

# THE HAWTHORNE EXPERIMENTS

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## THE WESTERN ELECTRIC RESEARCHES

### IV

A word about the Western Electric Company is a necessary introduction to what follows. This company is engaged in manufacturing equipment for the telephone industry. Besides doing this part of its work, it has always shown concern for the welfare of its employees. In the matter of wages and hours, it has maintained a high standard. It has provided good physical conditions for its employees; and it has tried to make use of every established method of vocational guidance in the effort to suit the worker to his work. The efforts of the company have been rewarded in good industrial relations: there has been no strike or other severe symptom of discontent for over twenty years. In short, there is no reason to doubt that while these researches were being carried out the morale of the company was high and that the employees, as a body, had confidence in the abilities and motives of the company management. These facts had an important bearing on the results achieved.

Perhaps the most important program of research studied by [the Committee on Work in Industry] is that which has been carried on at the Hawthorne (Chicago) Works of the Western Electric Company. This program was described by H. A. Wright and M. L. Putnam of the Western Electric Company and by F. J. Roethlisberger, Associate Professor of Industrial Research, Graduate School of Business Administration, Harvard University, particularly at a meeting of the Committee held on March 9, 1938. These men, together with Elton Mayo and G. A. Pennock, both members of the Committee, had been intimately associated with the research.<sup>1</sup>



The program of research which will be described grew out of a study conducted at Hawthorne by the Western Electric Company in collaboration with the National Research Council, the aim of which was to determine the relation between intensity of illumination and efficiency of workers, measured in output. One of the experiments made was the following: Two groups of employees doing similar work under similar conditions were chosen, and records of output were kept for each group. The intensity of the light under which one group worked was varied, while that under which the other group worked was held constant. By this method the investigators hoped to isolate from the effect of other variables the effect of changes in the intensity of illumination on the rate of output.

In this hope they were disappointed. The experiment failed to show any simple relation between experimental changes in the intensity of illumination and observed changes in the rate of output. The investigators concluded that this result was obtained, not because such a relation did not exist, but because it was in fact impossible to isolate it from the other variables entering into any determination of productive efficiency. This kind of difficulty, of course, has been encountered in experimental work in many fields. Furthermore, the investigators were in agreement as to the character of some of these other variables. They were convinced that one of the major factors which prevented their securing a satisfactory result was psychological. The employees being tested were reacting to changes in light intensity in the way in which they assumed that they were expected to react. That is, when light intensity was increased they were expected to produce more; when it was decreased they were expected to produce less. A further experiment was devised to demonstrate this point. The light bulbs were changed, as they had been changed before, and the workers were allowed to assume that as a result there would be more light. They commented favorably on the increased illumination. As a matter of fact, the bulbs had been replaced with others of just the same power. Other experiments of the sort were made, and in each case the results could be explained as a "psychological" reaction rather than as a "physiological" one.

This discovery seemed to be important. It suggested that the relations between other physical conditions and the efficiency of workers might be obscured by similar psychological reactions. Nevertheless the investigators were determined to continue in their course. They recognized the existence of the psychological factors, but they thought of them only as disturbing influences. They were not yet ready to turn their attention to the psychological factors themselves. Instead, they were concerned with devising a better way of eliminating them from the experiments, and the experiments they wanted to try by no means ended with illumination. For instance, there was the question of what was called "fatigue." Little information existed about the effect on efficiency of changes in the hours of work and the introduction of rest pauses. The investigators finally came to the conclusion that if a small group of workers was isolated in a separate room and asked to co-operate, the psychological reaction would in time disappear, and they would work exactly as they felt. That is, changes in their rate of output would be the direct result of changes in their physical conditions of work and nothing else.

The decision to organize such a group was in fact taken. A small number of workers was to be selected and placed in a separate room, where experiments were to be made with different kinds of working conditions in order to see if more exact information could be secured. Six questions were asked by those setting up the experiment. They were the following:

1. Do employees actually get tired out?
2. Are rest pauses desirable?
3. Is a shorter working day desirable?
4. What is the attitude of employees toward their work and toward the company?
5. What is the effect of changing the type of working equipment?
6. Why does production fall off in the afternoon?

It is obvious that several of these questions could be answered only indirectly by the proposed experiment, and several of them touched upon the "psychological" rather than the "physiological"

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girl for each instant of the day. Such records were kept for five years.

In this experiment, then, as in the earlier illumination experiments, great emphasis was laid on the rate of output. A word of caution is needed here. The Western Electric Company was not immediately interested in increasing output. The experiments were not designed for that purpose. On the other hand, output is easily measured, i.e., it yields precise quantitative data, and experience suggested that it was sensitive to at least some of the conditions under which the employees worked. Output was treated as an index. In short, the nature of the experimental conditions made the emphasis on output inevitable.

From their experience in the illumination experiments, the investigators were well aware that factors other than those experimentally varied might affect the output rate. Therefore arrangements were made that a number of other records should be kept. Unsuitable parts supplied by the firm were noted down, as were assemblies rejected for any reason upon inspection. In this way the type of defect could be known and related to the time of day at which it occurred. Records were kept of weather conditions in general and of temperature and humidity in the test room. Every six weeks each operator was given a medical examination by the company doctor. Every day she was asked to tell how many hours she had spent in bed the night before and, during a part of the experiment, what food she had eaten. Besides all these records, which concerned the physical condition of the operators, a log was kept in which were recorded the principal events in the test room hour by hour, including among the entries snatches of conversation between the workers. At first these entries related largely to the physical condition of the operators: how they felt as they worked. Later the ground they covered somewhat widened, and the log ultimately became one of the most important of the test room records. Finally, when the so-called Interviewing Program was instituted at Hawthorne, each of the operators was interviewed several times by an experienced interviewer.

The girls had no supervisor in the ordinary sense, such as they would have had in a regular shop department, but a "test room observer" was placed in the room, whose duty it was to maintain the

factors involved. Nevertheless, all of them arose out of the bewilderment of men of experience faced with the problem of dealing with fellow human beings in a large industrial organization. In fact, one of the executives of the company saw the purpose of the experiment in even simpler and more general terms. He said that the experiment grew out of a desire on the part of the management to "know more about our workers." In this way began the experiment which is referred to as the Relay Assembly Test Room. With this experiment and the others that followed, members of the Department of Industrial Research of the Graduate School of Business Administration, Harvard University, came to be closely associated.

In April 1927, six girls were selected from a large shop department of the Hawthorne works. They were chosen as average workers, neither inexperienced nor expert, and their work consisted of the assembling of telephone relays. A coil, armature, contact springs, and insulators were put together on a fixture and secured in position by means of four machine screws. The operation at that time was being completed at the rate of about five relays in six minutes. This particular operation was chosen for the experiment because the relays were being assembled often enough so that even slight changes in output rate would show themselves at once on the output record. Five of the girls were to do the actual assembly work; the duty of the sixth was to keep the others supplied with parts.

The test room itself was an area divided from the main department by a wooden partition eight feet high. The girls sat in a row on one side of a long workbench. The bench and assembly equipment were identical with those used in the regular department, except in one respect. At the right of each girl's place was a hole in the bench, and into this hole she dropped completed relays. It was the entrance to a chute, in which there was a flapper gate opened by the relay in its passage downward. The opening of the gate closed an electrical circuit which controlled a perforating device, and this in turn recorded the completion of the relay by punching a hole in a tape. The tape moved at the rate of one-quarter of an inch a minute and had space for a separate row of holes for each operator. When punched, it thus constituted a complete output record for each

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records, arrange the work, and secure a co-operative spirit on the part of the girls. Later, when the complexity of his work increased, several assistants were assigned to help him.

When the arrangements had been made for the test room, the operators who had been chosen to take part were called in for an interview in the office of the superintendent of the Inspection Branch, who was in general charge of the experiment and of the researches which grew out of it. The superintendent described this interview as follows: "The nature of the test was carefully explained to these girls and they readily consented to take part in it, although they were very shy at the first conference. An invitation to six shop girls to come up to a superintendent's office was naturally rather startling. They were assured that the object of the test was to determine the effect of certain changes in working conditions, such as rest periods, midmorning lunches, and shorter working hours. They were expressly cautioned to work at a comfortable pace, and under no circumstances to try and make a race out of the test." This conference was only the first of many. Whenever any experimental change was planned, the girls were called in, the purpose of the change was explained to them, and their comments were requested. Certain suggested changes which did not meet with their approval were abandoned. They were repeatedly asked, as they were asked in the first interview, not to strain but to work "as they felt."

The experiment was now ready to begin. Put in its simplest terms, the idea of those directing the experiment was that if an output curve was studied for a long enough time under various changes in working conditions, it would be possible to determine which conditions were the most satisfactory. Accordingly, a number of so-called "experimental periods" were arranged. For two weeks before the operators were placed in the test room, a record was kept of the production of each one without her knowledge. In this way the investigators secured a measure of her productive ability while working in the regular department under the usual conditions. This constituted the first experimental period. And for five weeks after the girls entered the test room no change was made in working conditions. Hours remained what they had been before. The investigators felt that this period would be long

enough to reveal any changes in output incidental merely to the transfer. This constituted the second experimental period.

The third period involved a change in the method of payment. In the regular department, the girls had been paid according to a scheme of group piece-work, the group consisting of a hundred or more employees. Under these circumstances, variations in an individual's total output would not be immediately reflected in her pay, since such variations tended to cancel one another in such a large group. In the test room, the six operators were made a group by themselves. In this way each girl received an amount more nearly in proportion to her individual effort, and her interests became more closely centered on the experiment. Eight weeks later, the directly experimental changes began. An outline will reveal their general character: Period IV: two rest pauses, each five minutes in length, were established, one occurring in midmorning and the other in the early afternoon. Period V: these rest pauses were lengthened to ten minutes each. Period VI: six five-minute rests were established. Period VII: the company provided each member of the group with a light lunch in the midmorning and another in the midafternoon, accompanied by rest pauses. This arrangement became standard for subsequent Periods VIII through XI. Period VIII: work stopped a half-hour earlier every day—at 4:30 P.M. Period IX: work stopped at 4 P.M. Period X: conditions returned to what they were in Period VII. Period XI: a five-day work week was established. Each of these experimental periods lasted several weeks.

Period XI ran through the summer of 1928, a year after the beginning of the experiment. Already the results were not what had been expected. The output curve, which had risen on the whole slowly and steadily throughout the year, was obviously reflecting something other than the responses of the group to the imposed experimental conditions. Even when the total weekly output had fallen off, as it could hardly fail to do in such a period as Period XI, when the group was working only five days a week, daily output continued to rise. Therefore, in accordance with a sound experimental procedure, as a control on what had been done, it was agreed with the consent of the operators that in experimental Period XII a return should be made to the original

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conditions. There is such a thing as heat prostration. It means only that, within the limits in which these conditions were varying in the test room, they apparently did not affect the rate of work.

The question remains: With what facts, if any, can the changes in the output rate of the operators in the test room be correlated? Here the statements of the girls themselves are of the first importance. Each girl knew that she was producing more in the test room than she ever had in the regular department, and each said that the increase had come about without any conscious effort on her part. It seemed easier to produce at the faster rate in the test room than at the slower rate in the regular department. When questioned further, each girl stated her reasons in slightly different words, but there was uniformity in the answers in two respects. First, the girls liked to work in the test room; "it was fun." Secondly, the new supervisory relation or, as they put it, the absence of the old supervisory control, made it possible for them to work freely without anxiety.

For instance, there was the matter of conversation. In the regular department, conversation was in principle not allowed. In practice it was tolerated if it was carried on in a low tone and did not interfere with work. In the test room an effort was made in the beginning to discourage conversation, though it was soon abandoned. The observer in charge of the experiment was afraid of losing the co-operation of the girls if he insisted too strongly on this point. Talk became common and was often loud and general. Indeed, the conversation of the operators came to occupy an important place in the log. T. N. Whitehead has pointed out that the girls in the test room were far more thoroughly supervised than they ever had been in the regular department. They were watched by an observer of their own, an interested management, and outside experts. The point is that the character and purpose of the supervision were different and were felt to be so.

The operators knew that they were taking part in what was considered an important and interesting experiment. They knew that their work was expected to produce results—they were not sure what results—which would lead to the improvement of the working conditions of their fellow employees. They knew that the eyes of the company were upon them. Whitehead has further pointed out that

conditions of work, with no rest pauses, no special lunches, and a full-length working week. This period lasted for twelve weeks. Both daily and weekly output rose to a higher point than ever before: the working day and the working week were both longer. The hourly output rate declined somewhat but it did not approach the level of Period III, when similar conditions were in effect.

The conclusions reached after Period XII may be expressed in terms of another observation. Identical conditions of work were repeated in three different experimental periods: Periods VII, X, and XIII. If the assumptions on which the study was based had been correct, that is to say, if the output rate were directly related to the physical conditions of work, the expectation would be that in these three experimental periods there would be some similarity in output. Such was not the case. The only apparent uniformity was that in each experimental period output was higher than in the preceding one. In the Relay Assembly Test Room, as in the previous illumination experiments, something was happening which could not be explained by the experimentally controlled conditions of work.

There is no need here to go into the later history of the test room experiment, which came to an end in 1933. It is enough to say that the output of the group continued to rise until it established itself on a high plateau from which there was no descent until the time of discouragement and deepening economic depression which preceded the end of the test. The rough conclusions reached at the end of experimental Period XII were confirmed and sharpened by later research. T. N. Whitehead, Associate Professor of Business in the Graduate School of Business Administration, Harvard University, has made a careful statistical analysis of the output records. He shows that the changes which took place in the output of the group have no simple correlation with the experimental changes in working conditions. Nor can they be correlated with changes in other physical conditions of which records were kept, such as temperature, humidity, hours of rest, and changes of relay type. Even when the girls themselves complained of mugginess or heat, these conditions were not apparently affecting their output. This statement, of course, does not mean that there is never any relation between output rate and these physical

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although the experimental changes might turn out to have no physical significance, their social significance was always favorable. They showed that the management of the company was still interested, that the girls were still part of a valuable piece of research. In the regular department, the girls, like the other employees, were in the position of responding to changes the source and purpose of which were beyond their knowledge. In the test room, they had frequent interviews with the superintendent, a high officer of the company. The reasons for the contemplated experimental changes were explained to them. Their views were consulted and in some instances they were allowed to veto what had been proposed. Professor Mayo has argued that it is idle to speak of an experimental period like Period XII as being in any sense what it purported to be—a return to the original conditions of work. In the meantime, the entire industrial situation of the girls had been reconstructed.

Another factor in what occurred can only be spoken of as the social development of the group itself. When the girls went for the first time to be given a physical examination by the company doctor, someone suggested as a joke that ice cream and cake ought to be served. The company provided them at the next examination, and the custom was kept up for the duration of the experiment. When one of the girls had a birthday, each of the others would bring her a present, and she would respond by offering the group a box of chocolates. Often one of the girls would have some good reason for feeling tired. Then the others would "carry" her. That is, they would agree to work especially fast to make up for the low output expected from her. It is doubtful whether this "carrying" did have any effect, but the important point is the existence of the practice, not its effectiveness. The girls made friends in the test room and went together socially after hours. One of the interesting facts which has appeared from Whitehead's analysis of the output records is that there were times when variations in the output rates of two friends were correlated to a high degree. Their rates varied simultaneously and in the same direction—something, of course, which the girls were not aware of and could not have planned. Also, these correlations were destroyed by such apparently trivial events as a change in the order in which the girls sat at the work-bench.

Finally, the group developed leadership and a common purpose. The leader, self-appointed, was an ambitious young Italian girl who entered the test room as a replacement after two of the original members had left. She saw in the experiment a chance for personal distinction and advancement. The common purpose was an increase in the output rate. The girls had been told in the beginning and repeatedly thereafter that they were to work without straining, without trying to make a race of the test, and all the evidence shows that they kept this rule. In fact, they felt that they were working under less pressure than in the regular department. Nevertheless, they knew that the output record was considered the most important of the records of the experiment and was always closely scrutinized. Before long they had committed themselves to a continuous increase in production. In the long run, of course, this ideal was an impossible one, and when the girls found out that it was, the realization was an important element of the change of tone which was noticeable in the second half of the experiment. But for a time they felt that they could achieve the impossible. In brief, the increase in the output rate of the girls in the Relay Assembly Test Room could not be related to any changes in their physical conditions of work, whether experimentally induced or not. It could, however, be related to what can only be spoken of as the development of an organized social group in a peculiar and effective relation with its supervisors.

Many of these conclusions were not worked out in detail until long after the investigators at Hawthorne had lost interest in the Relay Assembly Test Room, but the general meaning of the experiment was clear at least as early as Period XII. A continuous increase in productivity had taken place irrespective of changing physical conditions of work. In the words of a company report made in January, 1931, on all the research which had been done up to that date: "Upon analysis, only one thing seemed to show a continuous relationship with this improved output. This was the mental attitude of the operators. From their conversations with each other and their comments to the test observers, it was not only clear that their attitudes were improving but it was evident that this area of employee reactions and feelings was a fruitful field for industrial research."

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In order to study, make a more detailed relations in a work interview material behavior of employees. Research decided that investigators remain in the former test room which would not be of experimentation men—nine wiremen—engaged banks for use in the out of their regular a special room. Other conditions of the room was installed simply to observe the Relay Assembly Test of the principal event it consisted large workers in answer condition. Later it range of entries, which useful in interpretation of the different work in the new test room the work of keeping an interviewer was was not, however, room but remained employees from time. No effort was made the ones ordinarily which the group carried that such a procedure change from a regular the experiment was the Bank Wiring existence seven months May, 1932.

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sum out of which the wages of all the men in the department were paid. Each individual was then assigned an hourly rate of pay, and he was guaranteed this amount in case he did not make at least as much on a piecework basis. The rate was based on a number of factors, including the nature of the job a worker was doing, his efficiency, and his length of service with the company. Records of the output of every worker were kept, and every six months there was a rate revision, the purpose of which was to make the hourly rates of the different workers correspond to their relative efficiency.

The hourly rate of a given employee, multiplied by the number of hours worked by him during the week, was spoken of as the daywork value of the work done by the employee. The daywork values of the work done by all the employees in the department were then added together, and the total thus obtained was subtracted from the total earnings credited to the department for the number of units of equipment assembled. The surplus, divided by the total daywork value, was expressed as a percentage. Each individual's hourly rate was then increased by this percentage, and the resulting hourly earnings figure, multiplied by the number of hours worked, constituted that person's weekly earnings.

Another feature of the system should be mentioned here. Sometimes a stoppage which was beyond the control of the workers took place in the work. For such stoppages the workers were entitled to claim time out, being paid at their regular hourly rates for this time. The reason why the employees were paid their hourly rate for such time and not their average hourly wages was a simple one. The system was supposed to prevent stalling. The employees could earn more by working than they could by taking time out. As a matter of fact, there was no good definition of what constituted a stoppage which was beyond the control of the workers. All stoppages were more or less within their control. But this circumstance was supposed to make no difference in the working of the system, since the assumption was that in any case the workers, pursuing their economic interests, would be anxious to keep stoppages at a minimum.

This system of payment was a complicated one, but it is obvious that there was a good logical reason

In order to study this kind of problem further, to make a more detailed investigation of social relations in a working group, and to supplement interview material with direct observation of the behavior of employees, the Division of Industrial Research decided to set up a new test room. But the investigators remembered what happened in the former test room and tried to devise an experiment which would not be radically altered by the process of experimentation itself. They chose a group of men—nine wiremen, three soldermen, and two inspectors—engaged in the assembly of terminal banks for use in telephone exchanges, took them out of their regular department and placed them in a special room. Otherwise no change was made in their conditions of work, except that an investigator was installed in the room, whose duty was simply to observe the behavior of the men. In the Relay Assembly Test Room a log had been kept of the principal events of the test. At the beginning it consisted largely of comments made by the workers in answer to questions about their physical condition. Later it came to include a much wider range of entries, which were found to be extremely useful in interpreting the changes in the output rate of the different workers. The work of the observer in the new test room was in effect an expansion of the work of keeping the log in the old one. Finally, an interviewer was assigned to the test room; he was not, however, one of the population of the room but remained outside and interviewed the employees from time to time in the usual manner. No effort was made to get output records other than the ones ordinarily kept in the department from which the group came, since the investigators felt that such a procedure would introduce too large a change from a regular shop situation. In this way the experiment was set up which is referred to as the Bank Wiring Observation Room. It was in existence seven months, from November, 1931, to May, 1932.

The method of payment is the first aspect of this group which must be described. It was a complicated form of group piecework. The department of which the workers in the observation room were a part was credited with a fixed sum for every unit of equipment it assembled. The amount thus earned on paper by the department every week made up the

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for every one of its features. An individual's earnings would be affected by changes in his rate or in his output and by changes in the output of the group as a whole. The only way in which the group as a whole could increase its earnings was by increasing its total output. It is obvious also that the experts who designed the system made certain implicit assumptions about the behavior of human beings, or at least the behavior of workers in a large American factory. They assumed that every employee would pursue his economic interest by trying to increase not only his own output but the output of every other person in the group. The group as a whole would act to prevent slacking by any of its members. One possibility, for instance, was that by a few weeks' hard work an employee could establish a high rate for himself. Then he could slack up and be paid out of all proportion with the amount he actually contributed to the wages of the group. Under these circumstances, the other employees were expected to bring pressure to bear to make him work harder.

Such was the way in which the wage incentive scheme ought to have worked. The next question is how it actually did work. At first the workers were naturally suspicious of the observer, but when they got used to him and found that nothing out of the ordinary happened as a result of his presence in the room, they came to take him for granted. The best evidence that the employees were not distrustful of the observer is that they were willing to talk freely to him about what they were doing, even when what they were doing was not strictly in accord with what the company expected. Conversation would die down when the group chief entered the room, and when the foreman or the assistant foreman entered everyone became serious. But no embarrassment was felt at the presence of the observer. To avoid misunderstanding, it is important to point out that the observer was in no sense a spy. The employees were deliberately and obviously separated from their regular department. The observer did not, and could not, pass himself off as one of them. And if only from the fact that a special interviewer was assigned to them, the members of the group knew they were under investigation.

The findings reached by the observer were more detailed but in general character the same as those

which had emerged from the early interviews of other groups. Among the employees in the observation room there was a notion of a proper day's work. They felt that if they had wired two equipments a day they had done about the right amount. Most of the work was done in the morning. As soon as the employees felt sure of being able to finish what they considered enough for the day, they slacked off. This slacking off was naturally more marked among the faster than among the slower workmen.

As a result, the output graph from week to week tended to be a straight line. The employees resorted to two further practices in order to make sure that it should remain so. They reported more or less output than they performed and they claimed more daywork allowances than they were entitled to. At the end of the day, the observer would make an actual count of the number of connections wired—something which was not done by the supervisors—and he found that the men would report to the group chief sometimes more and sometimes less work than they actually had accomplished. At the end of the period of observation, two men had completed more than they ever had reported, but on the whole the error was in the opposite direction. The theory of the employees was that excess work produced on one day should be saved and applied to a deficiency on another day. The other way of keeping the output steady was to claim excessive daywork allowance. The employees saw that the more daywork they were allowed, the less output they would have to maintain in order to keep the average hourly output rate steady. The claims for daywork allowance were reported by the men to their group chief, and he, as will be seen, was in no position to make any check. These practices had two results. In the first place, the departmental efficiency records did not represent true efficiency, and therefore decisions as to grading were subject to errors of considerable importance. In the second place, the group chief was placed in a distinctly awkward position.

The findings of the observer were confirmed by tests which were made as a part of the investigation. Tests of intelligence, finger dexterity, and other skills were given to the workers in the room, and the results of the tests were studied in order to discover whether there was any correlation between output on the one hand and earnings, intelligence, or finger

dexterity on the one hand. The results of these tests were not. The only correlation was that the native intelligence of the group.

Obviously the working in the next question is section, the observer developed an interest in the group. It had been revealed by the foreman who saw the Bank Wiring and had worked with them. They asked him if he chose all the men in their work that were thrown to the friendships sprang from cliques were formed. It showed itself in the unevenness, in the different off-hours, and so on.

What is important in the observation is common. They found that a person if he did, he was if an excessive amount of management work the employees did more work for a longer time. On the other hand, a person who did not work. If he did, getting paid for it, say nothing which the group. If he was a member of the group.

The working of enforcing rules who devised the system that the group was slower workers increase the earnings something like that brought pressure on workers but upon contributed most



pressure was brought to bear in various ways. One of them was "binging." If one of the employees did something which was not considered quite proper, one of his fellow workers had the right to "bing" him. Binging consisted of hitting him a stiff blow on the upper arm. The person who was struck usually took the blow without protest and did not strike back. Obviously the virtue of binging as punishment did not lie in the physical hurt given to the worker but in the mental hurt that came from knowing that the group disapproved of what he had done. Other practices which naturally served the same end were sarcasm and the use of invectives. If a person turned out too much work, he was called names, such as "Speed King" or "The Slave."

It is worth while pointing out that the output of the group was not considered low. If it had been, some action might have been taken, but in point of fact it was perfectly satisfactory to the management. It was simply not so high as it would have been if fatigue and skill had been the only limiting factors. In the matter of wage incentives, the actual situation was quite different from the assumptions made by the experts. Other activities were out of line in this way. The wiremen and the soldermen did not stick to their jobs; they frequently traded them. This was forbidden, on the theory that each employee ought to do his own work because he was more skilled in that work. There was also much informal helping of one man by others. In fact, the observation of this practice was one means of determining the cliques into which the group was divided. A great many things, in short, were going on in the observation room which ought not to have been going on. For this reason it was important that no one should "sneak" on the men.

A group chief was in immediate charge of the employees. He had to see that they were supplied with parts and that they conformed to the rules and standards of the work. He could reprimand them for misbehavior or poor performance. He transmitted orders to the men and brought their requests before the proper authorities. He was also responsible for reporting to the foreman all facts which ought to come to his attention. The behavior of the employees put him in an awkward position. He was perfectly well aware of the devices by which they maintained their production at a constant level. But he was

dexterity on the other. The studies showed that there was not. The output was apparently not reflecting the native intelligence or dexterity of the members of the group.

Obviously the wage incentive scheme was not working in the way it was expected to work. The next question is why it was not working. In this connection, the observer reported that the group had developed an informal social organization, such as had been revealed by earlier investigations. The foreman who selected the employees taking part in the Bank Wiring Observation Room was co-operative and had worked with the investigators before. They asked him to produce a normal group. The men he chose all came out of the same regular shop department, but they had not been closely associated in their work there. Nevertheless, as soon as they were thrown together in the observation room, friendships sprang up and soon two well-defined cliques were formed. The division into cliques showed itself in a number of ways: in mutual exclusiveness, in differences in the games played during off-hours, and so forth.

What is important here is not what divided the men in the observation room but what they had in common. They shared a common body of sentiments. A person should not turn out too much work. If he did, he was a "rate-buster." The theory was that if an excessive amount of work was turned out, the management would lower the piecework rate so that the employees would be in the position of doing more work for approximately the same pay. On the other hand, a person should not turn out too little work. If he did, he was a "chiseler"; that is, he was getting paid for work he did not do. A person should say nothing which would injure a fellow member of the group. If he did, he was a "squealer." Finally, no member of the group should act officiously.

The working group had also developed methods of enforcing respect for its attitudes. The experts who devised the wage incentive scheme assumed that the group would bring pressure to bear upon the slower workers to make them work faster and so increase the earnings of the group. In point of fact, something like the opposite occurred. The employees brought pressure to bear not upon the slower workers but upon the faster ones, the very ones who contributed most to the earnings of the group. The

interviews of the observation day's work. equipments a amount. Most of us soon as the nished what they nked off. This ed among the n. week to week oyes resorted ake sure that it and had worked with the investigators before. They asked him to produce a normal group. The men he chose all came out of the same regular shop department, but they had not been closely associated in their work there. Nevertheless, as soon as they were thrown together in the observation room, friendships sprang up and soon two well-defined cliques were formed. The division into cliques showed itself in a number of ways: in mutual exclusiveness, in differences in the games played during off-hours, and so forth.

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able to do very little to bring about a change. For instance, there was the matter of claims for daywork allowance. Such claims were supposed to be based on stoppages beyond the control of the workers, but there was no good definition of what constituted such stoppages. The men had a number of possible excuses for claiming daywork allowance: defective materials, poor and slow work on the part of other employees, and so forth. If the group chief checked up on one type of claim, the workers could shift to another. In order to decide whether or not a particular claim was justified, he would have to stand over the group all day with a stop watch. He did not have time to do that, and in any case refusal to honor the employees' claims would imply doubt of their integrity and would arouse their hostility. The group chief was a representative of management and was supposed to look after its interests. He ought to have put a stop to these practices and reported them to the foreman. But if he did so, he would, to use the words of a short account of the observation room by Roethlisberger and Dickson, "lose sympathetic control of his men, and his duties as supervisor would become much more difficult."<sup>2</sup> He had to associate with the employees from day to day and from hour to hour. His task would become impossible if he had to fight a running fight with them. Placed in this situation, he chose to side with the men and report unchanged their claims for daywork. In fact there was very little else he could do, even if he wished. Moreover he was in a position to protect himself in case of trouble. The employees always had to give him a reason for any daywork claims they might make, and he entered the claims in a private record book. If anyone ever asked why so much daywork was being claimed, he could throw the blame wherever he wished. He could assert that materials had been defective or he could blame the inspectors, who were members of an outside organization. In still another respect, then, the Bank Wiring Observation Room group was not behaving as the logic of management assumed that it would behave.

Restriction of output is a common phenomenon of industrial plants. It is usually explained as a highly logical reaction of the workers. They have increased their output, whereupon their wage rates for piecework have been reduced. They are doing

more work for the same pay. They restrict their output in order to avoid a repetition of this experience. Perhaps this explanation holds good in some cases, but the findings of the Bank Wiring Observation Room suggest that it is too simple. The workers in the room were obsessed with the idea that they ought to hold their production level "even" from week to week, but they were vague as to what would happen if they did not. They said that "someone" would "get them." If they turned out an unusually high output one week, that record would be taken thereafter as an example of what they could do if they tried, and they would be "bawled out" if they did not keep up to it. As a matter of fact, none of the men in the room had ever experienced a reduction of wage rates. What is more, as Roethlisberger and Dickson point out, "changes in piece rates occur most frequently where there is a change in manufacturing process, and changes in manufacturing process are made by engineers whose chief function is to reduce unit cost wherever the saving will justify the change. In some instances, changes occur irrespective of direct labor cost. Moreover, where labor is a substantial element, reduction of output tends to increase unit costs and instead of warding off a change in the piece rate may actually induce one."

What happened in the observation room could not be described as a logical reaction of the employees to the experience of rate reduction. They had in fact had no such experience. On the other hand, the investigators found that it could be described as a conflict between the technical organization of the plant and its social organization. By technical organization the investigators meant the plan, written or unwritten, according to which the Hawthorne plant was supposed to operate, and the agencies which gave effect to that plan. The plan included explicit rules as to how the men were to be paid, how they were to do their work, what their relations with their supervisors ought to be. It included also implicit assumptions on which the rules were based, one of the assumptions being that men working in the plant would on the whole act so as to further their economic interests. It is worth while pointing out that this assumption was in fact implicit, that the experts who devised the technical organization acted upon the assumption without ever stating it in so many words.

There exist within the plant a certain type of men. To some it was not. For according to the men concerned did it seem to them to behave.

The investigation between the technical organization and the social organization of the plant is a constant making changes. Roethlisberger and Dickson point out, "changes in piece rates occur most frequently where there is a change in manufacturing process, and changes in manufacturing process are made by engineers whose chief function is to reduce unit cost wherever the saving will justify the change. In some instances, changes occur irrespective of direct labor cost. Moreover, where labor is a substantial element, reduction of output tends to increase unit costs and instead of warding off a change in the piece rate may actually induce one."

Once the response to a certain change occurs, and this order is to be maintained, the appropriate action being taken in which the investigation is carried out and action is taken. What happens when the workers are actually doing their work and Dickson make it clear that the worker occupies a position in the organization. He is at the organization. He is to accommodate his activities. It is not originate. Although the technical organization is affected by the decisions of the workers.



nature of things he is unable to share management's preoccupations, and management does little to convince him that what he considers important is being treated as important at the top—a fact which is not surprising, since there is no adequate way of transmitting to management an understanding of the considerations which seem important at the work level. There is something like a failure of communication in both directions—upward and downward.

The worker is not only "asked to accommodate himself to changes which he does not initiate, but also many of the changes deprive him of those very things which give meaning and significance to his work." The modern industrial worker is not the handicraftsman of the medieval guild. Nevertheless, the two have much in common. The industrial worker develops his own ways of doing his job, his own traditions of skill, his own satisfactions in living up to his standards. The spirit in which he adopts his own innovations is quite different from that in which he adopts those of management. Furthermore, he does not do his work as an isolated human being, but always as a member of a group, united either through actual co-operation on the job or through association in friendship. One of the most important general findings of the Western Electric researches is the fact that such groups are continually being formed among industrial workers, and that the groups develop codes and loyalties which govern the relations of the members to one another. Though these codes can be quickly destroyed, they are not formed in a moment. They are the product of continued, routine interaction between men. "Constant interference with such codes is bound to lead to feelings of frustration, to an irrational exasperation with technical change in any form, and ultimately to the formation of a type of employee organization such as we have described—a system of practices and beliefs in opposition to the technical organization." The Bank Wiring Observation Room seemed to show that action taken in accordance with the technical organization tended to break up, through continual change, the routines and human associations which gave work its value. The behavior of the employees could be described as an effort to protect themselves against such changes, to give management the least possible opportunity of interfering with them. When they said that if they increased

There existed also an actual social situation within the plant: groups of men, who were associated with one another, held common sentiments and had certain relations with other groups and other men. To some extent this social organization was identical with the technical plan and to some extent it was not. For instance, the employees were paid according to group payment plans, but the groups concerned did not behave as the planners expected them to behave.

The investigators considered the relations between the technical organization and the social. A certain type of behavior is expected of the higher levels of management. Their success is dependent on their being able to devise and institute rapid changes. Roethlisberger and Dickson describe what happens in the following terms: "Management is constantly making mechanical improvements and instituting changes designed to reduce costs or improve the quality of the product. It is constantly seeking new ways and new combinations for increasing efficiency, whether in designing a new machine, instituting a new method of control, or logically organizing itself in a new way." The assumption has often been made that these changes are designed to force the employee to do more work for less money. As a matter of fact, many of them have just the opposite purpose: to improve the conditions of work and enable the employee to earn higher wages. The important point here, however, is not the purpose of the changes but the way in which they are carried out and accepted.

Once the responsible officer has decided that a certain change ought to be made, he gives an order, and this order is transmitted "down the line," appropriate action being taken at every level. The question in which the investigators were interested was this: What happens when the order reaches the men who are actually doing the manual work? Roethlisberger and Dickson make the following observations: "The worker occupies a unique position in the social organization. He is at the bottom of a highly stratified organization. He is always in the position of having to accommodate himself to changes which he does not originate. Although he participates least in the technical organization, he bears the brunt of most of its activities." It is he, more than anyone, who is affected by the decisions of management, yet in the

restrict their of this experi- good in some Bank Wiring o simple. The with the idea n level "even" id that "some- out an unusu- ord would be they could do ed out" if they ct, none of the a reduction of thisberger and rates occur ge in manufac- chief function ing will justify zes occur irre- r, where labor output tends to warding off a induce one." room could not the employees they had in fact ther hand, the described as a zation of the technical orga- plan, written or awthorne plant agencies which cluded explicit paid, how they tions with their also implicit based, one of ing in the plant ) further their le pointing out implicit, that the organization acted stating it in so



their output, "something" was likely to happen, a process of this sort was going on in their minds. But the process was not a conscious one. It is important to point out that the protective function of informal organization was not a product of deliberate planning. It was more in the nature of an automatic response. The curious thing is that, as Professor Mayo pointed out to the Committee, these informal organizations much resembled formally organized labor unions, although the employees would not have recognized the fact.

Roethlisberger and Dickson summarize as follows the results of the intensive study of small groups of employees: "According to our analysis the uniformity of behavior manifested by these groups was the outcome of a disparity in the rates of change possible in the technical organization, on the one hand, and in the social organization, on the other. The social sentiments and customs of work of the employees were unable to accommodate themselves to the rapid technical innovations introduced. The result was to incite a blind resistance to all innovations and to provoke the formation of a social organization at a lower level in opposition to the technical organization."

It is curious how, at all points, the Relay Assembly Test Room and the Bank Wiring Observation Room form a contrast. In the former, the girls said that they felt free from the pressure of supervision, although as a matter of fact they were far more thoroughly supervised than they ever had been in their regular department. In the latter, the men were afraid of supervision and acted so as to nullify it. The Bank Wiremen were in the position of having to respond to technical changes which they did not originate. The Relay Assemblers had

periodic conferences with the superintendent. They were told what experimental changes were contemplated; their views were canvassed, and in some instances they were allowed to veto what had been proposed. They were part of an experiment which they felt was interesting and important. Both groups developed an informal social organization, but while the Bank Wiremen were organized in opposition to management, the Relay Assemblers were organized in co-operation with management in the pursuit of a common purpose. Finally, the responses of the two groups to their industrial situation were, on the one hand, restriction of output and, on the other, steady and welcome increase of output. These contrasts carry their own lesson.

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## NOTES

1. This research has been described in detail in a number of papers and in at least three books. The books are:

E. Mayo, "The Human Problems of an Industrial Civilization," The Macmillan Company, New York, 1933.

T. N. Whitehead, "The Industrial Worker," (2 vols.), Harvard University Press, Cambridge, 1938.

F. J. Roethlisberger and W. J. Dickson, "Management and the Worker," Harvard University Press, Cambridge, 1939.

2. F. J. Roethlisberger and W. J. Dickson, "Management and the Worker," Harvard Business School: Division of Research, Business Research Studies, No. 9 (a monograph). (All quotations relating to the Western Electric researches are from this study as well as from the book of the same title by the same authors.)

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