The Hawthorne experiments were groundbreaking studies in human relations that were conducted between 1924 and 1932 at Western Electric Company's Hawthorne Works in Chicago. Originally designed as illumination studies to determine the relationship between lighting and productivity, the initial tests were sponsored by the National Research Council (NRC) of the National Academy of Sciences. In 1927 a research team from the Harvard Business School was invited to join the studies after the illumination tests drew unanticipated results. Two additional series of tests, the relay-assembly tests and the bank-wiring tests, followed the illumination tests. The studies assumed the label Hawthorne experiments or studies from the location of the Western Electric plant. Concluded by 1932, the Hawthorne studies, with emphasis on a new interpretation of group behavior, were the basis for the school of human relations.

 ILLUMINATION TESTS

 In the early 1920s Chicago's Western Electric Hawthorne Works employed 12,000 workers. The plant was a primary manufacturer of telephones, and in 1924 the company provided a site to cooperate with the NRC on a series of test room studies to determine the relationship between illumination and worker efficiency. The basic idea was to vary and record levels of illumination in a test room with the expectation that as lighting was increased, productivity would too. In another test room, illumination was decreased, with the correlating expectation that efficiency would decrease. The electric power industry provided an additional impetus for these tests, hoping to encourage industries to use artificial lighting in place of natural light. The Illuminating Engineering Society's Committee on Research also supported the tests and cooperated with the NRC. From the fall of 1924 to the spring of 1927, three series of tests were conducted and carefully monitored. Three departments at the Hawthorne plant were involved—relay assembling, coil winding, and inspection. Workers were notified of the tests in order to attempt to control interference from human factors. When production increased in each test period, researchers looked to other factors such as increased supervision and a sense of competition that developed between the test and control groups. But the one conclusion the impressive team of industrial specialists and academics discovered was the lack of a consistent correlation between lighting levels and product output. No further tests were planned originally, but researchers were surprised at the unanticipated results.

 NRC representatives and the engineers involved drew several conclusions. First, illumination was one factor in output but not the most important. More important to the tests was the realization there was not a simple answer to the issue of illumination and worker productivity and that other factors that were not controlled presented a problem with the test results—the issue of human factors. In retrospect, researchers from the NRC and the Illuminating Engineering Society (which together formed the Committee on Industrial Lighting) stated they were not surprised by the test results. They even predicted that other factors would affect the results, but their mandate was to isolate other variables, and the Hawthorne studies continued.

 RELAY-ASSEMBLY TESTS

 In order to observe the impact of these other factors, a second set of tests was begun before the completion of the illumination studies on April 25, 1987. The relay-assembly tests were designed to evaluate the effect rest periods and hours of work would have on efficiency. Researchers hoped to answer a series of questions concerning why output declined in the afternoon: Did the operators tire out? Did they need brief rest periods? What was the impact of changes in equipment? What were the effects of a shorter work day? What role did worker attitudes play? Hawthorne engineers led by George Pennock were the primary researchers for the relay-assembly tests, originally intended to take place for only a few months. Six women operators volunteered for the study and two more joined the test group in January 1928. They were administered physical examinations before the studies began and then every six weeks in order to evaluate the effects of changes in working conditions on their health. The women were isolated in a separate room to assure accuracy in measuring output and quality, as temperature, humidity, and other factors were adjusted. The test subjects constituted a piece-work payment group and efforts were made to maintain steady work patterns. The Hawthorne researchers attempted to gain the women's confidence and to build a sense of pride in their participation. A male observer was introduced into the test room to keep accurate records, maintain cordial working conditions, and provide some degree of supervision. The women were employed in assembling relays or electromagnetic switches used in switching telephone calls automatically. The women assembled the more than 35 parts of the relay by hand. The relays were then carefully inspected. The entire process was highly labor intensive and the speed of assembly had an obvious effect on productivity.

 Initially the women were monitored for productivity, then they were isolated in a test room. Finally, the workers began to participate in a group payment rate, where extra pay for increased productivity was shared by the group. The other relay assemblers did not share in any bonus pay, but researchers concluded this added incentive was necessary for full cooperation. This single difference has been historically criticized as the one variable having the greatest significance on test results. These initial steps in the relay-assembly studies lasted only three months. In August, rest periods were introduced and other changes followed over the rest of the test period, including shortened work days and weeks. As the test periods turned from months into years, worker productivity continued to climb, once again providing unexpected results for the Hawthorne team to evaluate.

 Productivity increased in excess of 30 percent over the first two and-a-half years of the studies and remained steady for the duration of the tests. The physicals indicated improved worker health and absenteeism decreased. By their own testimony, the women expressed increased satisfaction with all aspects of their jobs. Researchers tentatively concluded that performance and efficiency improved because of the rest periods, relief from monotonous working conditions, the wage incentive, and the type of supervision provided in the test environment. After additional study and consideration, the first two factors were rejected and further tests were conducted in an attempt to verify the effects of incentives and working conditions. The results were still not totally conclusive. Finally, researchers realized worker attitudes within the group were influential as was the more personal atmosphere of the test room. They concluded factors such as lighting, hours of work, rest periods, bonus incentives, and supervision affected workers, but the attitudes of the employees experiencing the factors were of greater significance. As a result, the Hawthorne team decided not to pursue similar studies. Almost as significant during the relay assembly tests was the introduction of a team of academics from the Harvard Business School into the experiments. Led by professors Elton Mayo and F. J. Roethlisberger, this new group of researchers would have an enormous impact on the Hawthorne studies and the future of human relations in the workplace.

 Mayo's contributions became increasingly significant in the experiments during the interviewing stages of the tests. Early results from the illumination tests and the relay-assembly tests led to surveys of worker attitudes, surveys not limited to test participants. From 1928 to 1931, more than 21,000 individuals were interviewed to survey worker morale in an attempt to determine specific features of their jobs workers either liked or disliked. The objective was to identify areas where reasonable improvements might lead to greater job satisfaction and thus increased efficiency and productivity.

 The initial conclusions were disappointing. Interviewers looked for factors concerning job satisfaction, working conditions, and supervision. What they found was a complex battery of attitudes influenced by outside factors such as conditions at home or within the community, as well as one's social situation at work. Researchers began to conclude that prior life experience had an important influence on worker attitudes, and that manipulation of lighting, pay, supervision, and working conditions could not solely bring about a desired change. The one consistent conclusion was that employees felt more positive about the work environment when an interviewer or listener showed interest. This interviewing technique, the nondirective method, proved useful to later researchers at Hawthorne and eventually led to an employee counseling program, now widely practiced in personnel management circles.

 BANK-WIRING TESTS

 The final stage of the studies was the bank-wiring tests, which began in November 1931. The foreman of the bank-wiring department resisted the intrusion of observers into his work space and a bank-wiring test room was set up. The test room housed nine wirers, three solderers, and two inspectors. All were male between the ages of 20 and 25. Their job was to wire conductor banks, a repetitive and monotonous task. The banks were one of the major components of automatic telephone exchange. Between 3,000 and 6,000 terminals had to be wired for a set of banks. The work was tiring and required the workers to stand for long periods of time. Pay incentives and productivity measures were removed, but a researcher was placed into the test room as an observer and the workers were interviewed. The purpose of the bank-wiring tests was to observe and study social relationships and social structures within a group, issues raised by two other significant members of the research team, W. Lloyd Warner and William J. Dickson. Warner was on Mayo's Harvard team, trained as an anthropologist and primarily interested in Hawthorne from an entirely different perspective, that of an observer of the social behavior of a group. Dickson was a Hawthorne employee, with an even keener interest in the tests than the Harvard team; he remained with the company until retiring in 1969. Their contributions were to adapt social anthropology research methods to industrial conditions. Dickson conducted the interview phase of the tests. Perhaps the most revealing aspect of the bank-wiring tests was that the workers combined to slow down production—a clear indication of the need for analysis of the social relationships of workers. Research showed the most admired worker among the group was the one who demonstrated the greatest resentment of authority by slowing down production the most.

 The bank-wiring tests were shut down in the spring of 1932 in reaction to layoffs brought on by the deepening depression. Layoffs were gradual, but by May the bank-wiring tests were concluded. These tests were intended to study the group as a functioning unit and observe its behavior. The study findings confirmed the complexity of group relations and stressed the expectations of the group over an individual's preference. The conclusion was to tie the importance of what workers felt about one another to worker motivation. Industrial plants were a complex social system with significant informal organizations that played a vital role in motivating workers. Employees had physical as well as social needs, and the company gradually developed a program of human relations including employee counseling and improved supervision with an emphasis on the individual workers. The results were a reinterpretation of industrial group behavior and the introduction of what has become human relations.

 **THE HAWTHORNE LEGACY**

 The Hawthorne studies were conducted in three independent stages—the illumination tests, the relay-assembly tests, and the bank-wiring tests. Although each was a separate experiment, the second and third each developed out of the preceding series of tests. Neither Hawthorne officials nor NRC researchers anticipated the duration of the studies, yet the conclusions of each set of tests and the Hawthorne experiments as a whole are the legacy of the studies and what sets them apart as a significant part of the history of industrial behavior and human relations.

 The tests challenged prior assumptions about worker behavior. Workers were not motivated solely by pay. The importance of individual worker attitudes on behavior had to be understood. Further, the role of the supervisor in determining productivity and morale was more clearly defined. Group work and behavior were essential to organizational objectives and tied directly to efficiency and, thus, to corporate success. The most disturbing conclusion emphasized how little the researchers could determine about informal group behavior and its role in industrial settings. Finally, the Hawthorne studies proved beyond certainty that there was a great deal more to be learned about human interactions in the workplace, and academic and industrial study has continued in an effort to understand these complex relationships.

 Beyond the legacy of the Hawthorne studies has been the use of the term "Hawthorne effect" to describe how the presence of researchers produces a bias and unduly influences the outcome of the experiment. In addition, several important published works grew out of the Hawthorne experience, foremost of which was Mayo's The Human Problems of an Industrial Civilization and Roethlisberger and Dickson's Management and the Worker. Other books focused on the various parts of the experiments, and researchers have written countless analyses and histories of the Hawthorne studies.

 The Hawthorne studies have been described as the most important social science experiment ever conducted in an industrial setting, yet the studies were not without their critics. Several criticisms, including those of sociologist Daniel Bell, focused on the exclusion of unionized workers in the studies. Sociologists and economists were the most commanding critics, defending their disciplinary turf more than offering serious criticisms. For his part, Mayo called into question research findings of both economists and psychologists. More serious questions were raised by social scientists who termed the studies bad science due to Mayo's conservative views. Others expressed serious concerns about undue pressure from corporate interests and called Mayo and his colleagues "servants of power." Despite these critical views, the flow of writings on the Hawthorne studies attests to their lasting influence and the fascination the tests have held for researchers. The studies had the impact of defining clearly the human relations school. Another contribution was an emphasis on the practice of personnel counseling. Industrial sociology owes its life as a discipline to the studies done at the Hawthorne site. This, in part, led to the enormous growth of academic programs in organizational behavior at American colleges and universities, especially at the graduate level.

FURTHER READING:

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