines, but involving a greater number of people. At the same time, however, there is little doubt that several of the principles discussed in this paper are common to many forms of industrial work, and to this extent a repetition of the procedure may be expected to yield similar results.

In order that this experiment should be applicable to experienced workers all subjects were given preliminary training until they had mastered the particular task, which involved tapping in a regular pattern. Since experiments

have shown that a person reaches the physiological maximum at which he can tap with very little practice, this task did not require a long learning period. It was found that no subject showed any improvement after two periods of practice. This preliminary training was also necessary because in repetitive processes the attitude of the learners towards the conditions of work remains practically unchanged after the novelty of the work disappears. So we can assume that an increase in production once the experiment began, was not due to practice, but was caused by the introduction of new incentives into the work.

A further criticism of this type of experiment is, that a procedure which required the continued presence of an observer creates an artificial situation, which is different from the usual conditions in a factory. However, a preliminary experiment showed that in the majority of cases the subjects did the same amount of work whether the examiner was present or not.

The general aim of this enquiry was to collect information on the effects of various types of music on people employed on a simple type of repetitive work, involving the use of one hand only.

Since boredom is a personal experience which cannot be directly observed or measured, evidence of its existence

must depend to a great extent on introspective data. To obtain such data it is necessary to induce the individual to describe his thoughts and feelings, either in the form of free expression of opinion or in response to questions. The basic assumption used, however, was that an increase in output was synonymous with a decrease in monotony. The questions were only used to collaborate this.

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CHAPTER I

HISTORY OF THE PROBLEM

"Vast, repetitive processes are dulling the human mind. We must take account of the tendencies of our present repetitive industry to eliminate the creative instinct in their workers, to narrow their fields of craftsmanship, to discard entirely the contributions that could be had from their minds as well as from their heads. Indeed, if we are to receive the development of our people, we cannot permit the dulling of these sensibilities".^I

Until recently little attention has been given to the waste of human energy and abilities and therefore the waste of the most precious product of the Universe -- human life itself.

Industrial development has been accompanied by an increase in the amount of repetitive work due to extreme specialization. Formerly, the worker was responsible for the complete article, he saw it develop and grow under the guidance of his hands, whereas today, he is usually concerned with only one phase of the operation and probably never even sees the finished product. In modern industry the

^I President Hoover from A. Pound "The Iron Man of Industry"

operative has lost his individuality, he is no longer regarded as a human element but is merely considered part of a machine. The machines and materials with which he works are constantly being improved, but little or no attention is given to the human factor in industry, on one hand, and the effect of industry on human life, on the other.

This omission is being rapidly remedied, but not to a great enough degree. Human waste still occurs in industry through the failure to provide the best working conditions; by not employing the best method for the execution of work; and in not endeavoring to provide for each worker the type of work most suited to his or her abilities. The correction of these factors will result in increased output and profits, fewer accidents, a smaller turnover of labor, and a better employer-employee relationship. The country will also benefit by having a happier and healthier population and by an increased creation of wealth, which must benefit all classes.

The industrial psychologist has shown that there is an optimal length for the working day and since the hours of work in most industries have now been reduced to reasonable limits, and the fatigue produced has become physio-

logical rather than pathological, the center of interest of the industrial situation is moving to a consideration of the effects of continued repetitive work, and the possible elimination or alleviation of its evils. The greatest problem in industries today is what can be done to relieve monotony.

Veblen (2) and Parker (3) believe that monotony is experienced in repetitive work because of the inherent antagonism between this type of work and certain of the basic instincts of the human race, -- the instinct of workmanship or the creative instinct. Instincts are the motivating forces in life, they are the energizing forces underlying human conduct, they are the prime movers in human behavior. Their general function is to promote the well being of the individual and to preserve the race. The continued participation in an activity which runs markedly counter to the purpose and direction established by the instinctive urges of the race, creates a tension that may be serious in its consequences to the individual.

The individual is endowed with an urge for creative experience in his work. There is a desire to be actively associated with the preparation of the product in its entirety, and this is prohibited by the specialization of modern industry. The worker engaged in the unending

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The individual is endowed with an urge for creative experience in his work. There is a desire to be actively associated with the preparation of the product in its entirety, and this is prohibited by the specialization of modern industry. The worker engaged in the unending

repetition of the same task, his interest centered upon turning a single screw on the assembly line, or feeding pieces to the same machine, fails in satisfying the urge to be actively associated with the finished product. As a reaction to this thwarting of instincts, he seeks various means of escape such as indulging in day-dreaming and talking. This leads to dissatisfaction with conditions of work which, when directed into group activities helps lay the foundation of mass industrial unrest. The harmonious relations between labor and management, the very foundations of industry, are shaken by the conflict which arises from this reaction to monotonous work in modern industry (4).

In spite of the popularity, not so many years ago, of the instinct hypothesis, there is a tendency to question the adequacy of a treatment of motives in industrial life in terms of instincts. The chief objection is that, in the final analysis instincts are largely logical abstractions. The term may be useful as a label in aiding to classify human ways of acting, but there is no real evidence in the case of most of them, that they represent well-organized neurological or mental patterns of behavior.

An inhibitory theory of boredom was advanced by Myers (7), as a result of the study of simple muscular activities. Ergographic experiments have shown that in long continuous

simple muscular work through the control of the spinal cord, local inhibitory processes are set up, which prevent the evil effects of excessive monotonous muscular excitation.

In monotonous mental work a somewhat similar local function can be observed. If work must be continued, "the constant effort of the self to overcome these intruding inhibitions of local muscular or mental monotony is usually accompanied by feelings of boredom as interest, -- i.e., the pleasurable incentive in the work -- wanes, and later by feelings of weariness as that effort is invoked with greater difficulty. The feeling of monotony resulting from the conflict developed in overcoming the inhibitory forces, is thus a warning against continuance of the occupation (7)".

In many industrial processes a certain "attitude" or "set" must always be maintained if work is to be performed satisfactorily, but monotonous work prevents the establishment of these sets. Boredom is the unpleasant feeling experienced in the process of struggling against incompatible tendencies in preserving the "attitude", and arises whenever it is necessary to continue the activity in the face of intruding desires and inclinations.

Hugo Munsterburg (6) was the first to advance the theory of monotony which is generally accepted to-day. In conducting experiments in repetitive work, he was struck by the fact that the feeling of monotony depends much less upon

the particular kind of work, than upon the special disposition of the individual. Winkler (8) went deeper into the problem and found that monotony was associated with "attention sets". Individuals whose attention is neither completely absorbed in a repetitive task nor completely free from it, will experience boredom, such individuals find it necessary to give some but not the whole of their attention to their work, and competition for attention occurs between what he wants to attend to, and what he must do. The want must be inhibited in favor of the need, and the necessity of maintaining attention upon a routine task, when the mind is drawn towards pleasant memories means the expenditure of effort and is as a result fatiguing. This weariness will be increased in the case of work where fluctuation of attention means an accident.

The failure to find a purpose in the work, combined with the uniform and tedious nature of the work, stirs up active antipathy to the task, and this feeling is experienced as monotony. Wyatt (4) confirmed this theory when he found that the individual whose attention is either completely absorbed by a task, or entirely disassociated as a result of its mechanization, is free from the feeling of boredom in work. The former type of work absorbs the total attention of the individual, and leaves him no time to think about his work. In the case of the individual whose work requires no attention, monotony is not experienced because he is at

liberty to indulge in reverie or day-dreams, and thus shuts conditions of work out of his mind. So the only case where boredom is experienced is when the task requires partial attention at all times. Since some tasks require different amounts of attention from different people depending on their intelligence, we can expect the degree of monotony experienced to depend upon the individual to whom the task has been assigned. Most tasks, however, require partial attention from all operatives and so the degree of boredom will also depend on the type of work.

The conclusion we must reach is that monotony must not be conceived solely as a function of the task, but to a large extent as a function of the individual to whom the task is given. It is more apt to occur in uniform than in varied tasks, in simple than in complex tasks, in operation of a machine than in hand work, but it is to the susceptibility of the individual and not to the task that the responsibility for the feeling must be ascribed.

Thompson(36) and Wyatt(37) found that a promising approach to the problem of relieving monotony is in the possibility of discovering and allocating people who like repetitive work and who dislike varied work. This problem is related to the fundamental one of temperament and disposition, which has much to do in determining whether an individual prefers routine to change, and will be discussed at length in the next chapter.

If it is true that boredom is a function of the individual and not of the task, there is no possibility of telling objectively whether a job is monotonous or not. However, there are characteristics of monotonous work which can be detected from a careful examination of the individual and his work.

The chief characteristic of monotonous work is the unpleasant feeling that the task arouses in the individual. A feeling of boredom and an increasing feeling of tension as the work progresses represent the subjective characteristics of monotonous work. Objectively, this feeling of boredom is characterized by restlessness, indicated by frequent shifting of position, by yawning, and by verbal expressions of dissatisfaction with the work on the part of the worker. These expressions of discontent are accompanied by a distinct change in the rate and regularity of production and the form the output curve takes includes ---

- 1.- A drop in the rate of work in the middle of a working spell.
- 2.- An increased variability in the rate of work.

Work free from boredom tends to increase in speed around the middle of the working spell. There is a warming up period at the beginning of a working spell, a period of relatively high production during the middle of the spell followed by a gradual and consistent drop in the rate of production.

on the part of those engaged in monotonous work has been dis-
proved by Thompson(36) who found no significant difference in
the ability to judge time in people free from monotony and
those highly susceptible to it.

The next problem, once the fact has been established

Experimental studies indicate that a feature of
monotony in work is the tendency for production to fall
instead of to rise during the middle of the working spell.
According to Myers(8), "the worker comes to his task feeling
ready to go ahead with it, slows up in the middle of the
spell as he becomes bored with the work, and speeds up at
the end of the day in anticipation of its end". In addition,
the production from period to period in monotonous work tends
to be highly irregular "Boredom causes a more variable rate
of working, which is characterized by repeated fluctuations
in the time taken to complete consecutive units of output"(39).

him appears uniform and monotonous. Wyatt(5), found that
any large and unselected group of workers employed on the
same type of repetitive work, may contain some individuals who
are bored by the process, and others who find the work

interest. Such changes in the rate and variability of production,
represented by a change of the work curve, appear only in the
case of workers who express boredom and dissatisfaction with
repetitive work.

The belief that the onset of monotony can be character-
ized by a tendency toward the overestimation of time intervals

on the part of those engaged in monotonous work has been disproved by Thompson(36) who found no significant difference in the ability to judge time in people free from monotony and those highly susceptible to it.

The next problem, once the fact has been established that the work is monotonous for the individual is to try various means of overcoming this ill-feeling.

CHAPTER II

METHODS OF RELIEVING MONOTONY

The experience of monotony is dependent on a great many factors which may be either subjective or objective, although many believe the former are far more important.

The occasional visitor to the factory often fails to realize that operatives may find variety in work which to him appears uniform and monotonous. Wyatt(5), found that any large and unselected group of workers employed on the same type of repetitive work, may contain some individuals who are bored by the process, and others who find the work interesting. Those who hold to the point of view that monotony is a product of the individual and not of the job, believe that by discovering the personal factors that tend to make an individual dissatisfied with repetitive work, we can devise a series of tests to select individuals who will not experience monotony.

There is much evidence in favour of the view that susceptibility to boredom is related to intelligence. It is, of course, common knowledge that different types of work requires different degrees of intelligence for their successful performance. In repetitive work individuals possessing more intelligence than is required for their type of work, tend to become dissatisfied and bored, so that their output often bears little relation to their capacity for work. Although these operatives find the work boresome and tedious, their production still remains above the average whereas that of the less intelligent, though satisfied work, tends to remain below average. This emphasizes the distinction between efficiency of the individual and satisfaction on the job. It points to the importance of re-adjusting the superior worker so that their may be more satisfaction on the job while at the same time his efficiency is kept undisturbed rather than merely selecting individuals with less intelligence.

Other traits besides intelligence play a role in determining the individuals susceptibility to monotony among those which appear to deserve consideration are "attention sets", and the temperamental characteristics of the individual.

Temperament is used to describe that constitutional tendency to act and feel in a certain manner which characterises

the behaviour of the individual. A man may be constitutionally buoyant or gloomy, impulsive or cautious, excitable or phlegmatic. There can be little doubt that suitability for repetitive work is closely related to temperamental tendencies. A man may have the necessary speed and dexterity but his performance in practice may be seriously impaired, because of an unsuitable temperament and, as a result, may be inferior to a less capable worker who is better equipped temperamentally. Thus a knowledge of the mental and muscular capacities of an individual gives only an imperfect indication of suitability for repetition work, and any prediction which ignores temperamental characteristics is likely to be misleading.

From the temperamental standpoint the quiet, steady and persistent type of person, who lacks ambition and imagination, and remains placid and unperturbed in the midst of distractions, is most suitable for repetitive processes. The animated, variable and volatile individual who is expressive, responsive and easily disturbed is the type of person who is most satisfied when employed in routine work. Short performance tests cannot adequately measure these characteristics, but school records compiled by observant teachers are likely to provide the most reliable evidence of general suitability for repetitive work in industry and since these are not available this method is not practical(4).

Some experimenters think that tests of introversion and extroversion can be used as a basis for the selection of employees. They claim that the introvert should be suitable for monotonous work while the extravert would be unsuitable but no high correlations have been obtained between the two.

Wyatt(5) believed that perseveration would be a very good index of a person's susceptibility to monotony. He found that some people find it difficult to switch from one type of activity to another. The ideas and movements set in motion by the repeated performance of the first process tend to persist and to interfere with the activities of the second process. Others seem to be practically free from this kind of interference and it is possible, that proneness to monotony may be related to the one or the other of these tendencies. Although the results obtained are inconclusive, there is a strong indication that individuals who are least able to indulge in talking or day-dreaming, are most likely to be bored by factory repetitive work. Since truly monotonous work does not permit complete mechanization of work, perseveration will not be a decisive criterion in determining an individual's susceptibility to boredom.

The problem of monotonous work in industry, according to the viewpoint of many, is reduced to the single problem of developing a series of tests, by means of which it can be determined beforehand, whether the individual will suffer

from monotony when employed on repetitive work. A suitable battery of tests would serve the purpose of procuring fit operatives and effect the complete disappearance of complaints about monotony in industrial work.

Although it is not possible to agree with this extreme simplification of the problem of monotony, there seems no doubt that individual susceptibility is a specific factor in the genesis of monotony. As stated previously, in the selection of employees, we must not overlook the fact that experience of monotony is also a function of the type of work. Boredom arises as a result of conflict between the tendency to continue, and the tendency to get away from a situation which has become unpleasant, principally because of inadequate motivation. Therefore instead of trying to select individuals who will not experience this conflict, and who we have seen are inferior to those experiencing boredom, we should try to make the work interesting for the superior worker.

Interest whether immediate or remote, whether innate or acquired, is essential for successful occupation. Even acts which have become habitual, for which no mental effort is needed, cannot be performed for long, if all interest is lacking, whatever its direction, whether connected with the work or not. It is obvious that the solution of the problem of monotony lies in the ability to occupy that portion of the individual's attention which is not required by his work, rather than trying to select individuals who are less susceptible to boredom.

CHAPTER III

FACTORS CONDUCTIVE TO BOREDOM

The worker engaged in repetitive work is usually left to devise his own means of reducing or neutralizing the ill effects caused by his task. Day-dreaming or talking are the most common means of counteracting monotony.

As regards talking, the possibility in this direction depends on the proximity of the workers but in most factories two or more workers are usually within talking distance. Conversation is an antidote to boredom since it diverts attention from the unpleasant aspects of work and provides an interesting outlet for the expression of personal desires and inclinations. Although it is an effective remedy, talking is by no means the ideal solution. The successful performance of any task usually requires a certain amount of visual attention and anything which causes the operative to look in other directions, as is the case in talking, will have an adverse effect on the speed and accuracy of production. Production curves show a slump when conversation is indulged in(4).

This does not mean that talking should be forbidden because such a procedure would be more conducive to monotony, and the resulting output would probably be lower than it ordinarily would be during periods of conversation. It merely indicates that from the standpoint of production, talking has certain disadvantages and that it would be beneficial to the

employer to substitute another and more effective antidote, which requires no visual attention.

The objection to talking does not however apply to singing. Unfortunately, many of the employees regard whistling or singing as forms of frivolity which desecrate the atmosphere of serious work. They overlook the fact that singing is not only a wholesome means of escape from monotony, but is also a stimulant to cheerful feelings and increased activity. A factory where all the employees are singing or humming is a place where happy people are working. We all know when we are troubled by anything we can't sing, but when we feel free of all cares we feel the urge to sing or whistle.

The worker who is able to day-dream becomes oblivious to unpleasant realities, including the potentially unsatisfying features of repetitive work. Day-dreaming is only possible when a task is completely routine and free from all interruptions, and although many industrial processes are of this type, the majority make varied and intermittent demands upon the attention and judgment, and to this extent interferes with mind wandering.

Even when uninterrupted day dreaming is possible, it should be discouraged whenever possible. There are those like Mayo, who contend that reverie is predominantly pessimistic and therefore almost invariably harmful both to the individual and to good industrial relations. However, carefully interpreted experimental findings suggest that depressing moods

are probably in the minority(4). When such pessimistic revery does exist, it frequently arises not from the task itself, but out of dissatisfaction with surrounding conditions of work. Such grievances may initially be of minor significance, but uncontrolled rumination is often favorable to their growth, with the result that they eventually find expression in serious industrial unrest. The creation of a healthy industrial atmosphere is particularly important in this respect. Not only does it prevent the development of undesirable thoughts, but often sterilizes them at their source.

Day-dreaming cannot be used as a means of relieving monotony. According to our definition, boredom arises when the mental processes involved in the work occupy and hold part of the attention of the worker at all times. So in the true sense of the word, a monotonous task does not permit the operative to indulge in day-dreaming.

If production is to be maintained at a high level and if the operatives are to remain satisfied, we must not allow the employees to devise their own means of counteracting boredom. Before introducing any new method it is advisable to direct attention in the first place to, the possible existence of negative factors which are impeding production. Their detection and removal will have the same effect as the introduction of a stronger positive incentive such as an increased rate of payment. It is clearly uneconomical to increase wages in order to obtain a higher output while the

effects are being neutralized by disregarding obstacles to production. This would be synonymous to a careful driver who does everything in his power to save fuel, and then drives with the brakes on.

Obviously, boredom is a function of the duration of the work, consequently any reduction in the hours of work will tend to make monotony less prolonged and intense. We know that for every industry there is an optimal working day and it would be financially unsound to reduce hours of work, beyond this limit. So it becomes obvious that the reduction in the working day will relieve monotony to some degree, but it is not a strong enough incentive by itself and to be effective must be combined with other factors.

Closely associated with length of work is the question of rest-pauses. In work of a monotonous nature, the operatives frequently take short rests at different times during the day, but the introduction of real rest-pauses implies complete physical and mental relaxation. Besides this, the prospect of several hours continuous activity frequently has a depressing effect upon the operatives and causes a considerable reduction in output particularly around the middle of the work spell. Studies by the Industrial Health and Research Board indicate that properly spaced rest pauses tend to delay the onset of boredom, and helps to maintain the same rate and uniformity of production.

The psychological effects of the rest-pauses may be even greater than the physiological, especially for operatives

engaged in repetitive work, if there is a complete change from the main occupation rather than only a cessation of work. Rest-pauses should be utilized for allowing the worker to rest or obtain food and refreshments. Slocombe (1) believes that the lack of proper canteen facilities is one reason for England's war industries not producing to capacity. Many of the operatives have little or no breakfast before coming to work, and consequently have to wait five or six hours for their first substantial meal of the day, as a result of which they are distracted from working properly by hunger and they "long for dinner time". Wyatt (5) found that operatives work better after eating during their rest pauses.

"There is not the least doubt that a rest of ten minutes duration, introduced about the middle of the work spell tends to neutralize the unpleasant and unfavorable effects of repeated activity, and is capable of producing an increase in output varying from 2 to 10% (9).

There is a high relation between boredom and conditions of work and although it is improbable that inferior surroundings are the prime cause of boredom and discontent, they undoubtedly intensify existing conditions. Minor disturbances, which would pass unnoticed by an interested worker become exaggerated, and intensify still further the emotional background of discontent.

It is of the utmost importance that the

working environment be above reproach in plants where repetitive work is being conducted. The operative should be given no just cause for complaint, all heating, ventilation and lighting problems should be given proper attention. A bright attractive plant will help check the onset of boredom and reduce its effects by providing a useful form of distraction for roving thoughts and by inducing a cheerful mood in the operatives. There can be little doubt that the modern factory, with windows instead of walls and a spacious interior decorated in pleasing colours, has a psychological effect which is by no means negligible. If continued repetitive work is inevitable it can at least be performed under more congenial surroundings than at present exist (40).

The physical attitude of the operative also effects the onset of boredom. Investigations conducted in England illustrate the fact, that the maintenance of a more or less uniform posture increased the amount of fatigue and boredom experienced. Changes of work will be effective in counteracting this feeling of monotony, but the beneficial effects of this procedure will bear a direct relationship to the type of work. ---best results being obtained when the alternating processes make use of different sets of muscle groups and involve different mental attitudes.

We know that continued use of one set of muscles results in the fatiguing of the particular group activated. So, too, with nerve centers from which motive power springs. When

certain centers are worked continuously, monotonously from morning to night, day after day, week after week, it is physiologically inevitable that they should tire more easily than when work is sufficiently varied so as to call upon other centers in turn. It requires great effort on the part of human beings to continue monotonous work, since the natural tendency is to discontinue working. Experiments have shown that production can be stepped up from 4 to 24% on days when tasks are varied(5).

This does not imply that the operative should be permitted to change work whenever he feels bored. We must not overlook the fact that frequent changes are definitely detrimental to production, - the best results being attained when the form of activity is changed after $1\frac{1}{2}$ to 2 hours of unvaried work. Since beginners usually find the first days of work very fatiguing and monotonous, a plan of this type will be very effective in training them to work. Not only will they overcome the ill-feeling associated with the work, but they will become equally efficient in different industrial processes, and they can later be transferred to any one of the operations they have learned, in the case of an emergency.

Seating arrangements should receive particular attention because of the importance of placing individuals so that they should pull together. Workers with different tastes and temperaments when forced to work together show signs of irritation and strain, whereas when near a pleasant companion they find the complete working situation more pleasant, and as a result they

experience less boredom. Seating arrangement is also important in speeding up the rate of production since the output of an operative will increase when he is moved from the neighbourhood of a slower to that of a quicker worker. It is evident, therefore, that output and contentment may be seriously affected by the rate of working and behaviour of a neighbouring operative, and extreme care should be taken to arrange groups so that they should be made up of individuals who are approximately equal in capacity and temperament.

The value attached to an operation will have an important effect on the productive activity of the operative. Purposeless tasks seem to offer no reward for the amount of effort expended, and as a result fail to give that satisfaction which accompanies the production of useful and saleable commodities. Operatives employed at these tasks since they fail to find interest in their work, are highly susceptible to monotony. Instruction in the mechanical and technical details connected with the process of manufacturing would tend to arouse interest in the process of production, and do much to prevent the onset of boredom. This interest can be fostered by the distribution of pamphlets and short talks describing the history, development and final destination of the product. It seems natural that if a man could arrive at his job, with a full knowledge of the process of production and final destination of the product, he will find more interest in his work than if he knew none of these facts. Each operative must be shown that he is a vital

link in the chain of production, he must be made to realize that no matter how insignificant his task might appear, it is important.

The method in which material is supplied to the operative will effect the onset of monotony. Quantities which take about one hour to complete give much more satisfaction than an endless flow along a conveyor. The division of the work into smaller units appears to favor the maintenance of interest in the task, and as a result delays the onset of boredom. When material is supplied at intervals throughout the work period, each unit is regarded as a self-contained whole and instead of feeling swamped by the work the operative, as he completes each unit, experiences the same satisfaction as appears at the completion of the morning's or afternoon's work, and he is pleasantly relieved when the end is actually attained (9). No such variations however, are experienced by the conveyor worker who is carried along by the never ending stream of supplies.

These briefly, are the negative factors which require attention before any positive incentive will be effective. Their correction will, without a doubt, have a beneficial effect upon the production and well being of the individual.

Other and stronger possibilities of decreasing the effects of monotony consist in the provision of interests and incentives to activity which are operative while work is being performed.

CHAPTER IV.

POSITIVE INCENTIVE IN REPETITIVE WORK

The Machine Age industry has been largely managed as though the pay envelope was the only interest in the worker's life. This point of view has coloured the development of scientific management to such an extent, that the financial incentive is still regarded as the most effective means of counteracting boredom. Recent experiments have demonstrated the fact that financial incentives have a certain value, but they are not in themselves sufficient to produce the "will-to-work". Further verification of this conclusion is found in the fact that the majority of absentisms in England's War Industries occur on Sunday, a day on which operatives receive "time and half" for their work (1).

The efficiency of a wage incentive is so dependent on its relation to other factors, that it is impossible to consider it as a thing in itself having an independent effect upon the individual (11). That it does effect the production of the individual is beyond question, but too much stress must not be laid upon it. Careful experiment has shown, that the piece rate system of pay is less conducive to monotony than the time rate, because it increases the intensity of the work and leaves the operative less time to think about the conditions of work. However, to be effective it must be simple enough to be understood by all workers, and they must be assured that no ceiling will be placed upon their earning power. When these guarantees are lacking, the wage earner

not only adjusts production to meet the top rate of payment, but he also restricts output as a means of postponing lay-offs steadying his employment and stabilizing his earnings.

It is clear that financial incentives play a questionable role in setting up attitudes and morale favorable to work. This statement is not meant to imply that wage payments and money incentives are of no value in stimulating production, interests and satisfaction in work. There is no question that the additional necessities and luxuries which higher earnings can purchase loom large in the worker's mind. Therefore we must condemn the suggestion that to speed up production in war time, workers should be conscripted into the army, and made to work like soldiers work and fight. Anyone connected with the army knows that since the beginning of time, the soldier has been known as the man who does as little as he possibly can under any circumstances. He is also the most expert man in the world at doing this little, when he can't avoid it, with as great a show of effort as possible. Even when up in the front line the soldier is never overworked. In the last war, army regulations provided for men in the front line to be in the trenches ten days and back resting for five days. This means an average forty hour week where, except for special arrangements, the soldier is doing very little (1).

It would be a grave error to try and militarize labor.

Although, at times, we might feel like cracking down on the unions, we must try some other means of getting around them. Under no condition will they ever accept any reduction in rights or payment since all this represents what they have been struggling for, for years. If they are forced to work for army pay, they will only contribute an amount of work equal to what they are being paid.

The conclusion we can draw from these facts is that although money is not enough to overcome monotony, no other means of relieving boredom will be effective, unless the financial incentives of the employees receive adequate attention. If money is all that a man gets for his work, he will take every possible means of getting all he can. When he finds other sources of satisfaction in his work, he becomes less vividly conscious of the amount of pay he receives. Williams found that "as the workers proceed beyond the hunger minimum, the pay check's ability to buy material things is overshadowed by the ability of the worker to obtain an immaterial something of equal importance and of vastly greater intricacy, namely, his standing as a worker among his fellow-workers (11).

Such observations indicate very clearly that human nature has not changed, and although the forms of work have undergone modification in the Machine Age, the worker still appears to seek something more than pay alone in his work. The latter is unquestionably a basic motive in daily work, but

once this has been cared for, numerous other drives and desires must be satisfied in promoting efficiency at work. Although we do not agree with those psychologists who believe that we are born into the world with certain drives and instincts which must be satisfied; we cannot overlook the fact that the human element is an important factor in industry. Closer attention to the personal wishes and needs of the workers will not only make them more contented, but will cause them to put even more effort into their work.

The operative, above everything else, wants to enjoy the feeling of worth -- recognition and respect on the part of others. He feels that he has certain rights and privileges which must be respected by the Management. It is true that some men, need to be pushed to get their work done, but the majority readily respond to courteous treatment and human consideration. They want to feel that their jobs are secure provided they turn in a reasonable amount of work, they want to feel that there is a future for them in the firm, that there is ample opportunity for advancement that at all times they will get a "square deal". These are the mainsprings of action in industry, to ignore them is an invitation to trouble.

A sentiment of pride in the firm is the best way of gaining the full cooperation of the employees, and this can be fostered and developed by promoting and extending their

social life. Games are particularly useful in this connection and the formation of teams to take part in inter-company competitions, develops the consciousness of belonging to a particular firm. There is no reason why the attitude of operatives towards the firm should be any different from that of members of a college towards their institution. Loyal and enthusiastic workers, surrounded by a sympathetic and friendly atmosphere, will experience a satisfaction which will reduce boredom to comparative insignificance.

Morale will also be strengthened by a series of firm dances parties and picnics. They provide the operative with something to look forward to, and if he can look forward to an interesting evening or week-end, he will be in a more pleasurable frame of mind, and less inclined to be annoyed or depressed by repetitive work, than one whose life is always dull and drab.

The education of the worker as to how to utilize his leisure time, is also important if we are to have happy contented operatives. Men will suddenly find a new interest in life, if they can be induced to start a hobby. They will have something to look forward to after work and in those moments on the job, when his attention is free to turn to other things, if he has something interesting about which he has been reading, this will afford a desirable object of contemplation. This is advisable, since the mind tends to turn to the undesirable features of work when it has nothing else to

occupy its attention.

The above mentioned incentives cannot be regarded as alternative means of relieving boredom. They must really be viewed as positive incentives which must accompany any effective method of overcoming monotony. If these, and the negative factors discussed in the previous chapter, receive attention, we can be reasonably certain that there will be nothing present in the working environment to detract from the effectiveness of any positive incentive introduced.

A more concrete incentive than any mentioned thus far for relieving monotony was suggested by Barmarck (47). He believed that a state of boredom was caused principally by a physiological reversion to the sleep level due to inadequate motivation during the operation of the task. The operative engaged in repetitive work tries to escape from the depressing work, by introducing new methods of working and by day-dreaming, which are, in a way, means of staying alert. Barmack thought that certain antihypnotics should be effective in allaying or minimizing the onset of these effects.

He found that Benzedrine was the most suitable drug for this purpose, since it was a sympathomimetic drug, having the same effects as ephedrine but having a more prolonged action.

That antihypnotics such as Benzadrine and caffeine increase output by delaying the onset of a bored attitude towards monotonous work is beyond question, but we must not overlook the fact

that the results on different individuals are extremely variable and that the findings for the group cannot be applied to individuals . There is a group increase in measured efficiency and capacity for psychological work that seems to be most likely related to a favorable mind affective tone characterized by greater optimism and feelings of energy. Like the effects of other drugs such as alcohol, the effects of benzedrine is influenced by the predominant mood previous to the administration of the drug. If the subject is somewhat depressed when the drug is taken the effects may be a reversal of the usual trend and a deepened depression may follow (44). Doctors have found that any size dose will give intense feelings of fatigue and headaches. Overdose or idiosyncrasy, gives central nervous system symptoms such as manic manifestations, a delirium, gastro-intestinal disturbances such as nausea, vomiting and diarrhea; and cardiovascular manifestations such as hypertension (one of its main dangers), syncope and tachycardia. So even if benzedrine is the solution to the problem of monotony, its use is limited by these ill-effects. The only way of relieving boredom is to supply the operative with an interest to occupy that portion of his mind, which is free from work, and anti-hypnotics can in no way supply this interest.

We have established the fact that boredom is due to an awareness of the monotonous conditions of work, and its alleviation must of necessity depend to a great degree upon the extent to which the mind can be distracted from these

conditions. In this chapter many known methods of relieving monotony were mentioned, but none of these are really effective by themselves. It becomes more obvious that the form of distraction should appeal to the ear rather than to the eye for best results, and music in some form or another seems to be the most suitable medium for auditory stimulation.

The fact that rhythm increases the ease of work is not in reality a recent finding but seems to have been an early discovery of even the most primitive people. However, it is only since the advent of time studies, that the importance of rhythm in work has been given any consideration by efficiency experts. In recent years, there has been considerable popular reference to the use of music in industry but to date surprisingly little experimentation aside from the British studies by Sidney Wyatt, for the Industrial Health and Research Board, have been reported. Reinhardt, Duker, and Diserens, among others, made observations on the effect of music upon the individual's grip, blood pressure, heart beat, respiration and speed of typing, but these cannot be considered as experiments which prove that music will relieve boredom in industry. Rawson and Ramsey (43) have reported the results of a survey made in England on the prevalence of music in factories, the attitude of employees to its use and other phases of the problem. While this was not an experimental study, the investigation nevertheless concluded that 7.45 per cent of those employers using music considered that it increased efficiency.

Wyatt and his associates found that familiar types of dance music, with their well-marked rhythms and distinctive

melodies, were the most popular and effective stimulants to production, and were the type of music from which the operatives derived the most pleasure. "During the time when music was played the increase in output varied from 6.2 to 11.3 per cent, while the total daily output showed an increase of 2.6 to 6.0 per cent. The greatest increase in output was obtained when the music was played for a period of 75 minutes about the middle of the work-spell but the most popular arrangement was provided by the introduction of music during alternate half-hours throughout the work-spell (4). This emphasized the fact that the most popular arrangement was not always the best one for production. However, it must be stressed that in cases where the difference between the "best" and "most popular" arrangements is slight, the latter should always be adopted. The great difference in workers' attitude towards conditions of work will more than compensate for the insignificant drop in production.

In America, John Humes (24) has investigated the effects of music on production, at the Hygrade Sylvania Corporation in Pennsylvania. Humes, instead of trying to measure the increase in production between music and non-music periods, attempted to prove that music will decrease the number of errors made by the operatives. He found that "scrapage was generally less during the playing of all fast music, and all slow music, as compared with other conditions of the experiment ("check", "arranged" and "no music" periods)". This conclusion shows that music not only increases production, as seen in the results of Wyatt, Langdon and Stack, but at the same time will reduce the

number of errors- and accidents.

Tobacco factories in Cuba, and the United States, have experimented with reading to their employees in order to take their minds off the monotonous conditions of work. They find that employees respond more favorably to reading than they do to music, because there is no conflict of rhythms to irritate them and so cut down their efficiency. To date there has been no experimental confirmation of this claim, and the results can only be accepted at their face value.

Although much mention has been made of the value music would have in industry, suprisingly few of the larger firms have used it ^{to} increase efficiency. It is only during the last year that the munition plants in Britain started to use this plan, and so effective have been the results that it has now become a permanent feature of the working environment.

Through arrangements with the B.B.C., special musical programs are conducted for these essential war industries.

A recent release from the Rolls-Royce plant in London, which manufactures aeroplane engines, claims that production has been stepped up 40% since last year by allowing the operatives to listen to "jazz" music and smoke while on the job. The highest peak in the production history of the plant has been reached by allowing the workers to do as they please. No rules are set down, music is played when there is a demand for it, and not when the efficiency expert thinks it will do

the most good. This tends to contradict the finding of Wyatt (5), who believed that music should only be played during definite periods, but it must await further verification before it is applied to industry.

Some 500 factories, arsenals and shipyards in the U. S. A. are now wired for sound (46). Most of these plants restrict concerts to lunch periods and between shifts and so really use it as an entertaining feature rather than as a means of relieving boredom. In the few cases where tunes penetrate the clatter of machinery, as in the Botany Worsted Mills in Passaic, New Jersey, no previous experiments have been conducted to find which types of music are effective.

Contrary to the findings of this experiment the Oregon Shipbuilding Yards play music of the type of Brahms's Fifth and Sixth Hungarian Dances, which although it might have an beneficial effect upon the morale of the individual, will not help increase his efficiency. In most cases the type of music played is suitable because they have been selected on the basis of appeal to the average individual - modern jazz music.

Most U. S. installations are recent---Picatinny Arsenal, Dover, N. J. began using music last fall, Consolidated Aircraft in San Diego started broadcasting lunch-time entertainment to its 39,000 workers in December and it was not until April 1942 that the Todd Shipyards Corporation began noon-hour dance band concerts in their Brooklyn and Hoboken yards.

The use of music in industry in America is a step in the right direction, but it must also be accompanied by experiment to determine its most effective time and duration.

In Canada, very few factories use music, and in most cases the plan adopted has been of the hit or miss variety. No previous experiments are made to find which types of tempo will be most effective, and at what times, the introduction of music will do the most good. An example of this is found in the Paul's Service Store Factory in Montreal, where all types of music from the waltz to the rhumba are played continuously all day long. The management believes that workers do their best work when listening to music, but production records are not available to illustrate any increase in output. That it does meet with the approval of the operatives is beyond question, and verification of this fact was received on the first day the gramophone needed repairs, 90% of the staff signed a petition asking for the continuation of music during work.

Rhythm in human beings is not a principle or theoretic motion, it is a common endowment. Bucher, in his classic text "Arbeit and Rhythmus" points out the interdependence of work and rhythm. The human organism seems to instinctively attune itself to rhythms, and so it is not surprising to find that spontaneous whistling or singing is a natural accompaniment to many forms of rhythmical work. This whistling or singing is unconscious and to inhibit it requires conscious effect and induces boredom because a natural impulse has been

suppressed. Rhythm not only makes work more enjoyable, but it also makes it a great deal easier because each effort is followed by a corresponding rest. Many experiments have been conducted to show that work done in rhythm was less tiring than when the operatives were allowed to choose their own speed of work. For every type of work there exists an optimal speed and rhythm, which will make it possible to obtain maximum production with the least expenditure of energy and without increasing the feeling of fatigue, discomfort and illhealth. Therefore, any incentive which depends upon rhythm for its beneficial effects will be the ideal solution to the problem of monotony.

Music answers all the qualifications listed above, but the question arises as to whether artificial rhythm will have the same effects as the music which the worker himself makes. If this be so, there are a number of problems connected with the use of music which must be solved.

Music induces a pleasant emotional effect, which acts as a favorable background to production, but at the same time it tends to dictate the rate of working, especially for those operations habitually performed in a rhythmical manner. This tyrannical influence may be good or bad depending upon the individual concerned, and upon its tempo in relation to the speed of the work. When the tempo is too fast, it causes the operative to work at a faster speed than he feels inclined, and as a result causes strain and discomfort. Music which is

too slow, on the other hand, increases monotony and in reality acts as a brake to speed. When rhythm and tempo are right -- fairly close to the habitual speed in production -- more work will be done without any strain or extra effort on the part of the operatives.

It is obvious that no one musical plan can be established for industry in general. Each firm is an individual problem, where the musical adviser must be a man who knows the personal problems, the difficulties in production, and the labour turnover, if he is to have any success in arranging a program. He must, by careful experimentation, discover which type of rhythm will produce the best results. By carefully studying the production records of each individual, he can discover the time at which the introduction of music will be most effective, since it is generally agreed that it has its greatest influence on the operative just as he begins to tire.

Most operatives engaged in repetitive work are apparently able to maintain a satisfactory rate of production during the first two hours of the spell, and so no added incentive will be needed at this time. At the end of this period, operatives begin to show signs of unrest, and a desire for change often appears. The continued performance of the task becomes increasingly difficult and efficiency is only maintained at the expense of increased effort, and if this increased effort is not forthcoming then efficiency suffers. Frequently, a compromise between these two conflicting tendencies is effected,

and the rate of working will be characterized by alternating phases of effort and relaxation, resulting in a reduction in the average rate of working (4).^I

In general, boredom seems more pronounced around the middle of the work spell, and it is during this period that attention should be directed to the question of alleviating the monotony. Although, as stated above, the most effective duration and distribution of playing periods for each factory will depend on the conditions of work, the total duration should never be less than one hour or more than two hours in any one spell. If the shorter time is adapted, it should be introduced as a single period about the middle of the work-spell, otherwise the playing of music during alternate half-hours is the best arrangement (4).

Music will not only be effective during the period in which it is played, but it will have a positive effect upon the total production of the operative. It seems probably that the thoughts of the worker instead of being directed to the prospect of a long period of somewhat monotonous activity, will be diverted by the anticipation of music. The mind will become more or less detached from the work and this detachment will be practically complete during the actual music period (5).

It is a well known fact that a rhythm which is pleasant and stimulating to one worker may be uncomfortable and distracting to another. Will this difference in reaction have any effect

I.- See : Output curve for monotonous work in Chapter II.

upon the production of the operatives? This is a very pertinent question, since it is difficult to arrange a program which will appeal to the taste of all individuals, and if a selection which is disliked has a detrimental effect on the operative, then music cannot be used to relieve boredom.

However, Hyde (20) "definitely established the fact that for people that lacked sympathy for a particular type of music, the tones neither inhibited nor stimulated the nervous control of the functions of the cardio-vascular system under consideration, nor the emotions of depression or sadness". We can safely assume from his results that music which is disliked, or to which the operative is indifferent, will have no ill-effect upon the production of the individual. There need be no anxiety about appealing to the tastes of all the workers, a program influencing the majority of the operatives, is one which is worth while putting into effect.

The general conclusion of experiments with music is, that it should be introduced into industry, "for the pleasure of the employed and the profit of the employer" (15). It is without a doubt the best method of relieving monotony, but to really be effective, it must be combined with other factors in the working environment such as increase in pay and decrease in the hours of work. The present experiment was conducted to test the effectiveness of different types of rhythm upon output, and to see if music will be just as useful in relieving monotony under the time and piece rate systems of payment.

We must recognize the fact that whatever methods may be adopted for the purpose of relieving monotony, for many individuals a certain amount of boredom is an inescapable condition of modern factory life. The beneficial effects of the incentive will bear a direct relationship to the degree of monotony associated with the daily work. Therefore, we should not expect all operatives to show an equal increase in output due to the introduction of music. This difference in response will be increased by such factors as meals, smoking, fatigue, excited and depressed states of mind.

CHAPTER V

EXPERIMENTAL CONDITIONS

SUBJECTS

As mentioned in the Introduction, due to war conditions, this experiment had to be conducted under laboratory conditions. The subjects were fifteen girls and ten boys, between the ages of 18 and 22, all of whom were members of the Psychology I class at McGill University. The subjects were chosen at random from a list of students who volunteered to offer their services. Since the subjects, being college students, were not as representative a lot as would be found in a factory, no attempt was made to duplicate factory conditions, where the operative is generally employed as a member of a group, in a large room. This investigation was conducted in a small isolated room, free from outside disturbances, where the

operative worked alone, the examiner being the only other person present.

PROCEDURE

The task confronting the operative was to insert a metal stylus into a series of ten holes. A small degree of complexity was added to this purely routine task by making the holes slightly larger than the stylus. The individual's attention as a result could never^{be} completely free from the task. If his attention wandered he would miss the hole, and as a result would have to retrace, thus lowering his production. The stylus was held in one hand only, --- the preferred hand, -- and no switching was permitted. The holes were numbered, and the correct pattern had to be followed at all times.

1	2	3	0		0
			2		3
0	0	0	0	0	0
			7	1	6
			0		0
			4		5

The apparatus used was a whipple tapping board connected to one pen of an ink recording chronograph. When the stylus was inserted into the hole it made an electrical contact with the metal plate below, closing the electrical connected and thus moving the pen, no contact was made unless it was inserted right into the hole. The number of times the subject tapped was recorded on the paper, and this was used as his rate of production. An electric clock was connected to another pen to provide a means of checking the output of the individual.

per minute.

Since Wipple (45) found that the rate of tapping of the individual will vary from day to day depending on his physical condition, it was necessary to conduct this experiment on a paired comparison basis. The operative after a two minute warm-up period was instructed to work at whatever speed he felt inclined. At the end of ten minutes, a rest pause of two and one half minutes was provided, during which time the operative was encouraged to walk around, talk or listen to music. After the rest which was provided to eliminate the effects of fatigue, he worked for another period of ten minutes but during this work spell music was played. In this manner any gain or loss in output can be attributed to the introduction of the incentive and not to a change in the physiological condition of the subject.

To standardize conditions for each subject, he always came on the same day of the week and at approximately the same time. This was made necessary by the finding of Wyatt (5) that music has different effects on operatives on different days. Each day was devoted to music of one type and at the conclusion of each period the subject was questioned as to his preference for working with or without music. His answers were compared with his output record and this provided a check to the effectiveness of the incentive.

Five different types of records were used - slow, fast, rhumba, classical and drama. When the music which proved to be most effective was found, the experiment was

repeated for these types of rhythm, but this time the subjects were told to work at their fastest rate. Since this part of the research was conducted along the lines of a contest, with a bonus being promised for the subject who obtained the highest output, the cooperation of all was assured. The first part of the experiment, when working at the speed he felt inclined, was supposed to measure the value of music under the time rate system of pay and the latter half was to judge the effect under a piece rate system of pay.

At no time were the subjects told the purpose of the experiment so that a gain in output couldn't be traced to the cooperation of the operatives.

APPARATUS

An R.C.A. Victor Record Player, Model V 5, was used, attached to a General Electric Radio. The records used are listed under five headings - Slow, Fast, Rhumba, Classical and Drama.

SLOW

I Know Why	- Glenn Miller	- Bluebird #11230A
We're the Couple in the Castle	- " "	- " #11397B
The White Cliffs of Dover	- " "	- " #11397A
T'is Autumn	- Les Brown	- Columbia #485
The Shrine of St. Cecilia	- Vaughn Monroe	- Bluebird #11344A
The Bells of San Raquel	- Claude Thornhill	- Columbia #503

FAST

Chattanooga Choo Choo	- Glenn Miller - Bluebird #11230 B
Boogie Woogie Stomp	- Albert Armond- Decca #3386 B
That Solid Old Man	- Les Brown - Columbia #485
Fraidy Cat	- Vaughn Monroe-Bluebird #1134 B
Elmer's Tune	- Glenn Miller - Bluebird #11274A
Delilah	- Glenn Miller - Bluebird #11274B
Bugle Call Rag	- Benny Goodman- Columbia #461

RHUMBA

A Week-end in Havana	-	Enric Madriguera	-	Victor #2764A
The Nango	-	"	*	Victor #27640B
Tony's Wife	-	Xavier Cugat	-	Columbia #317
La Cucaracha	-	Xavier Cugat	-	Columbia #317

CLASSICAL

Poet and Peasant's Overture	-	Victor #35509
Refrains from Tosca	-	Columbia #338

DRAMA

"Deposition Scene"	-	Maurice Evans	-	Columbia	11046D
				Columbia	11047D

GENERAL PROCEDURE

Each time the operative came to the laboratory he worked to a different type of music, no regular plan being arranged for the introduction and presentation of the records. The subject as nearly as possible always came on the same day and at about the same time. The Maurice Evans records were used to see whether a distraction having no rhythm was more effective than one having a definite tempo.

A clear-cut distinction between fast and slow music is difficult to establish so those peices which ranged from 60 to 65 beats per minute, as measured by a metronome, was considered "slow", while those ranging about 105 were put in the "fast". classification (42).

The music at all times was played softly to avoid having it become a distracting influence, and thus interfering with the operatives ability to work. All efforts were made to make the music a background to the work.

RESULTS

The basic assumption underlying this experiment is that large differences between no music periods and music periods suggests the presence of an important factor - monotony - which impaired performance under the usual conditions of work. The variations in the experimental procedure was introduced in order to find whether different types of music produced any noticeable difference in output or in attitude towards the conditions of work. The beneficial effects of music will bear a direct relation to the degree of monotony associated with the work. and by using the difference in output between the two periods we have the amount of boredom which the music relieved.

For the sake of convenience and to avoid working with large figures, the average difference between periods was used in computing the results. Any difference in output is in reality the average difference in output per minute, and the total difference may be obtained by multiplying this figure by ten.

In the following results any incentive having a critical ratio of more than three will be effective as an antidote to boredom.

TABLE I

Average Increase or Decrease in Output for Each Period.

Worker	Slow	Fast	Rhumba	Classical	Heavens	Fast-Slow	Fast-Fast
A	14.4	0.7	2.7	3.6	-1.8	4.3	5.1
B	0.7	0.3	0.8	1.2	-1.1	16.9	4.1
C	7.7	2.9	1.0	7.9	3.4	3.9	7.8
D	14.1	5.3	9.5	7.0	-1.0	3.9	5.1
E	1.2	9.0	6.7	-1.0	4.0	13.4	4.3
F	-1.9	-2.2					
G	0.5	11.3				0.5	1.8
H	-0.5	10.8	6.0	-10.6	0.5	18.7	5.3
I	8.0	18.6	13.7	-0.9	1.2	15.0	0.1
J	6.2	2.7	11.6	-1.8	0.7	0.3	1.2
K	3.1	6.3	10.2	2.4	0.6	5.3	8.2
L	7.5	7.3	-0.8	6.6	-0.9	21.7	4.4
M	8.5	5.7	3.6	9.6	-1.6	6.3	4.9
N	5.7	8.8					
O	8.0	1.2	0.7	2.0	-3.5	0.3	2.3
P	-2.5	-1.2	+1.7	-1.2	1.9	3.4	1.7
Q	2.8	14.5	5.3	2.3	8.4	18.5	10.1
R	5.6	11.1	19.0	-5.3	7.4	1.5	3.0
S	5.4	13.5	14.0	2.6	0.7	7.8	5.1
T	0.3	18.0	10.7	-4.2	-14.4	14.0	8.1
U	1.1	2.2	6.1	-2.9	-5.7	4.8	7.4
V	2.1	1.6	10.3	4.9	-6.6	14.7	1.6
X	4.4	12.4	-6.9	12.0	12.4	22.4	8.7
Y	-0.2	1.1	-10.0	9.2	3.1	0.8	1.7
Z	9.0	7.9	9.9	-0.9	4.4	10.5	7.8
A ^I	4.8	12.0	1.4	4.8	5.5	- 0.7	5.4

TABLE II

The Effect of Slow Music

NO Music	Music	Diff	D	D ²
60.4	74.8	14.4	+ 9.6	92.16
94.8	95.5	0.7	- 4.1	16.81,
70.7	78.4	7.7	+ 2.9	8.41
69.2	83.3	14.1	+ 9.3	86.49
96.4	97.6	1.2	- 3.6	12.96
84.0	83.5	-0.5	-5.3	28.09
79.1	87.1	8.0	+ 3.2	10.24
106.5	112.7	6.2	+ 1.4	1.96
59.2	67.7	8.5	+ 3.7	13.69
70.8	78.3	7.5	+ 2.7	7.29
92.9	100.9	8.0	+ 3.2	10.24
82.0	79.5	-2.5	- 7.3	53.29
99.9	102.7	2.8	- 2.0	4.0
114.0	119.6	5.6	+ 0.8	0.64
102.3	107.7	5.4	+ 0.6	0.36
109.7	110.0	0.3	-4.5	20.25
76.1	77.2	1.1	-3.7	13.69
99.9	102.0	2.1	-2.7	7.29
97.6	102.0	4.4	+ 0.4	0.16
89.0	88.8	-0.2	-5.0	25.00
75.4	84.4	9.0	+4.2	17.64
84.7	89.5	4.8	0.0	0.0
75.6	78.7	3.1	-1.7	2.89
				433.85

$$M = \frac{114.9 - 3.2}{23} = \frac{11.7}{23} = 4.8$$

$$6 = \sqrt{\frac{433.55}{23}} = \sqrt{18.85} = 4.34$$

$$6 \text{ diff between means} = \frac{4.34}{\sqrt{23}} = \frac{4.34}{4.77} = .909$$

$$C.R. \frac{4.8}{.909} = 5.28$$

TABLE III

Fast MusicThe Effect of Fast Music

No Music	Music	Diff	D	D ²
68.1	68.8	0.7	-6.4	40.96
84.1	84.4	0.3	-6.8	46.24
76.4	79.3	2.9	-4.2	17.64
67.6	72.9	5.3	-1.8	3.24
100.1	109.1	9.0	+1.9	3.61
99.2	97.0	-2.2	-9.3	86.49
96.7	108.0	11.3	+4.2	17.64
76.0	86.8	10.8	+3.7	11.47
87.0	105.6	18.6	+11.5	132.25
109.8	112.5	2.7	-4.4	19.36
75.6	81.9	6.3	-0.8	0.64
68.1	73.8	5.7	-1.4	1.96
72.5	79.8	7.3	+0.2	0.4
96.4	105.2	8.8	+1.7	2.89
99.8	101.0	1.2	-5.9	34.81
76.5	75.3	-1.2	-8.3	68.89
95.5	110.0	14.5	+7.4	54.76
120.1	131.2	11.1	+4.0	16.0
108.5	122.0	13.5	+6.4	40.96
98.7	116.7	18.0	+10.9	118.81
80.5	82.7	2.2	-4.9	24.01
127.2	128.8	1.6	-5.5	30.25
110.4	122.8	12.4	+5.3	28.04
88.8	89.9	1.1	-6.0	36.0
78.8	86.7	7.9	+0.8	0.64
87.5	99.5	12.0	+4.9	24.01
				862.02

$$M = \frac{188.9 - 3.4}{26} = 7.1$$

$$6 = \sqrt{\frac{862.02}{26}} = \sqrt{33.15} = 5.76$$

$$6 \text{ Diff between means} = \frac{5.76}{\sqrt{26}} = \frac{5.76}{5.1} = 1.12$$

$$C. R. = \frac{7.1}{1.12} = 6.339$$

TABLE IV

Rhumba Rhythm and Ability to Work

No Music	Music	Diff.	D	D ²
59.0	61.7	2.7	- 2.8	7.84
99.3	100.1	0.8	- 4.7	22.09
76.4	77.4	1.0	- 4.5	20.25
58.6	68.1	9.5	+ 4.0	16.00
98.0	104.7	6.7	+ 1.2	1.44
84.14	90.14	6.0	+ 0.5	0.25
87.7	101.4	13.7	+ 8.2	67.24
96.4	108.0	11.6	+ 6.1	37.21
79.8	90.0	10.2	+ 4.7	22.09
87.7	91.3	3.6	- 1.9	3.61
79.5	78.7	-0.8	- 6.3	39.69
93.3	94.0	+0.7	- 4.8	23.04
72.5	74.2	+1.7	- 3.8	14.44
134.8	140.1	+5.3	- 0.2	0.4
92.6	111.6	+19.0	+13.5	182.25
122.2	136.2	+14.0	+ 8.5	72.25
108.5	119.2	+10.7	+5.2	27.04
77.1	83.2	+6.1	+0.6	0.36
93.1	103.4	+10.3	+ 4.8	23.04
101.2	94.3	-6.9	-12.4	153.76
99.4	89.4	-10.0	-15.5	240.25
93.3	103.2	+9.9	+4.4	19.36
101.7	103.1	+1.4	-4.1	16.81
				1010.71

$$M = \frac{144.9}{23} - \frac{1.77}{23} = \frac{127.2}{23} = 5.5$$

$$6 = \sqrt{\frac{1010.71}{23}} = \sqrt{43.94} = 6.63$$

$$6 \text{ Diff between means} = \frac{6.63}{\sqrt{23}} \div \frac{6.63}{4.77} = 1.38$$

$$C. R. = \frac{5.5}{1.38} = 3.985$$

TABLE 5

No Rhythm - Monologues from Richard II, and output.

No Record	Record	Diff	D	D ²
63.2	61.4	-1.8	-2.56	6.5536
98.4	97.3	-1.1	-1.86	3.4596
93.7	97.1	+3.4	+2.64	6.9696
68.0	67.0	-1.0	-1.76	3.0976
103.2	107.2	+4.0	+3.24	10.4976
78.8	79.3	+0.5	-0.24	0.0676
118.8	120.0	+1.2	+0.44	0.1936
110.4	111.1	+0.7	-0.06	0.0036
107.5	108.1,	+0.6	-0.16	0.0256
91.0	89.4	-1.6	-2.36	5.5696
69.7	68.8	-0.9	-1.66	2.7556
93.0	90.5	-3.5	-4.26	18.1476
74.7	76.6	+1.9	+1.14	1.2996
112.3	120.7	+8.4	+7.64	58.3696
101.8	109.2	+7.4	+6.64	44.0896
120.0	120.7	+0.7	+0.06	0.0036
157.7	143.3	-14.4	-15.16	229.8256
81.4	75.7	-5.7	+6.46	41.7316
122.0	115.4	-6.6	+7.36	54.1696
98.5	110.9	+12.4	+11.64	135.4896
96.2	99.3	+3.1	+2.34	5.4756
93.3	97.7	+4.4	+3.64	13.2496
101.1	106.6	+5.5	+4.74	22.4676
				663.6857

$$M = \frac{54.2 - 36.6}{23} = \frac{17.6}{23} = .76.$$

$$6 = \sqrt{\frac{663.6857}{23}} = \sqrt{28.85} = 5.37$$

$$6 \text{ Diff between means} = \frac{5.37}{\sqrt{23}} = \frac{5.37}{4.77} = 1.12$$

$$C. R. = \frac{.76}{1.12} = .678.$$

TABLE 6

Classical Music and Output

No Music	Music	Diff	D	D ²
63.4	67.0	3.6	+ 1.6	2.56
87.0	88.2	1.2	-0.8	0.64
92.1	100.0	7.9	+5.9	34.81
90.6	97.6	7.0	+5.0	25.0
159.66	158.6	-1.0	-3.0	9.0
96.5	85.9	-10.6	-12.6	158.76
97.6	96.7	-0.9	-2.9	5.41
126.2	124.4	-1.8	-3.8	14.44
113.2	115.6	2.4	+0.4	0.16
105.5	112.1	6.6	+4.6	21.16
66.9	76.5	9.6	+7.6	57.76
90.0	92.0	2.0	0.0	0.0
72.1	70.9	-1.2	-3.2	10.24
117.4	119.7	2.3	+0.3	0.9
105.3	100.0	-5.3	-7.3	53.29
106.1	108.7	2.6	+0.6	0.36
155.1	150.9	-4.2	-6.2	38.44
87.5	84.6	-2.9	-4.9	24.01
94.9	99.8	4.9	+2.9	8.41
114.8	126.8	12.0	10.0	100.0
96.2	105.4	9.2	7.2	51.84
96.1	95.2	-0.9	-2.9	8.41
84.7	89.5	-4.8	+2.8	7.84
				636.44

$$M = \frac{76.1}{23} - \frac{28.8}{23} = \frac{47.3}{23} = 2$$

$$6 = \sqrt{\frac{636.44}{23}} = \sqrt{27.67} = 5.26$$

$$6 \text{ Diff. between means} = \frac{5.26}{\sqrt{23}} = \frac{5.26}{4.8} = 1.09$$

$$C. R. = \frac{2.0}{1.09} = 1.834$$

TABIE 7

Fast Music Working at Fastest Speed

No Music	Music	Diff.	D	D ²
86.4	91.5	5.1	-0.3	0.9
128.9	133.0	4.1	-0.7	0.49
124.6	132.4	7.8	+3.0	9.0
90.0	95.1	5.1	+0.3	0.9
159.0	163.3	4.3	-0.5	0.25
114.4	116.2	1.8	-3.0	9.0
132.9	138.2	5.3	+0.5	0.25
151.2	151.3	0.1	-4.7	22.09
120.4	121.6	1.2	-3.6	12.96
108.0	116.2	8.2	+3.4	11.56
111.0	115.9	4.9	+0.1	0.1
105.3	107.6	2.3	-2.5	6.25
72.7	76.1	3.4	-1.4	19.6
166.7	176.8	10.1	+5.3	28.09
109.7	112.7	3.0	-1.8	3.24
137.9	143.0	5.1	+0.3	0.9
153.2	161.3	8.1	+3.3	10.89
145.0	122.4	7.2	+2.6	6.76
173.0	174.6	1.6	-3.2	10.24
135.7	144.4	8.7	+3.9	15.21
129.9	131.6	1.7	-3.1	9.61
140.9	148.7	7.8	+3.0	9.0
108.0	113.4	5.4	+0.6	0.36
140.4	144.8	4.4	-0.4	0.16
				187.81

$$M = \frac{116.9}{24} = 4.8$$

$$6 = \sqrt{\frac{187.81}{24}} = 2.8$$

$$6 \text{ Diff. between means} = \frac{2.8}{\sqrt{24}} = \frac{2.8}{4.9} = .571$$

$$C.R. = \frac{4.8}{.57} = 8.42$$

TABLE 8

Working at Fastest Rate to Slow Music

No Music	Record	Diff	D	D ²
76.3	80.6	4.3	-4.3	18.49
124.1	141.6	16.9	-8.3	68.89
104.3	108.2	3.9	-4.7	22.09
87.3	91.2	3.9	-4.7	22.09
138.3	151.7	13.4	-4.8	23.04
109.4	109.9	.5	-8.1	65.61
124.1	139.1	15.0	-6.4	40.96
124.2	142.9	18.7	-10.1	102.01
116.6	116.9	0.3	-8.3	68.89
91.8	97.1	5.3	-3.3	10.89
96.2	102.5	6.3	-2.3	5.29
119.4	141.5	21.7	-13.1	171.61
106.4	106.7	0.3	-8.3	68.89
89.3	91.0	1.7	-6.9	47.61
114.8	133.3	18.5	-9.9	98.01
107.9	109.4	1.5	-7.1	50.41
122.6	130.4	7.8	-0.8	0.64
131.0	145.0	14.0	-5.4	29.16
105.7	110.5	4.8	-3.8	14.44
120.8	135.5	14.7	-6.1	37.21
131.6	154.0	22.4	-13.8	190.44
118.3	119.1	0.8	-7.8	60.84
124.0	134.5	10.5	-1.9	3.61
102.1	101.4	-0.7	-9.3	86.49
				1307.61

$$M = \frac{207.2}{24} - .7 = 8.6$$

$$6 = \sqrt{\frac{1307.61}{24}} = 7.38$$

$$6 \text{ Diff Between means } = \frac{7.38}{\sqrt{24}} = \frac{7.38}{4.9} = 1.506$$

$$C. R. = \frac{8.6}{1.506} = 5.71$$

CHAPTER VI

DISCUSSION OF RESULTS

The results of this experiment warrant only a most cautious interpretation. While there are certain statistical indications of advantage in the use of music in general, and of fast and slow music in particular, the experimental observations were not recorded over a sufficiently long period to justify definite conclusions.

It is apparent from the results given in Table I that while the majority of workers responded to the music by an increased output, which in some cases was very marked, there were isolated cases in which the music seemed to have little or no effect. In only one case did the music interfere with work, and the majority of operatives found that the rhythm was a distinct aid to production, -- "You try to work to the music especially when the time is quick".

This experiment establishes the fact, that dance music of the fast and slow type are most effective in counteracting monotony. The fast type of music seems to be the most effective, but the operatives also tend to make more errors when working to music of this type. Since the slow music is almost equally effective, and at the same time the operative does better work, we can conclude that this is the best music for use in industry. In general operatives prefer a varied program of dance music and it is probably that a similar taste exists in most industrial workers.

It was found that lyrics are not advisable in records. The operative tends to pay too much attention to the words and not enough to his work. Most subjects found that it was easier to work to records which did not have a vocal refrain. Inasmuch as the fast pieces did not contain as many lyrics as the slow pieces we can attribute part of the difference in effect between these two, to this factor.

In general, music to which the individual was indifferent or which he disliked had little or no effect upon him. Contrary to all expectation it did not have any ill effect upon his working ability.

The more familiar the operative becomes with a selection the less effect it will have upon him. Therefore, the selection of records should be changed frequently, if we wish the music incentive to be really effective.

The only other type of music experimented with, which gave a beneficial result, was the rhumba music. The tempo of this music is inclined to be on the fast side, but most operatives do not like to listen to records of this type for any long period of time. This suggests that it should only be used occasionally, along with fast and slow pieces, but never by itself.

Music of the character of the symphony is not to be recommended for individuals employed at repetitive work. Most operatives enjoyed this type of music but complained that it made them feel dull and sleepy. The rhythm is usually

slower and less marked and more variable than in dance tunes, and this may be one of the reasons for the lower output observed when the classical pieces were played.

Few operatives responded favorably to the Maurice Evans records. We might expect to find an increase in output since there is no conflict of rhythms, but the results do not verify this fact. Subject P, was the only one who found it easier to work to than music and who responded with increased output.

In all other trials this operative showed little or no increase due to music and claimed that she was not able to work comfortably when listening to music.

The radio is not as good a medium for music as the gramophone and should only be used to supplement it. The objection to the radio is that the majority of programs contain too much talking by the announcers and the subjects do not respond to this favorably. The talking has the same effect as lyrics and unless special programs are arranged for industry the radio cannot be used.

When listening to Walter Damrosch whose program contains a good deal of verbal explanations, Subject I claimed he enjoyed it very much although his output fell. However, when music was played after this program his output increased again. This tends to prove that talking provides too much distraction for operatives and seems to refute all arguments in favor of substituting reading for music as is done in some plants.

T A B L E 9

DISTRACTION CAUSED BY LISTENING TO TALKING ON RADIO

No Music	Walter Damrosch	Music
99.5	98.2	102.6

Music is not only effective during the period in which it is played but the mere fact that it will be played creates a favorable outlook and results in an increase in production prior to its introduction. There is also a long after effect which permits the operative to maintain the same rate of speed after the music has stopped.

TABLE 10

CARRY OVER EFFECT OF MUSIC

No Music	Music	No Music
94	97	96
78.8	86.7	84.5
68.1	68.8	68.4
92.9	100.9	99.5
99.9	102.7	101.8
97.6	102.	101

When the two most effective types of music were tried on operatives working at their fastest rate, tables 7 and 8, it was found that fast music was still the best incentive. The operatives found it easier to work to the faster tempo but claimed they could not continue working at that speed for any great length of time. However they could continue for a much longer time when listening to the slower type of music, and this fact together with the fact that less errors are made seems to indicate that the slight increase in production should be

sacrificed for the convenience of the worker.

The fact that music caused an increase in output even when the operatives worked at their fastest rate, indicates that greater output was not merely due to acceleration, but was the result of removing some factor in the environment which was restricting output ---- monotony.

Music serves the purpose of diverting the mind from monotonous conditions of work, provides an attractive aim, makes time seem to pass more quickly, and creates a more cheerful attitude toward work. There can be little doubt that in all forms of simple repetitive work the effects of music on the individual will be beneficial, and, since this type of work is very common in industry, there is plenty of scope for its use. However, in the case of industrial processes requiring concentrated thought for their successful performance, music will be a disturbing factor and should not be employed.

The conclusion we arrive at from this experiment is that even if production remained unaffected, the benefits derived by the operatives would still justify the adoption of music as an accompaniment to work. We must always remember that frequent changes of records is advisable for best results and the establishment of a lending library for all industries would be very economical and convenient.

Since susceptibility to monotony is a product of the individual an attempt was made to discover if personal characteristics would be a reliable index for the selection of individuals

suitability for repetitive work. It was found that only three types of music were effective in relieving boredom, and since the beneficial effects of music bear a direct relation to the degree of monotony associated with the work, the average increase of output for these three types was used as an index of the degree of monotony of the individual.

Intelligence was measured by the Otis-Self-Administering Test-Higher form. The correlation between monotony and intelligence was negative, indicating that the intelligent individual was more susceptible to boredom. The correlation was extremely low but can be expected to be higher in other cases, since a group of university students covers a rather restricted range in intelligence inasmuch as they have been selected to a certain degree by their academic history. If there had been more subjects covering a wider range of intelligence it is probable that the correlation would have been statistically significant. As a matter of fact we find in practical situations some indications of a closer relation between monotony and intelligence.

Temperament was measured by a questionnaire on introversion-extroversion^I. The correlation between introversion-extroversion and monotony was negative and low, but was significant considering the number of cases. We can, therefore, assume that temperament as measured by a test of introversion-extroversion will give some indication of the individual's ability to perform repetitive work.

Perseveration was measured by a knotting test. Short pieces of string of equal length were set before the subjects who then tied them as quickly as possible for ten minutes. During the last five minutes they were asked to answer a series of simple questions². The difference in the number of knots tied was used as an index of the perseveration of the individual. The correlation here too was negative and low but with a wider range of subjects it would probably be more significant. This type of test seems to have promising possibilities and should be of value in future research along this line.

The conclusion from this part of the experiment is that to date no tests have been devised which will give a true picture of the individual's ability to do repetitive work.

A questionnaire answered by all operatives shows that work that "had nothing to it" was disliked, and since this type of work is very common in industry it may be inferred that any satisfaction which arises from this work is due to external or derived interest and it would be of no value to try and select employees by means of tests.

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*2 - See Appendix

S U M M A R Y

- I The general impression formed as the result of this enquiry is that repetitive work contains little that is inherently interesting or satisfying. Music diverted the mind from the monotonous conditions of work by occupying that portion of the operatives mind that was free from the work.
- II Individuals differ in their degree of susceptibility to boredom and as a result the beneficial effects of music bear a direct relation to the degree of monotony associated with the work.
- III Fast and slow music are the best types of antidote to boredom and a program made up of selections of both types will prove the most effective.
- IV Records which do not meet with the approval of the individual leave him undisturbed. He will neither reduce nor increase his output.
- V Reading to the operatives or listening to dramas will not have a beneficial effect on the individual in repetitive work.
- VI Music which is unfamiliar is not as desirable as familiar music because the former becomes more or less of a distraction.
- VII For the same reason music without lyrics is more effective than those having a vocal refrain.
- VIII Records should be changed often because music loses its effect when it becomes too familiar.
- IX The most effective duration and distribution of playing periods will vary from factory to factory and the most suitable time will have to be determined by experiment.
- X There is a negative correlation between intelligence and boredom showing that people of greater intelligence are more susceptible to monotony. The correlation however is extremely low and cannot be used as an index of suitability for repetitive work.
- XI Temperament as measured by introversion-extroversion tests gives a slight indication of individuals ability to perform repetitive work.

- XII Perserveration yields a negative and low correlation when measured with intelligence but indicates that there are great possibilities for tests of this type in future research.
- XIII Results tend to indicate that it is more effective to provide an interest for workers employed at repetitive work rather than try to select suitable operatives by means of a battery of tests.
- XIV Music is only effective in work requiring no great concentration of thought. In difficult work, music will interfere with the performance of the task since it will be a distraction.

APPENDIX

QUESTIONS FOR TEST OF PERSEVERATION

- I.- Repeat the numbers from 1-10 backwards, from 33 - 38, 83 - 91, 69 - 74 etc.
- II.- What letter in the alphabet comes before R, before, L, P, H, etc.
- III.- Add 17 and 12 and take the result from 32; 39 and 14 from 75; 16 and 13 from 59 etc.

QUESTIONNAIRE GIVEN TO SUBJECTS

- I.- Do you like easy routine work or more varied and different work?
- II.- Do you prefer work which doesn't require any thought or work which makes you plan and think?
- III.- Do you prefer music to no music when you work?
- IV.- Which type of music do you prefer?
- V.- Do you day-dream or think of other things when working?
- VI.- Do you find you do this as much when the music plays as when it is off?
- VII.- Which kind of music do you work better to?
- VIII.- Are your thoughts frequently about real things that have happened or imaginary things that are not likely to happen?
- IX.- Are your thoughts pleasant or unpleasant?
- X.- Do you dislike people watching you work?

SOME ANSWERS TO THE QUESTIONS

- I.- I like slow records, they are a great help but I can't concentrate on the work when I hear lyrics.
- II.- I don't like the classical pieces, but they didn't bother me; I just didn't listen to them.
- III.- The music makes work so easy that I feel as if I'm zipping along.

IV.- I find I have an irresistible urge to keep time to the music.

In all cases except one, subjects preferred music, all thoughts or day dreams were pleasant and about real things that had or would happen.

Most operatives thought about other things less when listening to music.

TABLE II

Worker	Slow	Fast	Rhumba	Average or Monotony
A	14.4	0.7	2.7	5.9
B	0.7	0.3	0.8	0.9
C	7.7	2.9	1.0	3.8
D	14.1	5.3	9.5	9.6
E	1.2	9.0	6.7	5.6
H	-0.5	10.8	6.0	5.4
I	8.0	18.6	13.7	13.4
J	6.2	2.7	11.6	7.1
K	3.1	6.3	10.2	6.5
L	7.5	7.3	-0.8	4.6
M	8.5	5.7	3.6	5.9
O	8.0	1.2	0.7	3.3
P	-2.5	-1.2	1.7	-0.6
Q	2.8	14.5	5.3	7.5
R	5.6	11.1	19.0	11.9
S	5.4	13.5	14.0	10.9
T	0.3	18.0	10.7	9.6
U	1.1	2.2	6.1	3.1
V	2.1	1.6	10.3	4.6
X	4.4	12.4	-6.9	3.3
Y	-0.2	1.1	-10.0	-3.0
Z	9.0	7.9	9.9	8.9
A ^I	4.8	12.0	1.4	6.1

By Arthur S. Otis, Ph.D.
Author of the Otis Group Intelligence Scale

$$(y) \quad r_{xy} = \frac{-.19}{.13} = -1.46$$

CALCULATION	
Correlation Formula	
$r_{xy} = \frac{(C+F-G)-2HJ \div N}{2\sqrt{(C-H^2 \div N)(F-J^2 \div N)}}$	
A	30
B	7
A-B	23
H ²	529
C	103
H	23
H ² ÷ N	

$$r_{xy} = \frac{(C+F-G)-2HJ \div N}{2\sqrt{(C-H^2 \div N)(F-J^2 \div N)}}$$

FY	Y	YF	Y ²	Y ² FY
10	9	81	81	0
9	8	64	128	0
8	7	49	49	0
7	6	36	36	0
6	5	25	50	0
5	4	16	9	0
4	3	9	2	0
3	2	4	3	0
2	1	1	2	0
1	0	0	0	0

D	55	C-H ² ÷N	80	P
E	37			
D-E	18	J		
H	23	J ²	324	
HJ	414	F	521	
HJ÷N	13.6	J ² ÷N	14.08	
2HJ÷N	27.2	K FJ ² ÷N	506.92	Q
C	103			
F	521	PQ	40533.6	
C+F	624	√PQ	201.4	
G	673	2√PQ	402.8	S
C+H-G	-49			
K	272			
L-K	-76.2	M	M÷S	-14
				COEF. OF COR.

NUMERATOR

To find PE, r

r ²	.63
1-r ²	.97
√N	4.8
T÷W	7

[illegible]

Table of Products																																							
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
280	273	266	259	252	245	238	231	224	217	210	203	196	189	182	175	168	161	154	147	140	133	126	119	112	105	98	91	84	77	70	63	56	49	42	35	28	21	14	7
1960	1911	1862	1813	1764	1715	1666	1617	1568	1519	1470	1421	1372	1323	1274	1225	1176	1127	1078	1029	980	931	882	833	784	735	686	637	588	539	490	441	392	343	294	245	196	147	98	49
240	234	228	222	216	210	204	198	192	186	180	174	168	162	156	150	144	138	132	126	120	114	108	102	96	90	84	78	72	66	60	54	48	42	36	30	24	18	12	6
1440	1404	1368	1332	1296	1260	1224	1188	1152	1116	1080	1044	1008	972	936	900	864	828	792	756	720	684	648	612	576	540	504	468	432	396	360	324	288	252	216	180	144	108	72	36
200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1000	975	950	925	900	875	850	825	800	775	750	725	700	675	650	625	600	575	550	525	500	475	450	425	400	375	350	325	300	275	250	225	200	175	150	125	100	75	50	25
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4
640	624	608	592	576	560	544	528	512	496	480	464	448	432	416	400	384	368	352	336	320	304	288	272	256	240	224	208	192	176	160	144	128	112	96	80	64	48	32	16
120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	3
360	351	342	333	324	315	306	297	288	279	270	261	252	243	234	225	216	207	198	189	180	171	162	153	144	135	126	117	108	99	90	81	72	63	54	45	36	27	18	9
80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Table of Products

Table Square	
Num.	Square
11	121
12	144
13	169
14	196
15	225
16	256
17	289
18	324
19	361
20	400
21	441
22	484
23	529
24	576
25	625
26	676
27	729
28	784
29	841
30	900
31	961
32	1024
33	1089
34	1156
35	1225
36	1296
37	1369
38	1444
39	1521
40	1600
41	1681
42	1764
43	1849
44	1936
45	2025
46	2116
47	2209
48	2304
49	2401
50	2500
51	2601
52	2704
53	2809
54	2916
55	3025
56	3136
57	3249
58	3364
59	3481
60	3600
61	3721
62	3844
63	3969
64	4096
65	4225
66	4356
67	4489
68	4624
69	4761
70	4900
71	5041
72	5184
73	5329
74	5476
75	5625
76	5776
77	5929
78	6084
79	6241
80	6400

OTIS CORRELATION CHART

By Arthur S. Otis, Ph.D.
Author of the Otis Group Intelligence Scale

Correlation between

Personality

(x) and

P

Personality

(y) $r_{xy} =$

$-.36 \pm .12$

CLASS INTERVAL Y-VARIABLE From To	FV	V ²	V ² FV
324	6	36	216
289	5	25	145
256	4	16	104
225	3	9	68
196	2	4	39
169	1	1	19
144	0	0	0
121	-1	1	-19
100	-2	4	-39
81	-3	9	-68
64	-4	16	-104
49	-5	25	-145
36	-6	36	-216
25	-7	49	-289
16	-8	64	-368
9	-9	81	-459
1	-10	100	-550
0	-11	121	-641

Correlation Formula

$$r_{xy} = \frac{(C+F-G)-2HJ \div N}{2\sqrt{(C-H^2 \div N)(F-J^2 \div N)}}$$

Calculation	A	B	C	H ²
	29	7	102	484
	22	22	23	79

D-E	3	J	9
H	22	F	217
HJ	66	J ² ÷ N	42
HJ ÷ N	3.1	K FJ ² ÷ N	216.58
2HJ ÷ N	6.2		

C	102	PQ	1710.8
F	217	VPQ	130.8
C+F	319	2VPQ	261.6
C+F-G	407		
K	6.2		
L-K	94.2		

M	M ÷ S	-0.36	r _{xy}

To find P.E. _r	r ²	.12
1-r ²		.88
√N		4.6
T ÷ W		19
.67Z		.12
		P.E. _r

CLASS INTERVAL X-VARIABLE From To	FV	V ²	V ² FV
64	8	64	512
49	7	49	343
36	6	36	216
25	5	25	125
16	4	16	64
9	3	9	27
4	2	4	8
1	1	1	1
0	0	0	0
-1	-1	1	-1
-2	-2	4	-8
-3	-3	9	-27
-4	-4	16	-64
-5	-5	25	-125
-6	-6	36	-216
-7	-7	49	-343
-8	-8	64	-512
-9	-9	81	-729
-10	-10	100	-1000
-11	-11	121	-1331
-12	-12	144	-1728
-13	-13	169	-2197
-14	-14	196	-2744
-15	-15	225	-3375
-16	-16	256	-4096
-17	-17	289	-4913
-18	-18	324	-5832
-19	-19	361	-6859
-20	-20	400	-8000
-21	-21	441	-9261
-22	-22	484	-10648
-23	-23	529	-12167
-24	-24	576	-13824
-25	-25	625	-15625
-26	-26	676	-17576
-27	-27	729	-19683
-28	-28	784	-21952
-29	-29	841	-24389
-30	-30	900	-27000
-31	-31	961	-29791
-32	-32	1024	-32768
-33	-33	1089	-35937
-34	-34	1156	-39304
-35	-35	1225	-42875
-36	-36	1296	-46656
-37	-37	1369	-50649
-38	-38	1444	-54868
-39	-39	1521	-59319
-40	-40	1600	-64000
-41	-41	1681	-68921
-42	-42	1764	-74088
-43	-43	1849	-79509
-44	-44	1936	-85192
-45	-45	2025	-91135
-46	-46	2116	-97348
-47	-47	2209	-103831
-48	-48	2304	-110592
-49	-49	2401	-117639
-50	-50	2500	-125000
-51	-51	2601	-132609
-52	-52	2704	-140480
-53	-53	2809	-148621
-54	-54	2916	-157044
-55	-55	3025	-165755
-56	-56	3136	-174768
-57	-57	3249	-184099
-58	-58	3364	-193760
-59	-59	3481	-203769
-60	-60	3600	-214136
-61	-61	3721	-224875
-62	-62	3844	-235992
-63	-63	3969	-247495
-64	-64	4096	-259392
-65	-65	4225	-271695
-66	-66	4356	-284412
-67	-67	4489	-297551
-68	-68	4624	-311120
-69	-69	4761	-325129
-70	-70	4900	-339580
-71	-71	5041	-354485
-72	-72	5184	-369840
-73	-73	5329	-385659
-74	-74	5476	-401948
-75	-75	5625	-418715
-76	-76	5776	-435968
-77	-77	5929	-453715
-78	-78	6084	-471968
-79	-79	6241	-490735
-80	-80	6400	-510020
-81	-81	6561	-529835
-82	-82	6724	-550180
-83	-83	6889	-571065
-84	-84	7056	-592500
-85	-85	7225	-614495
-86	-86	7396	-637056
-87	-87	7569	-660195
-88	-88	7744	-683920
-89	-89	7921	-708245
-90	-90	8100	-733180
-91	-91	8281	-758735
-92	-92	8464	-784920
-93	-93	8649	-811745
-94	-94	8836	-839220
-95	-95	9025	-867365
-96	-96	9216	-896100
-97	-97	9409	-925535
-98	-98	9604	-955680
-99	-99	9801	-986555
-100	-100	10000	-1018180

CLASS INTERVAL X-VARIABLE From To	FV	V ²	V ² FV
64	8	64	512
49	7	49	343
36	6	36	216
25	5	25	125
16	4	16	64
9	3	9	27
4	2	4	8
1	1	1	1
0	0	0	0
-1	-1	1	-1
-2	-2	4	-8
-3	-3	9	-27
-4	-4	16	-64
-5	-5	25	-125
-6	-6	36	-216
-7	-7	49	-343
-8	-8	64	-512
-9	-9	81	-729
-10	-10	100	-1000
-11	-11	121	-1331
-12	-12	144	-1728
-13	-13	169	-2197
-14	-14	196	-2744
-15	-15	225	-3375
-16	-16	256	-4096
-17	-17	289	-4913
-18	-18	324	-5832
-19	-19	361	-6859
-20	-20	400	-8000
-21	-21	441	-9261
-22	-22	484	-10648
-23	-23	529	-12167
-24	-24	576	-13824
-25	-25	625	-15625
-26	-26	676	-17576
-27	-27	729	-19683
-28	-28	784	-21952
-29	-29	841	-24389
-30	-30	900	-27000
-31	-31	961	-29791
-32	-32	1024	-32768
-33	-33	1089	-35937
-34	-34	1156	-39304
-35	-35	1225	-42875
-36	-36	1296	-46656
-37	-37	1369	-50649
-38	-38	1444	-54868
-39	-39	1521	-59319
-40	-40	1600	-64000
-41	-41	1681	-68921
-42	-42	1764	-74088
-43	-43	1849	-79509
-44	-44	1936	-85192
-45	-45	2025	-91135
-46	-46	2116	-97348
-47	-47	2209	-103831
-48	-48	2304	-110592
-49	-49	2401	-117639
-50	-50	2500	-125000
-51	-51	2601	-132609
-52	-52	2704	-140480
-53	-53	2809	-148621
-54	-54	2916	-157044
-55	-55	3025	-165755
-56	-56	3136	-174768
-57	-57	3249	-184099
-58	-58	3364	-193760
-59	-59	3481	-203769
-60	-60	3600	-214136
-61	-61	3721	-224875
-62	-62	3844	-235992
-63	-63	3969	-247495
-64	-64	4096	-259392
-65	-65	4225	-271695
-66	-66	4356	-284412
-67	-67	4489	-297551
-68	-68	4624	-311120
-69	-69	4761	-325129
-70	-70	4900	-339580
-71	-71	5041	-354485
-72	-72	5184	-369840
-73	-73	5329	-385659
-74	-74	5476	-401968
-75	-75	5625	-418715
-76	-76	5776	-435968
-77	-77	5929	-453715
-78	-78	6084	-471968
-79	-79	6241	-490735
-80	-80	6400	-510020
-81	-81	6561	-529835
-82	-82	6724	-550180
-83	-83	6889	-571065
-84	-84	7056	-592500
-85	-85	7225	-614495
-86	-86	7396	-637056
-87	-87	7569	-660195
-88	-88	7744	-683920
-89	-89	7921	-708245
-90	-90	8100	-733180
-91	-91	8281	-758735
-92	-92	8464	-784920
-93	-93	8649	-811745
-94	-94	8836	-839220
-95	-95	9025	-867365
-96	-96	9216	-896100
-97	-97	9409	-925535
-98	-98	9604	-955680
-99	-99	9801	-986555
-100	-100	10000	-1018180

D	25	C-H ² ÷N	79
E	25		
D-E	3	J	
H	22	J ²	9
HJ	66	F	217
HJ÷N	3.1	J ² ÷N	42
2HJ÷N	6.2	K FJ÷N	216.58

C	102	PQ	17109
F	217	VPQ	130.9
C+F	319	2VPQ	261.6
G	407		
C+F-G	-88	L	
K	6.2		
L-K	94.2	M	M÷S

NUMERATOR		COEF. OF CO	
	</		

Table of Products										30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
280	273	266	259	252	245	238	231	224	217	210	203	196	189	182	175	168	161	154	147	140	133	126	119	112	105	98	91	84	77	70	63	56	49	42	35	28	21	14	7	6	5	4	3	2	1
1960	1911	1862	1813	1764	1715	1666	1617	1568	1519	1470	1421	1372	1323	1274	1225	1176	1127	1078	1029	980	931	882	833	784	735	686	637	588	539	490	441	392	343	294	245	196	147	98	49	6	3	2	1		
240	234	228	222	216	210	204	198	192	186	180	174	168	162	156	150	144	138	132	126	120	114	108	102	96	90	84	78	72	66	60	54	48	42	36	30	24	18	12	6	3	2	1			
1440	1404	1368	1332	1296	1260	1224	1188	1152	1116	1080	1044	1008	972	936	900	864	828	792	756	720	684	648	612	576	540	504	468	432	396	360	324	288	252	216	180	144	108	72	36	6	3	2	1		
200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	2	1				
1000	975	950	925	900	875	850	825	800	775	750	725	700	675	650	625	600	575	550	525	500	475	450	425	400	375	350	325	300	275	250	225	200	175	150	125	100	75	50	25	10	5	2	1		
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	2	1				
640	624	608	592	576	560	544	528	512	496	480	464	448	432	416	400	384	368	352	336	320	304	288	272	256	240	224	208	192	176	160	144	128	112	96	80	64	48	32	16	6	3	2	1		
120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	3	2	1				
360	351	342	333	324	315	306	297	288	279	270	261	252	243	234	225	216	207	198	189	180	171	162	153	144	135	126	117	108	99	90	81	72	63	54	45	36	27	18	9	6	3	2	1		
80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	1					
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	2	1				
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	1					
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	2	1				
120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	3	2	1				
360	351	342	333	324	315	306	297	288	279	270	261	252	243	234	225	216	207	198	189	180	171	162	153	144	135	126	117	108	99	90	81	72	63	54	45	36	27	18	9	6	3	2	1		
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	1					
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	2	1				
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
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40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
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1960	1911	1862	1813	1764	1715	1666	1617	1568	1519	1470	1421	1372	1323	1274	1225	1176	1127	1078	1029	980	931	882	833	784	735	686	637	588	539	490	441	392	343	294	245	196	147	98	49	0
240	234	228	222	216	210	204	198	192	186	180	174	168	162	156	150	144	138	132	126	120	114	108	102	96	90	84	78	72	66	60	54	48	42	36	30	24	18	12	6	0
1440	1404	1368	1332	1296	1260	1224	1188	1152	1116	1080	1044	1008	972	936	900	864	828	792	756	720	684	648	612	576	540	504	468	432	396	360	324	288	252	216	180	144	108	72	36	0
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1000	975	950	925	900	875	850	825	800	775	750	725	700	675	650	625	600	575	550	525	500	475	450	425	400	375	350	325	300	275	250	225	200	175	150	125	100	75	50	25	0
160	156	152	148	144	140	136	132	128	124	120	116	112	108	104	100	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	0
640	624	608	592	576	560	544	528	512	496	480	464	448	432	416	400	384	368	352	336	320	304	288	272	256	240	224	208	192	176	160	144	128	112	96	80	64	48	32	16	0
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360	351	342	333	324	315	306	297	288	279	270	261	252	243	234	225	216	207	198	189	180	171	162	153	144	135	126	117	108	99	90	81	72	63	54	45	36	27	18	9	0
80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
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B I B L I O G R A P H Y

1. Charles S. Slocombe
 How to Increase War Production
 Personal Journal, December 1941
2. T. Veblen
 *The Instinct of Workmanship"
 Viking Press New York 1918 - pp355
3. C. Parker
 *The Casual Labour and Other Essays"
 Harcourt, Brace and Howe, New York 1920, pp197
4. Sidney Wyatt, F. Stock and Langdon
 "Fatigue and Boredom in Repetitive Work "
 Industrial Health and Research Board-Report 77
5. S. Wyatt, S. Frost and F. Stock
 "Incentives in Repetitive Work
 Industrial Health and Research Board, Report 69
6. Hugo Munsterburg
 " Psychology and Industrial Efficiency
 Houghton Mufflin, Boston 1913, pp 320
8. C. S. Myers
 "Industrial Psychology in Great Britain"
 People's Insitiute Publishing Co., New York 1925
9. Morris Viteles
 "Industrial Psychology"
 W. W. Norton & Company, New York 1932 pp512
10. Roetllisberger and Dickson
 Management and the Worker
11. Morris Viteles
 The Science of Work
 W. W. Norton & Company, New York 1934 pp 314
12. Joseph Barmach
 Boredom and Other Factors in the Physiology of
 Mental Effort
 Archives of Psychology 31,1937-38, Serial No.218
13. C. S. Myers
 Mind and Work
 G. P. Putnam's Sons, New York 1921, pp42

14. B. Muscio
"Lectures on Industrial Psychology"
George Routledge & Sons, New York 1919 - pp 101
15. Tindall
"Rhythm for the Restless"
16. G. Goldmark
"Fatigue and Efficiency"
Russel Sage Foundation, New York 1919,-- 59
17. Robert Hoffock
"Job Satisfaction"
Harper and Brother, New York 1935
18. Harold Burtt
"Psychology and Industrial Efficiency"
D. Appleton and Co., 1929 - pp
19. E. L. Gatewood
"An Experiment in the use of Music in a Drafting Room"
Journal of Applied Psychology 1921,5,350 -8
20. I. M. Hyde
"Effects of Music on E. C. G. and Blood Pressure"
Journal of Experimental Psychology 1924,7,213-224
21. M. B. Jensen
"Influence of Jazz and Dirge Music upon Speed
and Accuracy of Typing"
Journal of Educational Psychology 1931,22,458-62
22. A. R. Gilliland and H. T. Moore
"Immediate and Long Time effects of Classical and
Popular Phonographic Selections".
Journal of Applied Psychology 1924,8,309-23
23. Kate Hevner
"The Affective Value of Pitch and Tempo in Music"
American Journal of Psychology 1937,49,621-30
24. John F. Humes
"The Effects of Occupational Music on Scrappage in
Manufacture of Radio Tubes"
Journal of Applied Psychology October 1941,573,87
25. John G. Jenkins
"Psychology in Business and Industry"
John Wiley and Sons, New York, 1935

26. H. J. Welch and G. H. Miles
"Industrial Psychology in Practice"
Sir Isaac Pitman and Sons, London 1932
27. T. N. Whitehead
"The Industrial Worker"
Harvard University Press, Massachusetts, 1938
28. Albert Walton
"Industrial Psychology"
McGraw Hill Book Company, New York 1941
29. H. M. Vernon
"Influences of Rest Pauses and Change of Posture
in Muscular Work"
Industrial Health and Research Board, Report 29
30. W. F. Watson
"The Worker's point of View"
Human Factor 1935, 9, 68-75
31. A. Macrae and Marion Milner
"Interest and Ability"
National Institute Industrial Psychology
1930, 5, 144-53
32. H. D. Kitson
"Making Him Interested in His Work"
American Machinist 1920, 52, 983-985
33. Musscio
"Feeling-tone in Industry"
British Journal of Psychology 12, 1921, 150-62
34. Rex B. Hersey
"A Monotonous Job in an Emotional Crisis"
Personnel Journal 1930, 9, 290, 296
35. Otto Liffman
"German Industrial Inquiry"
Personnel Journal 1930, 9, 86-91
36. Lorin A. Thompson
"Measuring Susceptibility to Monotony"
Personnel Journal 1930, 8, 172-195

37. Arthur Berman
"The Effects of Benzedrine Sulfat on Satiation"
American Journal of Psychology 52,1939,297-399
- 38 E. Mayo
"The Human Problem of an Industrial Civilization"
The MacMillan Company, New York 1933
- 39 S. Wyatt, Fraswe and Stack
"The Effects of Monotony in Work"
The Industrial Health and Research Board,
Report No.56
- 40 S. Wyatt
"Monotony"
Journal of the National Institute of
Industrial Psychology 1923, 11.
- 41 J. Barmack
"A definition of Boredom: A Reply to Mr. Berman"
American Journal of Psychology 52,1939,467
- 42 Kate Hevner
"The Effective Value of Pitch and Tempo in Music"
American Journal of Psychology 1937,49,
621-630
- 43 J. Ramsay, R. Rawson and Others
"Rest-Pauses and Refreshments in Industry"
National Institute Industrial Psychology,
Report No. 8, London 1939
- 44 S. R. Hathaway
"Physiological Psychology"
D. Appleton Century Company, New York 1942
- 45 John P. Foley, Jr.
"Factors Conditioning Motor Speed and Tempo"
Psychological Bulletin 34,1937,351-392
- 46 Music While Your Work
"Time Magazine Volume xxxix Number 15, page 62
- 47 J. Barmack
"The Effect of Benzedrine Sulfate upon the
report of Boredom."
Journal of Psychology 5,1938,125-132

