DANIEL NELSON

I Scientific Management in Retrospect

In January 1912, Frederick W. Taylor, the center of a highly publicized controversy over the effects of “scientific management,” testified before a House of Representatives committee investigating his handiwork. His first objective, he explained, was to “sweep away a good deal of rubbish.” Scientific management was “not any efficiency device. . . . It is not a new system of figuring costs; it is not a new system of paying men. . . it is not holding a stop watch on a man . . . it is not time study; it is not motion study. . . .” In fact, it was “not any of the devices which the average man calls to mind when scientific management is spoken of.” On the contrary, it was “a complete mental revolution on the part of the workingman” and an “equally complete mental revolution on the part of those on management’s side. . . . And without this complete mental revolution on both sides scientific management does not exist.”

Taylor’s identification of scientific management with a “mental revolution” had several purposes. It was the culminating step in a long campaign to sell his approach to industrial management as a system rather than a series of palliatives for specific problems. It was also a defense against criticisms that had arisen from piecemeal installations and the association of scientific management with hostility to unions. Finally, it emphasized a point that Taylor

The author gratefully acknowledges the comments and suggestions of K. Austin Kerr, Patrick Fridenson, Heidrun Homburg, Barbara Clements, Eisuke Daito, and the authors of the other essays in this volume.
himself had only recently begun to articulate: that successful management depended on ideas that were applicable to many different kinds of organizations. Taylor's imagery evoked an enthusiastic response from engineers and factory managers and from a larger group whose interests extended to virtually every institution. From this point scientific management was both a detailed plan for improving the operations of a plant or office and a set of prescriptions for improving any activity. Its popularity underlined the significance of Taylor's metaphor.

Taylor and the Origins of Scientific Management

The journey that ultimately led Taylor to define his work as "a complete mental revolution" was long and arduous. It included experiences in a variety of industrial enterprises, involvement in the emerging engineering profession and in the existing management movement, and associations with a corps of associates who disseminated the Taylor system.

The events of Taylor's early years played a large and controversial part in these activities. Born in 1856 into an aristocratic Philadelphia family, Taylor had the benefit of tutors and exclusive schools, extended travel, and associations with the Philadelphia elite. After attending Phillips Exeter Academy, he rejected a university education in favor of a traditional apprenticeship and an industrial career, which began in the machine shop of the Midvale Steel Company in 1878. He rose rapidly, thanks to ability and hard work and to close personal ties with the Clark family, the principal owners of Midvale. In 1885, after receiving an engineering degree via correspondence courses from the Stevens Institute of Technology, he became the company's chief engineer. His prospects of rising still further received a severe jolt the following year when the Clarks sold Midvale to a local industrialist who had a son of similar age and experience. As a result, Taylor resigned in 1889 to head a company that a group of New York financiers had organized to exploit a novel paper-making process. This experience proved to be equally frustrating. The new technology was defective, the company lost money, and Taylor and his wife were unhappy in the Maine frontier town where they had to live. With considerable bitterness, Taylor left in 1893 to become a self-employed consultant.
By that time he had taken important steps toward a new role. He had a substantial reputation as an inventor of industrial machinery and broad experience as an industrial manager. He had also undertaken several experiments that forced him to think more explicitly about organizations and people. One of these, an effort to compute operating times for machine tools with a stopwatch, would evolve into time and motion study, his signature contribution to industrial management.

Most of all, Taylor had become associated with two enterprises that were reshaping the industrial environment. The first was the rapidly maturing engineering profession, whose advocates sought an identity based on rigorous formal education, frequent contact, mutually accepted standards of behavior, and social responsibility. In factories, mines, and railroad yards, they rejected the empiricism of the practitioner for scientific experimentation and analysis. They acknowledged the primacy of the profit motive, but they insisted that reason and truth were essential to continued financial success. The second, closely related development was the systematic management movement, an effort among engineers and sympathizers to substitute administrative systems for the informal methods of industrial management that had evolved with the factory system. Systematic management was a rebellion against tradition, empiricism, and the assumption that common sense, personal relationships, and craft knowledge were sufficient to run a small factory. In the large, capital intensive, technologically advanced operations of the late nineteenth century, “rule-of-thumb” methods resulted in confusion and waste. The revisionists’ answer was to replace traditional managers with engineers and to substitute managerial systems for guesswork and ad hoc evaluations.

By the time Taylor began his career as an engineer and manager, cost accounting systems, methods for planning and scheduling production and organizing materials, and incentive wage plans were staples of engineering publications and trade journals. Their objective was an unimpeded flow of materials and information. In human terms, proponents of systematic management sought to transfer power from the first-line supervisor to the plant manager and to force all employees to pay greater attention to the manager’s goals. Most threatening, perhaps, they advocated decisions based on performance rather than on personal qualities and associations.
In the 1890s, Taylor became the most ambitious and vigorous proponent of systematic management. As a consultant he introduced accounting systems that permitted managers to use operating records to guide their actions, production control systems that allowed managers to know more precisely what was happening on the shop floor, piece rate systems that encouraged workers to follow orders and instructions, and related measures. In 1895 he employed a colleague, Sanford E. Thompson, to continue his time study research with the goal of calculating standards for various occupations that would be published and sold to employers. Between 1898 and 1901, as a consultant to the Bethlehem Iron Company, Taylor introduced all of his systems and vigorously pursued his research. This experience, punctuated by controversy and escalating conflict with the company's managers, was the capstone of his creative career. Two developments were of special importance. Taylor's discovery of "high speed steel," which improved the performance of metal cutting tools, assured his fame as an inventor. In addition, his effort to introduce systematic methods in many areas of the company's operations forced him to develop an integrated view of managerial innovation and a broader conception of the manager's role. By 1901 Taylor had fashioned scientific management from systematic management.

As the events of Taylor's career make clear, the two approaches were intimately related. Systematic and scientific management had common roots, attracted the same kinds of people, and had the same business objectives. Yet in retrospect the differences stand out. Systematic management was diffuse and utilitarian, a series of isolated measures that did not add up to a larger whole or have recognizable implications beyond day-to-day industrial operations. Scientific management added significant detail and a larger view. In 1901, when he left Bethlehem, Taylor resolved to devote his time and ample fortune to promoting both. His first report on his work, "Shop Management" (1903), portrayed an integrated complex of systematic management methods, supplemented by refinements and additions like time study.

At first Taylor was disappointed with the response to his work. He could talk about a larger, integrated conception of management but most manufacturers wanted solutions to specific problems. Furthermore, their preoccupation with the particulars, notably time study and incentive wage plans, threatened more
serious difficulties. Many machine shop owners, for example, introduced time study and an incentive wage to raise output and wean employees from the International Association of Machinists (IAM) and other trade unions. Taylor and his followers, who had little sympathy for unions, were slow to realize the dangers of this course. By 1910 the IAM and the American Federation of Labor (AFL) had become implacable enemies of scientific management and Taylor was embroiled in a public controversy that would haunt him for the rest of his life.\(^9\)

Taylor responded to these problems with two tactical adjustments. First, he began to rely more heavily on anecdotes from his career—"object lessons"—to convey his message to audiences that had little interest in technical detail. Taylor liberally interpreted his experiences to make his point. Thus the tale of "Schmidt," the oxlike Bethlehem laborer whose stupidity Taylor had supposedly overcome with an incentive wage, was largely apocryphal.\(^10\)

Second, apart from the object lessons, Taylor spoke less about factory operations and more about the significance and general applicability of his ideas. Between 1907 and 1909, with the aid of one of his shrewdest associates, Morris L. Cooke, he wrote a sequel to "Shop Management" that ultimately became *The Principles of Scientific Management* (1911). Rather than discuss the specific methods he introduced in factories and shops, Taylor used colorful stories and language to illuminate "principles" of management. To suggest the integrated character and broad applicability of scientific management, he equated it with a "complete mental revolution."\(^11\)

Taylor's reformulation of scientific management as a series of principles and as a mental revolution made him a celebrity. "Shop Management" had reached an audience of engineers and industrialists; the *Principles* potentially appealed to everyone. Building on the momentum of other efficiency movements devoted to natural resource conservation, improved government service, more effective education, and similar goals, Taylor invited readers to extrapolate.\(^12\) How did scientific management apply to their circumstances? Could they duplicate Taylor's successes? What were the possibilities of rational organization, time study, and material incentives? What costs could they anticipate? Taylor's book became an inspiration to those on both sides of the Atlantic who equated industrial or social progress with increased efficiency.
As Taylor’s name became a household word, his role in the management movement paradoxically declined. The popularity of the *Principles* created more demands for appearances and statements than any individual could satisfy, and Taylor had little choice but to turn to others to assist him. Initially, he had no qualms about this step. For years he had attracted devoted followers. At first they were employees like Thompson, who performed specific tasks. After Taylor’s retirement in 1901 they became more independent, introducing the techniques he had developed and refined at Bethlehem. In addition, Taylor attracted other individuals who were intrigued both by his methods and by the larger implications of his activities. They soon began to play creative roles in their own right. In 1910 Louis Brandeis, the distinguished lawyer and reformer, skillfully used their testimony in the celebrated Eastern Rate Case before the Interstate Commerce Commission to publicize scientific management. By the time the *Principles* appeared and Taylor testified before the Congressional investigating committee, Taylor’s followers were well prepared to apply scientific management in industry and to explain its significance to an eager public. Their competence and fidelity became a major concern of Taylor’s later years; the tensions that arose from his concerns have in turn been a feature of most histories of scientific management.¹³

The most influential disciples were Henry L. Gantt and Morris L. Cooke, whom Taylor trusted and generally endorsed; Frank B. Gilbreth and Harrington Emerson, whom he grew to dislike and distrust; and Harlow S. Person, who became a major figure in the scientific management movement after his death. Gantt was Taylor’s first important follower, the creator of valuable refinements such as the task and bonus wage plan and the charts that became his trademark. He was also the first of the Taylor group to recognize the common ground between scientific management and personnel work.¹⁴ Cooke was the most political of Taylor’s followers, the principal link between scientific management and progressive reform. He became known for his applications of scientific management to public administration and for his overtures to union leaders.¹⁵ Gilbreth’s colorful activities often obscured his substantive contributions to the analysis of work. Emerson was a creative publicist who grasped the potential of scientific management as a business, and Person was the foremost
theorist of scientific management after Taylor's death. As head of the Taylor Society, the association of Taylor's professional and intellectual disciples, in the 1920s and 1930s, he identified scientific management with the liberal business community of that era. Among other important individuals with ties to the Taylor circle, Richard A. Feiss and Mary Van Kleeck symbolized the diverse potential of scientific management.

Scientific Management in Industry

During Taylor's lifetime, scientific management was first and foremost a plan for enhanced business performance that Taylor's followers and other consultants installed for fees. Taylor and his allies argued that their work increased profits, enhanced productivity, and eliminated class divisions and labor unrest. Critics charged that it encouraged excessive specialization, degraded work, and encouraged personal competition, hostility, and a sense of alienation. The conflicting charges were so sweeping that it was (and is) impossible to reconcile them. However, historical research has addressed several pertinent issues, including the extent to which scientific management was adopted in industry, the character of the changes that occurred in those plants, and the impact of such activities on the work and well-being of employees.

Between 1901 and 1915 Taylor's associates introduced scientific management in nearly 200 American businesses, 181 or eighty percent of which were factories. Some of the plants were large and modern, like the Pullman and Remington Typewriter companies; others were small and technologically primitive. Approximately one-third of the total were large volume producers for mass markets, but scientific management initially had limited appeal among the managers of mass production plants. A majority of the 181 firms fell into one of two broad categories. First were those whose activities required the movement of large quantities of materials between numerous work stations (such as textile mills, railroad repair shops, and automobile plants). Their managers sought to reduce delays and bottlenecks and increase throughput, the volume of production per unit of time. The second group consisted of innovative firms, mostly small, that were already committed to managerial reform. Their executives were attracted to Taylor's promise of social harmony and improved working conditions. A
significant minority of the total fell in both categories. Many of the textile mills, for example, were leaders in welfare work.19

The history of scientific management in these plants provides little support for the contention, common to many later accounts, that Taylor's central concern was the work of the individual employee. Consultants devoted most of their time and energies to machine operations, tools and materials, production schedules, routing patterns, and cost and other record systems. In one-third of the factories these activities generated such controversy that time and motion studies were never undertaken. In others, such as the Franklin Automobile Co. and several textile mills, the installation consisted almost exclusively of improvements in schedules and routing. As a result at least one-half of the employees of the 181 firms were essentially onlookers. They may have experienced fewer delays, used different tools, or found that their supervisor's authority had diminished, but their own activities were unaffected.20

What about the other employees? Taylor promised that they would receive higher wages and have more opportunities for promotion and less reason for conflict with their supervisors. Most assessments of these claims have concluded that Taylor promised more than his associates could or would deliver. By the same token, the union leaders and other critics exaggerated the dangers of scientific management. They argued that skilled workers would forfeit their skills and creativity, that scientific management would promote speedups, fatigue, and rate cuts, and that average workers would lose their jobs.21 Taylor's followers mocked the deskilling argument; Gilbreth compared it to the notion that surgeons or dentists were deskilled general practitioners.22 In recent years, however, it has reappeared in social science texts and in radical critiques of the economy, notably in the influential work of Harry Braverman. The modern critics extrapolated from the Principles rather than from the experiences of the 181 plants or other historical data.23 They reasoned that industrial jobs had become intellectually and psychologically unrewarding since Taylor's time; that Taylor was the architect of modern work (or so the text writers insisted); and therefore, that Taylor had tipped his hand when he referred, in the Principles to "gathering together all of the traditional knowledge which in the past has been possessed by the workmen."
The most important effect of the deskilling argument may have been to obscure the more serious charges that scientific management led to speedups, rate cuts, and the discharge of employees whose skills or motivation were no better than average. In orthodox settings, where employers lived up to the letter of scientific management, only inferior performers had to worry. And in firms that were also committed to personnel management, even that threat was minimal. But many employers were less scrupulous or less patient. In their minds faster work meant faster, more diligent workers, not better planning and coordination, improved communications, and systematic maintenance. They gave lip service to Taylor's idea of an interrelated whole, but they looked to the employees for immediate gains. Even among the 181 firms there was some tendency to use time study to cut rates. That was the prospect that sparked the famous Watertown Arsenal strike of 1912. It was apparently also the cause of strikes at Joseph & Feiss and at three American Locomotive Company plants where Emerson worked. Outside the Taylor circle the tendency was far more pronounced. In early 1913, for example, Firestone Tire & Rubber Company managers assigned an employee named Robert Holmes to conduct time studies of tire workers to learn why earnings were so high. Holmes had had no contact with the Taylor group or experience in time study, but he spent a day timing the workers with a stopwatch and concluded, predictably, that piece rates were too high. The managers then cut the rates and the workers struck, precipitating the industry's most serious labor conflict before the 1930s.

Considering the experiences of firms that have left records (including those like Firestone) several conclusions about the impact of scientific management on factory work seem warranted: (1) First-line supervisors lost much of their authority to higher-level managers and their staffs. (2) The proportion of the work day devoted to production increased due to the elimination of delays. (3) Fewer decisions depended on personal judgments, biases, and subjective evaluations. (4) The individual worker exercised less discretion, particularly in plants where time studies were used to schedule production and/or set piece rates; in the small minority of plants where individual instruction cards were also used, the area of discretion was reduced even more. (5) In most cases earnings rose, but there were enough exceptions to
blur the effect. (6) The level of skill required in production did not change as a result of scientific management though the most highly skilled employees, like the foremen, lost some of their de facto managerial functions. (7) Some unskilled jobs disappeared as improved scheduling and routing reduced the need for gangs of laborers and encouraged the introduction of materials handling machinery. (8) The “great fear” of skill and job losses that David Montgomery has documented among craft workers in the early 1910s quickly waned and scientific management ceased to be associated with labor turmoil until the spread of the Bedaux system in the 1920s.26

Only in recent years has it become apparent that the traditional preoccupation of contemporary analysts with factory conditions was far too narrow. Scientific management was also applicable to the operations of stores and offices, as a handful of illuminating studies have emphasized.27 There were parallels with manufacturing plants: large establishments were most likely to introduce scientific management techniques and the managers’ overriding motivation was a desire to increase the speed of operations. But there were also differences. Because clerical work was labor intensive and dependent on small, hand-operated machines, reorganization efforts focused on the individual employee to a greater degree and at an earlier stage than in most factories. Indeed, the approach that Taylor and his orthodox followers scorned became the standard in white-collar settings and evoked little controversy. Efforts to improve scheduling and routing, to employ time and motion study to reduce wasteful effort, and to introduce economic incentives were most effective where large volume, repetitive operations were the rule. In other settings, employers paid less attention to industrial engineering techniques reminiscent of factories, and concentrated on improving employees’ skills and morale. In either case, scientific management was associated with the mechanization of clerical operations and the growth of a largely female labor force. The impact on the individual worker is harder to gauge. Judging from the experiences of factory workers, it varied considerably and defies easy summary.28

In the meantime the “efficiency craze” that followed the publication of the Principles overshadowed everything Taylor’s associates had accomplished or failed to accomplish in American factories. As a result, Taylor, Gilbreth, Emerson and other associates
became celebrities; organizations and publications devoted to efficiency proliferated; professional societies recognized the importance of management as well as of technical knowledge; universities began to teach management, and virtually every organization gave lip service to the goal of enhanced efficiency.

This activity, together with Taylor's death in 1915, marked the beginning of a new phase in the history of the management movement. Though the picture is far from complete, a series of dramatic changes in the character and imagery of scientific management between 1915 and 1920 suggest the outlines of this new era. The best known of these changes was the reconciliation of Taylor's followers and union leaders that followed the engineers' formal endorsement of collective bargaining. The practical importance of this concession is unclear but it removed a major source of misunderstanding and demonstrated the appeal of scientific management among union leaders once its anti-union implications were muted. Nearly as important was the gradual merger of the scientific management and personnel management movements. Thanks to labor market conditions during the war period, scientific management by 1920 embraced the full panoply of personnel reforms, including personnel departments that performed the foreman's traditional functions of hiring, firing, and training as well as new activities associated with industrial psychology.

A third unanticipated development was the growing role of scientific management in the federal government. Taylor had had extremely poor relations with the Taft administration and his followers had little contact with Wilson and his advisors. Though virtually every member of the Taylor Society was a government employee during 1917–1918, they had no demonstrable effect on mobilization policy. The war experience nevertheless had important indirect effects, not the least of which was the rise of Herbert Hoover to the forefront of American politics. Hoover quickly developed close and cordial relations with the scientific management movement and superseded Taylor as the nation's foremost apostle of efficiency. His influence was apparent in *Waste In Industry*, a report that soon rivaled the *Principles* as the most widely read manifesto of the scientific management movement. In subsequent years Hoover would lead an American rationalization effort that depended, even more than comparable efforts in Europe, on the ideas and techniques of scientific management.
Before the 1970s most histories of scientific management gave the impression that it was an American phenomenon that had its greatest impact on American institutions. Authors either disregarded Paul Devinat’s *Scientific Management in Europe* (1927) or relegated it to a footnote. In recent years, however, a new emphasis on scientific management has accompanied the study of twentieth-century political and economic institutions in European history. Taylor’s popularity, for example, was “one of the first tangible signs of the Americanization of French society.” After World War I, scientific management became a potent force for economic and political renewal. Above all, perhaps, it was a gauge of the growth of large organizations and bureaucratic cultures, a development that transcended national boundaries.

Before World War I, the diffusion of scientific management in most European countries and in Japan resembled the American experience. It depended on engineers and industrialists who had some exposure to systematic management and who were eager to realize the potential of the large and complex organizations they worked for or consulted. In most countries charismatic individuals within this group provided the intellectual and organizational impetus that converted the technicians’ interest into a more broadly based movement. Initially, their focus was factory reform, which proved to be as difficult and contentious as it was in the United States. The most common conflicts pitted company executives, sensitive to costs and short-term results, like their American counterparts, against engineers and technicians who adopted the broader perspective of Taylor and his followers. Nearly as important before the war was the division between these groups and the labor unions, which strongly opposed any change in the industrial status quo.

Systematic management began to make inroads in Europe and Japan after 1900. As in the United States, the rise of the engineering profession and the enhanced role of the engineer in manufacturing were major underlying forces. The appearance of books and articles promoting coordination through management systems signaled a new sensitivity to the limits of empiricism and tradition. Yet change was gradual and uncoordinated. In Germany, for example, systematic management seemed to grow
naturally out of “bureaucratic traditions.” As a result, German industrialists introduced “various scientific management techniques before they ever heard of the American movement.” On the other hand, Japanese railroad executives decided to introduce western managerial methods after they purchased American rolling stock. The majority of European executives fell between these extremes. A crude measure of the spread of systematic management was the popularity of incentive wage plans. In Britain and France nearly half of all engineering employees worked under some form of incentive by 1914. In Russia, the largest employers followed the lead of their western counterparts. St. Petersburg, with many large metal working factories, became a hotbed of experimentation. In state plants and then in private operations, engineers and managers debated ways to increase throughput and productivity. They installed cost accounting and incentive wage plans and, in some cases, made time studies. By 1908, at least sixteen of the largest plants in the St. Petersburg area had introduced “American” bonus plans. Union leaders viewed the wage plans as another effort to undercut the powers of skilled workers and reduce wages, but were unable to prevent their introduction or extension.

Taylor first became known to European industrialists and engineers for his invention of high-speed tool steel. At the Paris Exposition of 1900, where high-speed steel attracted much attention, he had contacts with leading German and French technicians, including Henri Le Chatelier, who would soon emerge as his best-known European follower. Le Chatelier published Taylor’s “The Art of Cutting Metals” in his prestigious Revue de Métallurgie in 1907 and “Shop Management” a few months later. In the meantime, Zeitschrift des Vereins Deutscher Ingenieure, the journal of the Association of German Engineers, published a long report on Taylor’s work in 1901, stimulating widespread experimentation by German engineering firms. One of the participants in this activity, Professor Georg Schlesinger, of the Royal Institute of Physics at Charlottenburg, soon emerged as an expert on high-speed steel and Taylor’s managerial ideas. A German translation of “Shop Management” appeared in 1904. From this point, Taylor’s international contacts increased and his influence grew. After hearing Taylor’s lecture on the potential of scientific management, André Michelin, the French tire manufacturer, supposedly rushed
out to buy a stopwatch. Japanese technicians were no less enthusiastic. Koichi Kanda, author of the first Japanese manual on factory management, published in 1911, included an extensive discussion of Taylor's work. Yoichi Ueno, a university professor and consultant, translated Gilbreth's *Motion Study* in 1911 and the *Principles* in 1913.\(^41\)

Still, there were limits to Taylor's personal influence. Despite considerable effort, only a handful of European and Japanese engineers and managers spent extended periods in Philadelphia, and his associates worked almost exclusively in the United States. The notable exception was Gilbreth, who spent much of 1913 and 1914 at the Auergesellschaft company, which was allied with Allgemeine Elektrizitäts-Gesellschaft (AEG), the largest German engineering firm.\(^42\) The exact nature of Gilbreth's work and his relations with his client remain a mystery, but Walther Rathenau, the head of AEG, and Wichard von Moellendorff, one of its key manufacturing executives, were among the most influential promoters of scientific management in Germany during the following decade.

Of the European pioneers, Le Chatelier was unquestionably the most important. After 1904 he became the "driving force" that insured the spread of Taylor's ideas "in France and over large parts of continental Europe."\(^43\) As a distinguished chemist and professor at the Ecole des mines and the College de France, his prestige insured that Taylor's ideas received a respectful hearing in the highest circles of French society. Together with Charles de Fréminville, an engineer who held a succession of high positions in large industrial firms, Le Chatelier made France the center of the European scientific management movement.

After Le Chatelier, de Fréminville, and Schlesinger, no follower of Taylor had a greater impact than Alexsei Gastev, a Russian revolutionary who helped introduce scientific management to the new Soviet state. Trained as a teacher, Gastev became a metal worker in 1908 and began a lifelong fascination with western technology. Exiled in 1910 for political activity, he went to Paris, worked in several large plants, and became familiar with the contemporary debate over scientific management. He returned to St. Petersburg in 1913 and was employed at the large Aivaz plant when workers there struck against managerial innovations, including an ill-conceived effort to introduce time studies. Gastev,
nevertheless, was intrigued with the potential of scientific management. Like Lenin, who began to write positively about Taylor's ideas in 1914, he saw scientific management as a method for achieving a "cultural revolution" and "making every man a manager."\textsuperscript{44}

Only in Great Britain, among the larger European countries, was there no influential advocate or group of advocates before World War I. The major engineering publications either disregarded Taylor's work or criticized it. Industrialists such as Edward Cadbury and B. Seebohm Rowntree, closely identified with managerial reform, wrote generally hostile analyses. Socialist critics of the status quo were also unfriendly. The consensus of economic historians is that Taylor's work had no immediate impact in Britain due to the hidebound conservatism of British executives.\textsuperscript{45} Their indictment may be overdrawn. As Judith Merkle has noted, the problem in British industry may have been the absence of a "self-propagating class of merchandisers," not lack of interest.\textsuperscript{46} Michael Rowlinson has recently shown that Cadbury introduced many of Taylor's methods despite his public disclaimers.\textsuperscript{47} Additional investigations would likely show that Cadbury and the few industrialists, such as Hans Renold, who publicly endorsed scientific management, were not alone. An American engineer who surveyed European industry in 1920 found in England "the most complete installations of scientific management I have ever seen."\textsuperscript{48}

Why were British executives so reticent? The answer may have been their preoccupation with industrial relations and labor unrest. In Britain, as in other countries, the years after 1900 saw a sharp increase in labor militancy and union activity. Among craft workers, particularly those in technologically backward trades, changes in manufacturing operations were at least as threatening as wage cuts or attacks on unions.\textsuperscript{49} Union leaders in Britain, France, and Germany carefully monitored the Watertown arsenal incident and the ensuing conflict between Taylor and the AFL, and were ready to react whenever a stopwatch appeared.

If European workers had any doubts about the malign intentions of Taylor and his European allies, Louis Renault soon eliminated them. A brilliant autocrat who created Europe's largest automobile firm, Renault was typical of the French manufacturers who were attracted to scientific management. In 1907, one
of his subordinates, Georges de Ram, introduced a planning department, time study, instruction cards, and other measures in two shops. Production soon doubled. Renault was impressed but refused to extend de Ram's reforms because of their cost. Four years later, after visiting Taylor in Philadelphia, touring several plants and publicly announcing his "conversion," he decided to proceed with his own version of scientific management, and abruptly introduced time studies into his factory. His workers, fearful of what would follow, struck. Renault was conciliatory. He blamed de Ram for the trouble, agreed to the election of shop stewards, and promised to consult the workers before revising their rates. The strikers returned to their jobs but remained suspicious. After reading exaggerated accounts of conditions in American plants and failing to gain new concessions, they struck again in February 1913. The second strike lasted six weeks and initially commanded the support of most Renault workers. Like the Firestone strike in the United States, which occurred at the same time, and a strike at the Bosch Company in Germany several months later, it collapsed when the strikers exhausted their savings and became disenchanted with their leaders.

The Renault strike was a turning point in the diffusion of scientific management. From Britain to Russia, workers and unions became alert to the dangers of uncontrolled time study. Yet they also became aware of the possibilities of scientific management. Le Chatelier argued that once workers learned about scientific management, they would distinguish between Taylor's promises of affluence and harmony and the foolish actions of a Renault. He considered the strike a public relations coup. In any event, Taylor's writings became more popular after 1913. If the new enthusiasm did not match the American "efficiency craze," it did mark the beginning of a proliferation of nonindustrial applications of Taylor's ideas. And, as in the United States, one measure of this broader conception of scientific management was the reconciliation of many unionists and working-class political leaders who, like Gastev, were more impressed with the promise of order, planning, and security from capricious rule-of-thumb management than with the dangers of time study.

Though there were important similarities between the American and European experiences in the mid 1910s, there was one crucial difference—the First World War. Beginning in the fall of
1914, European executives and government leaders had to cope with mounting pressures for industrial expansion, coordinated activity, class and interest group cooperation, and efficient use of scarce resources, pressures that American executives and employees would not experience until 1918. As government expanded it became more dependent on individuals with managerial and technical expertise. As factories grew, their managers became more dependent on management systems. After 1914 the exigencies of war, more than the work of Taylor, Le Chatelier or others, shaped the scientific management movement.

In three areas this effect was especially noticeable. First, the disruption of the economy and the labor force created powerful pressures for effective resource utilization. Unlike the American firms that produced arms and munitions for the Allies, European manufacturers had to increase production without commensurate increases in materials and labor. Their responses inevitably were to reduce waste, reorganize production for volume operations, and recruit women, handicapped workers, and other heretofore unconventional employees. Second, the labor shortage and the demand for uninterrupted production forced manufacturers to introduce labor reforms and to work more closely and cooperatively with unions. The result was an amalgamation of scientific and personnel management and a new emphasis on the compatibility of time study, incentive wage plans, and collective bargaining. Third, the substitution of political controls for market forces in many sectors required an unprecedented degree of production planning and coordination.

While there was growing reliance on scientific management in all countries, the French experience is particularly well documented. Even before the war, French military officers had recognized the potential of scientific management for arsenal operations and had introduced Taylor’s methods in at least one plant. After 1914, as they struggled to increase production, they increasingly relied on scientific management for the manufacture of shells, arms, explosives, motor vehicles, and airplanes. At the Penhöet navy yard at Saint-Nazaire, for example, they gave Léon Guillet, Le Chatelier’s close friend and associate, a “free hand.” Guillet organized a planning department, introduced time studies and a bonus wage, and installed other managerial innovations. When he left in late 1915, de Fréminville succeeded him and
completed his work. Guillet and de Fréminville treated the employees well and “won” their support. Most private employers were less enthusiastic and less scrupulous. Yet an American expert wrote in 1918 that he found in France “a better grasp of the essentials . . . than in the United States.” Interest in scientific management was “more widespread.” Aimée Moutet concludes that scientific management made substantial inroads in French industry during the war, that engineers substituted a “scientific spirit” for the “ruling empiricism,” and that the war experience “integrated the Taylor system in the general organization of the enterprise.”

No less dramatic was the change in union attitudes. Organized labor’s reaction to the Renault strike had suggested unyielding hostility. Yet the reformers who controlled the largest unions and the largest union federation were pragmatists who embraced the war effort and the campaign to increase production and productivity, provided they were accompanied by labor reforms. Under Alphonse Merrheim and Léon Jouhaux, the French labor movement shifted from hostility to qualified support for scientific management. The attitudes of rank-and-file workers are more difficult to ascertain, though there were apparently no strikes against scientific management during the war period.

Most dramatic of all was the conversion of high government officials, notably the individuals responsible for directing the war economy and planning the postwar reconstruction. Neither Albert Thomas, the socialist who directed munitions production until late 1917, nor Etienne Clémental, the Minister of Commerce, had had more than a superficial knowledge of Taylor’s writings. Yet by 1916 they were advocates of scientific management, promoters of industrial modernization, and champions of labor-management cooperation. Thomas, in particular, pushed scientific management in conjunction with collective bargaining and labor reform. His outspoken advocacy of scientific management won him the enmity of conservative industrialists and far-left political colleagues, but he persisted. His rival and successor, Louis Locheur, was no less aggressive in promoting scientific management. Clémental, who became the central figure in the reconstruction effort, saw in wartime experiences the basis of a new postwar order, which would feature larger, more modern, and more sophisticated industrial operations, scientific management, labor-
management cooperation, and government coordination of the
economy.  

The American role in the war, coupled with the collapse of
living standards in the last months of the war and the first months
of peace, created enormous interest in scientific management. In
Germany more than one thousand books and articles on scientific
management or "Taylorismus" appeared in the postwar period. Waste in Industry had a galvanizing effect in Eastern Europe; it "contributed very largely to the promotion of scientific manage­
ment in Czechoslovakia." Karol Adamiecki, an engineering
professor who had developed a series of charts and graphs similar
to Gantt's, played a similar role in Poland. Professional groups
devoted to aspects of scientific management emerged in Britain,
though an effort to form an English branch of the Taylor Society
did not fare as well. In industry, scientific management tech­
niques became widespread. Corporations with at least some mass
production operations, such as Renault, Siemens, and Fiat, were
leaders, but smaller firms in the textile, food processing, and
mining industries were also active. By the mid 1920s, banks,
insurance companies, department stores, and a variety of govern­
ment agencies were using scientific management to increase the
quality and quantity of their services.  

Three developments of the 1920s illustrated the appeal of scien­
tific management. First, the German Rationalization movement
embraced a variety of objectives and causes. Yet the works of
Schlesinger, Rathenau, Moellendorff, and other theorists, the
operations of such firms as AEG and Siemens, and the activity of
quasi-public agencies such as the Reichskuratorium für Wirt­
schaftlichkeit did not compartmentalize factory operations, eco­
nomic planning, cartel negotiations, and corporatist political ar­
rangements. Rationalization was a seamless web, a measure of the
larger implications of Taylor's ideas. Second, during the same
period, enthusiasts in other nations formed a variety of promo­
tional associations analogous to the Taylor Society: the Masaryk
Labor Academy in Czechoslovakia, E.N.I.O.S. in Italy, the Ox­
ford Management Conference in Britain, the French Conference
on Scientific Management (which after its 1925 merger with
Henry Fayol's Center for Administrative Studies became the
French National Management Council). These groups organized
international congresses in Prague (1924), Brussels (1925), Rome
They also persuaded the American philanthropist Edward A. Filene and the International Labor Organization to establish an International Management Institute in Geneva in 1927. Headed by Albert Thomas and later Lyndall Urwick, the Institute symbolized the acceptance of scientific management in postwar, pre-Depression Europe. Third, the rapid spread of scientific management was also related to a new tolerance among organized workers and union leaders similar to the position of the French labor movement after 1915. This change of attitude reflected greater care in the use of time study, but also the new link between scientific management and labor reform, the desire for American living standards, and the unions' declining fortunes.

The most striking example of the allure of scientific management in the 1920s was its popularity in the Soviet Union. Lenin and Gastev found few allies until 1920. Then the desperate state of the Soviet economy, the Bolshevik commitment to industrialization, and the attractions of western technology led Soviet leaders to embrace scientific management in much the same way that their successors in the 1930s would embrace a similar panacea, the importation of American and German technology. At the height of his influence, Gastev preached a “Soviet Americanism” and a “new, flowering America” based on scientific management.

Gastev’s first victory came in 1920 when he obtained official support for an Institute of Labor (TsIT) to conduct managerial research and promote scientific management. In the following months he outmaneuvered rivals and won additional patrons in the Soviet government. With the advent of the New Economic Policy, Gastev’s cause flourished. In early 1921 there were twenty groups conducting research under his auspices; by mid 1923 there were fifty-eight. Most of them focused on raising industrial productivity but “rationalizing education, combating excessive lines at stores, improving the sorting of mail, reorganizing the harvesting of potatoes and even curing syphilis were all subjects of experimentation and research, . . .” Gastev soon attracted critics and rivals. His opponents attacked his preoccupation with time study and his technocratic approach, his slogan, for example, that “mankind learned how to process things; the time has come to thoroughly process man.” Gastev’s most serious challenger was Pavel Kerzhentsev, a journalist who promoted a popular, non-
technical approach to scientific management. Kerzhentsev’s Time League, devoted to reducing waste in all areas of daily life, enjoyed a brief vogue in 1923–1924 and temporarily eclipsed Gastev’s operations. Yet Kerzhentsev was no match for Gastev in the arena of bureaucratic combat. By 1925 he had lost official favor; together with the Time League he soon faded from view. Gastev, however, had little opportunity to savor his victory. The death of his chief patron, Felix Dzerzhinsky, in 1926, made him vulnerable to attack and the triumph of Stalin in the late 1920s abruptly ended the Soviet commitment to scientific management. Some of Gastev’s followers were purged as early as 1929; he persisted, with declining influence until his arrest and imprisonment in 1938. By that time nearly all his allies and associates had been killed or imprisoned.72

What did Gastev accomplish, if anything? The reports of American engineers who visited the Soviet Union provide one measure of his impact. Royal R. Keely, a peripheral member of Taylor’s coterie who made an extended survey in 1920, was contemptuous of Soviet industry.73 Walter Polakov, a prominent consultant of leftist sympathies who spent a year and half in the Soviet Union a decade later, reported only modest progress. “All of the vital details of scheduling, dispatching, production control, progress records, etc. are left mainly to chance.” Time and motion study, he added, “is a thing little known in the U.S.S.R.”74 While Polakov probably missed subtle changes of approach and attitude as well as applications outside manufacturing, his judgment was a commentary on the corrosive effects of political infighting and the intensity of grassroots opposition. Despite official support for nearly a decade, scientific management had few friends in mines or factories. The management expert was “the most hated man in industry.” As Gastev himself acknowledged in 1927, “he is opposed by the director; he is opposed by the chief engineer; to a large degree he is opposed by the foreman; he clashes with the opposition of the workers.”75 Donald Filtzer’s recent examination of Soviet time study data attests to the enormity of the challenge.76 As Gastev and his allies fell out of favor, the resistance grew increasingly violent. The Stakhanovite movement of the mid 1930s was a rebellion against time and motion study and the managerial authority that it enhanced.77 By the end of the decade few engineers or managers were sufficiently bold or foolish to hold out.
The remarkable rise and fall of scientific management in the Soviet Union had no western parallel. The Depression of the 1930s diminished the attraction of American ideas and such European surrogates as rationalization, but apparently did not affect the progress of scientific management in industry. The best example was the success of the Bedaux firm in the 1930s. European affiliates of the American consulting company began to operate in Britain, France, Italy, Germany, and other countries in the late 1920s. Hard times were good for business, despite renewed labor opposition. Bedaux's promise to save more than his fee, primarily through increased labor productivity, suited the thinking of industrialists in the 1930s. But Bedaux was not the only consulting firm that thrived. Urwick, Orr & Partners, and Wallace Clark & Co., for example, did well despite their fidelity to the Taylor approach. And though the international scientific management movement (including the International Management Institute) fell victim to hard times and rising political tensions, most of the institutions that impressed Paul Devinat in the 1920s continued to uphold the heritage of Taylor and his associates in the 1930s.

The Japanese experience was similar. In the late 1920s and 1930s three groups promoted scientific management in Japanese industry: consultants such as Yoichi Ueno and Araki Toichiro, who had personal contacts with Taylor, Gilbreth, and Emerson; mechanical engineers such as Takuo Godo of the naval arsenal at Kure and Shigeo Kato of Niigata Iron Works, who wanted to improve the operation of their plants; and engineering employees of Japanese firms allied with General Electric, Westinghouse, and other American multinationals, who borrowed technique as well as technology. Takeo Kato of Mitsubishi Electric, for example, brought back the Westinghouse factory manual and time study guide from a 1925 visit and used them to modernize operating procedures in his firm. The Japanese government encouraged this activity, creating committees on rationalization that served as forums for proponents of scientific management.

Though the history of scientific management in Europe and Japan in the 1930s and 1940s is hardly more complete than the history of scientific management in the United States, it is clear that the post–World War II leaders who argued that American management techniques would save wartorn countries from economic backwardness greatly exaggerated the novelty of their
proposals. Like Americans who saw in Stalin's Five Year plans the ultimate expression of scientific management planning, they confused superficial appearances with reality. The mental revolution was not and had never been an American monopoly.

Scientific Management in America, 1915 to the 1950s

What happened to scientific management in the United States after 1915? The following essays examine the fates of the scientific management pioneers, the diffusion of scientific management in society and industry, and the criticisms of a later generation of analysts who had no firsthand knowledge of Taylor or his work. More important, they show that in the United States, as in Europe, scientific management continued to be a stimulus to thinking about the functions of organizations and a series of techniques for improving short-run economic performance. Because of this dual role, the study of scientific management provides an avenue for understanding the American interest in economic and technical rationalization as well as the evolution of production management and the changing character of industrial work in the middle decades of the century.

At the time of Taylor's death, none of the men close to him could match the fame or influence of two outsiders, Richard A. Feiss and Frank B. Gilbreth. Feiss was an innovative executive whose Joseph & Feiss Company had recently emerged as the most attractive and promising expression of the promise of scientific management. Feiss's operation was not only large and successful; it also was a compelling example of the logical links between Taylor-inspired industrial engineering and advanced personnel work. Feiss and his influential assistant, Mary Barnett Gilson, soon embraced a form of social engineering commensurate with the company's commitment to industrial efficiency but far exceeding anything Taylor or his immediate disciples ever imagined. Scientific management and a large female labor force proved to be a potent combination. David Goldberg's essay (chapter 2) is the most complete description to date of the Feiss operation and the ironic fate of Feiss and his colleagues in the 1920s.

Gilbreth's career is better known. His ebullient personality, innovations in job analysis, conflicts with Taylor, and unconventional family life made him a celebrity. Yet, as Brian Price explains
in chapter 3, public visibility did not translate into professional or material success. Despite his fame, Gilbreth made little progress in establishing the superiority of his innovations to conventional time study or in satisfying his clients. At the time of his death in 1924, his career was at low ebb, his reputation sullied by repeated failures. He escaped the fate of Feiss, however, because of the potential of motion study and because of the efforts of his wife and partner, Lillian Gilbreth. During the 1930s, as motion study reemerged as an important feature of work analysis and Lillian became a celebrity in her own right, the Gilbreths of the early 1920s gave way to the more enduring and attractive Gilbreths of *Cheaper by the Dozen* (1948)—happy, successful, and respected.

In the meantime the ideas or principles of scientific management had attracted wide interest in American intellectual circles. Some writers and scholars became critics; others saw potential benefits for themselves and society. The spectrum of possibilities is evident in chapters 4 and 5, which examine the reactions of several groups of academics and the prominent social investigator, Mary Van Kleeck. Professors saw scientific management primarily in terms of academic politics; yet their effort to exploit it for their benefit created a powerful and wholly unanticipated mechanism for the spread of Taylor's ideas. It was no coincidence that a large proportion of active participants in the management movement of the 1920s and 1930s were university faculty members or that Taylor's work became an important feature of the education of engineers and managers. Van Kleeck, on the other hand, began her career as a prominent social worker, not unlike Mary Barnett Gilson. She became interested in industrial issues, saw scientific management as an answer to the disorganization and anarchic individualism of laissez-faire capitalism, and viewed its success as proof of the efficacy of production planning in society as a whole. As Guy Alchon explains, these views also led her to admire the Soviet experiment and ultimately to become an apologist for the Soviet state.

Although scientific management had implications for all institutions, it is most closely identified with industrial production. Supporters and critics alike assumed that its greatest impact was in the factory. But they have had more trouble specifying the nature of that impact. During Taylor's lifetime, when relatively small numbers of firms and workers were involved, it was possible to
physically inspect most of the important sites, as C. Bertrand Thompson and Robert Hoxie did. By the late 1910s that type of evaluation was impossible; a small group of practitioners no longer controlled access to Taylor’s techniques, and the number of applications exceeded the investigative capabilities of any individual. Nevertheless, several indirect measures are possible. They suggest that by the 1930s scientific management in the workplace no longer implied revolutionary change or had special appeal for avant garde executives like Richard A. Feiss. In most cases managers viewed it in narrow, utilitarian terms and introduced or extended it to help achieve the potential of mass production technologies and to manage semiskilled workers. These trends probably accelerated in the 1930s, when economic decline spurred a renewed search for lower costs.

Three papers examine the application of scientific management in industry. Kathy Burgess’s subject in chapter 6 is the Link-Belt Company, which had been one of Taylor’s original demonstration firms. She reports a pattern of activity that was consistent over a long period but which differed markedly from that of Joseph & Feiss and presumably the mass production and service firms that embraced scientific management in the 1920s. Link-Belt depended on highly skilled workers. Scientific management improved their work and generally won their applause, but it could not insure that they would not join unions or strike. To Link-Belt managers, this was a serious shortcoming, which they addressed through traditional union avoidance measures: labor spies, black lists, and arbitrary discharges. Thus the mental revolution at Link-Belt was never complete; despite the introduction of modern personnel work and other refinements of scientific management in the 1920s, Link-Belt managers continued to rely on draconian anti-union tactics as long as it was legally feasible to do so.

During the same period, the enigmatic Charles Bedaux demonstrated that the techniques of scientific management could be successfully applied without a broader commitment, or a liberal vision like that of the Taylor Society insiders. In the 1920s and 1930s, Bedaux became the best-known industrial consultant, with a large clientele in the United States and Europe. A latecomer to scientific management, he prospered while Feiss, Gilbreth, and many of the pioneers stumbled. Yet the ingredients of his success are obscure because of his deliberately secretive approach. The
discovery of the records of his British operations has finally raised the veil on Bedaux's activities. In chapter 7, Steven Kreis discusses Bedaux's tactics and their effects.

Most big businesses, however, did not employ outsiders or employed them only briefly and sporadically. John Rumm's study of Du Pont (chapter 8) is the first detailed account of an industrial engineering department over a long period. Like Kreis's study, it illustrates the narrow, practical focus of most scientific management applications. Du Pont executives had created a sophisticated organization based on principles of scientific management long before they established an industrial engineering department. Only when the Depression required extensive cost cutting did they extend scientific management to the shop floor. Still, their effort provides a detailed view of Taylor's techniques in action and an illuminating contrast with the experiences of Joseph & Feiss, Link-Belt, and other pioneers.

During Taylor's lifetime, the focus of most assessments of the impact of scientific management was its effect on work and workers. In the 1920s and 1930s this emphasis gradually faded, though Bedaux's work continued to elicit controversy. In part, this change was political; union policy changed and personalities like Taylor and Gilbreth no longer served as lightning rods for opposition to managerial change. In the 1930s, when labor militancy revived, organizing efforts and economic issues overshadowed the concerns of a more prosperous and confident era. Equally important, however, was the ambiguous effect of scientific management on industrial work. By the 1920s, it was clear that scientific management had not fulfilled its critics' apocalyptic forecasts. If Link-Belt and Du Pont were representative, most effects of scientific management were the results of changes in the operation of the firm as a whole, of changes in production processes, and of often diverse and inconsistent applications of time and motion study. The relationship between scientific management and work remained complex and variable.

Nevertheless, in the 1940s scientific management attracted a new generation of critics who focused on the worker. Two stimuli probably accounted for this development: the wide acceptance of managerial principles that were directly or indirectly associated with Taylor and a growing tendency to use Taylor as a straw man in order to emphasize revisionist ideas. The result was a percep-
tion of scientific management as both influential and defective. Of the postwar critics, the best known was Peter F. Drucker, an Austrian-born scholar and management theorist whose works attracted a wide popular and academic audience. While professing admiration for Taylor’s ideas, Drucker had reservations about their application in the large private bureaucracies that dominated the postwar economy. As an antidote to excessive specialization, organizational fragmentation, and professional isolation, Drucker proposed a procedure that he called Management By Objective (MBO). As Stephen Waring explains in chapter 9, MBO was a natural outgrowth of Drucker’s earlier philosophical studies and ideological perspective. In practice it was highly controversial. Waring finds it flawed in conception and poorly or incompletely applied. Among other problems, Drucker, like Taylor, was afflicted by a legion of followers whose activities were halfhearted or uninspired and whose principal interest was immediate financial gain.

Waring concludes that Taylor’s ideas continued to influence managers in the 1950s and 1960s. To rephrase his point, Taylor’s ideas, modified and expanded upon by Richard A. Feiss, Mary Gilson, Frank and Lillian Gilbreth, Mary Van Kleeck, Charles Bedaux, a host of academic proponents and critics, executives at Link-Belt, Du Pont, and other firms, and many others influenced the operation of American institutions in the 1950s, 1960s, and after. The precise nature of that influence has not been adequately gauged or appreciated. This collection of essays is a step toward that end.

NOTES


17. C. B. Thompson, *The Theory and Practice of Scientific Management* (Boston, 1917), pp. 36–104. Thompson was an instructor at the Harvard Business School who was given released time to visit plants and interview industrialists and consultants. He visited approximately 60 firms that Taylor’s closest associates had worked at and approximately 20 (of perhaps 55) that Emerson and his staff had assisted. C. B. Thompson to Edwin F. Gay, August 17, 1914, Dean’s Office File, Baker Library, Harvard Business School.


31. See Alford, Gantt, pp. 185–206, and Trombley, Happy Liberal, pp. 71–86 for the activities of two key members of the Taylor circle. For industrial mobilization in general, see Robert Cuff, The War Industries Board; Business-Government Relations during World War I (Baltimore, 1973).


35. Jürgen Kocka, “The Rise of the Modern Industrial Enterprise in Germany,” in Alfred D. Chandler, Jr. and Herman Daems, eds., Managerial Hierarchies:


42. Frank B. Gilbreth to Lillian M. Gilbreth, 1913, Frank B. Gilbreth Papers, Purdue University. See also Homburg, “Anfänge des Taylorsystems in Deutschland,” pp. 174-79.


54. Professor Heidrun Homburg objects that this description oversimplifies the changes that occurred in Germany, particularly in industrial relations practices. Government intervention was as important as market forces in promoting cooperation. I am indebted to her for her careful critique. See also Gerald D. Feldman, Army, Industry and Labor in Germany 1914–1918 (Princeton, 1966), pp. 89–92.
57. Humphreys, Taylorism in France, pp. 161–63.
70. Beissinger, *Scientific Management, Socialist Discipline*, p. 84.


