Taylor-made.(19th-century efficiency expert Frederick Taylor)

by Robert Kanigel

Frederick Taylor, who worked in the Philadelphia, PA, steel industry during the late 19th century, established principles of labor efficiency that have had an impact through the 20th century. Taylor conducted experiments on the proper setting for lathes and boring machines and developed productivity tables that laborers should follow. He insisted that efficiency standards were a matter of science, and that human behavior could be adapted to them.

How the world's first efficiency expert refashioned modern life in his own image

Through cajolery, threats, fines and firings, Frederick Taylor, a young foreman in a Philadelphia steelworks, had by late 1880 succeeded in doubling the work done by the skilled machinists working under him. For the moment, the men were cowed and his bosses were happy with him. But he himself was miserable. "I was a young man in years," he said later, "but I give you my word I was a great deal older than I am now with worry, meanness, and contemptibleness of the whole damn thing. It is a horrid life for any man to live, not to be able to look any workman in the face all day long without seeing hostility there." He would get out of the business altogether or else, as he said, "find some remedy for this unbearable condition."

The "remedy," as he came to see it, was knowledge.

Taylor worked in the machine shop of the Midvale Steel Company, where forged steel locomotive axles and rimlike "tyres," some weighing half a ton or more, were cut to size with such tools as lathes and boring mills. Those great belt-driven machines could cut metal only so fast without burning themselves up or prematurely dulling their tool bits. But how fast was that? How should the machines be set?

Taylor would have liked to tell his men: "You're running it way too slow. With this kind of steel, and that depth of cut, and that feed, you should be able to go at twenty feet per minute, easy. Use these pulleys here." But he couldn't say that, because he didn't know for sure. The grizzled machinists under him would say, "No, that's too fast. It'll burn up the tool. It'll wreck the machine." But they didn't know either, not really; much of their wisdom was guesswork, built up over the years into serviceable rules of thumb. Besides, what was the big hurry? For them informed guesses were good enough.

For Taylor they were not. To find out just how fast the tools could cut, he undertook a series of experiments. Ultimately, the variables in almost any metal-cutting operation--speed, feed, tool shape, the kind of metal being cut and so forth--could be reduced to a mathematical problem solvable, on a special slide rule, in twenty or thirty seconds.

Taylor's experiments went on for twenty-six years. But even the earliest Midvale tests yielded tables and charts able to supply machine settings that depended relatively little on a machinist's judgment. Soon, as Taylor wrote later, first-class machinists were being replaced "by men who are trained up from a lower class of work," typically laborers or machinists' helpers. Traditional craft know-how, reduced to scientific data, was passing from workman to manager, from shop floor to front office. On the big boring mills at Midvale, Taylor was creating a new world of work.

Frederick Winslow Taylor, still just twenty-five when he began his experiments and only a few years out of his apprenticeship, was the world's first efficiency expert. His ceaseless quest for "the one best way"--the phrase that came to be associated with him and the whole efficiency movement--influenced Henry Ford and Lenin and moved the management guru Peter F. Drucker to include him, along with Freud and Darwin, as one of three seminal makers of the modern world.

To the organized labor of his day Taylor was a slave driver. To the bosses he was an eccentric who raised wages while ruling the factory floor with a stopwatch. To himself he was a misunderstood visionary who, under the banner of science, would confer prosperity on all and abolish the old class hatreds. To millions today who feel they give up too much to their jobs he is the source of that fierce, unholy obsession with "efficiency" that marks modern life. "Why is it so easy," Michael W. Munley, then at the University of Massachusetts in Amherst, asked in a 1991 doctoral dissertation, "to hear and see reminders of Frederick Taylor in the brusque efficiency with which affluent American professionals organize their lives ... [with] personal planning calendars, car telephones, voice mail, [and] beepers to track them anywhere, even on vacation?"

By one definition Taylorism is "the application of scientific methods to the problem of obtaining maximum efficiency in industrial work or the like." Or the like. And in that slight, almost parenthetical extension lies a hint of Taylorism's hold. Because though Taylor got his start in the factories of the industrial Northeast in the 1880s, it is not just the

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workplace that bears his imprint today but modern life in general.

Scholars have laid at Taylor's door phenomena as various as the evolution of "leisure," from genuinely free time to organized recreation; the Reagan Administration's approach to managing the federal bureaucracy, and even what the late historian and social critic Christopher Lasch has called a "new interpretation of the American dream." Various writers have seen Taylor's hand in the work of the poet William Carlos Williams; in the French modernist writer Louis-Ferdinand Celine's call for an industrialized, standardized medical-care system; in the rigid daily timetables meted out to Alcatraz inmates during the 1930s.

Since 1910, when Taylorism was propelled from the narrow precincts of industry into the consciousness of the world, it has become a ubiquitous presence, for good and ill, in modern life. And it was Midvale Steel in the early 1880s to which its roots reach back.

Soon after he came to Midvale, Taylor recorded in his notebook that a bricklayer and helper laid, on the average, 480 bricks in a ten-hour day. That kind of straightforward observation was nothing new; similar notes had been made a hundred years before by the Scottish economist Adam Smith in The Wealth of Nations, and by generations of shop foremen and owners. But soon after Taylor embarked on his metal-cutting experiments, he began to ask a different question. Not, How long does a job take to complete? But, How long should it take? Taylor's early notebook entries were History. The new questions, viewed the right way, were Science.

Sources from Taylor's time, some of which he may have consulted, suggested that a man could accomplish between one-and-a-half million and four million foot-pounds of work in ten hours. But Taylor decided to do his own experiments: he offered workers double pay, warned them their windfall would be over at the first sign of slacking off, gave them arduous tasks and calculated the work they did per day in foot-pounds and its rate in horsepower. But the tests still yielded nothing consistent enough to use in computing a man's wages.

In these experiments Taylor and his assistant used a stopwatch to time the work they gave the men; with it they could as easily measure what a man did in ten seconds as in ten hours. Sometime in 1883, Taylor wrote later, it "occurred to [me] that it was simpler to time each of the elements" of a job and establish an overall time for it by adding up those times than it would be to search through records of past jobs and guess how they might apply to a future one.

Taylor had found a hidden bonanza: in breaking work into its components, you were almost forced to study it. What got in a workman's way? How could a machine be modified? Which operations could be improved, which eliminated? At first, work might seem no more than a featureless smear of movement. But after a while it was as if you were seeing it in slow motion, each element of It highlighted, dissected, splayed open for view.

An early subject of time study was the manufacture of locomotive tires Taylor had investigated in his first metal-cutting experiments. Formerly, the workmen earned a fixed amount for turning each tire to size. But once Taylor was through, their job was no longer to machine a tire but was a succession of smaller tasks: Set tire on machine ready to turn. Rough-face front edge. Finish-face front edge. Rough-bore from. And so on, each step minutely described and timed to the tenth of a minute.

Taylor had seen his experiments as balm for the ill will on the shop floor: by recourse to an impartial arbiter--ever fair-minded science--he and his men would be able to rise above mere opinion, with its raised voices, to serene and stable fact. Once the time-study man had finished and a clerk had added up his columns of numbers, the time needed to machine an axle or overhaul a boiler warranted no further discussion: the numbers spoke for themselves.

Or did they?

In Taylor's mind, at least, working more efficiently did not necessarily mean working harder. And yet, to yield to the stopwatch, to keep relentlessly on task, took something out of you that the older, looser ways did not. The work itself might be no more physically demanding. But somehow, by day's end, it felt as if it were. You had to do things now in the one best way prescribed for you, not in your old, idiosyncratic and less-efficient way. And no self-respecting workman liked that.

"It is one thing to know how much work can be done in a day," Taylor realized, "and an entirely different matter to get even the best men to work at their fastest speed or anywhere near it." To get them to conform, he learned, you had to pay them more.

How much more?

The answer, Taylor would write with a shrug of sarcasm years later, was not a "subject to be theorized over, settled by boards of directors sitting in solemn conclave, nor voted upon by trade unions." Rather, it was dictated by "human nature," and he had established it through more experiments. Back at Midvale he had approached half a dozen workers with a deal: On a particular job they would

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get a 15 percent premium. But they had to do it in precisely the way Taylor decreed. "When we tell you we want you to use such and such feed and such and such speed," as Taylor put it, "we want you to use it." After some months, they could go back to the old way, at the old wages. Or they could continue in the new way, at the new wages.

The decisions of the workmen constituted the data of Taylor's experiment. Along with the men making 15 percent more, he set up other groups, paid an additional 20, 25, 30 or 35 percent. How much would it take to buy them off?. The experiment gave the answer, establishing the pay that just barely overcame the workmen's resentment at having to keep to the stern beat of Taylor's drum and not their own.

And there it was--the Faustian bargain in embryonic form: You do it my way, by my standards, at the speed I mandate, and in so doing you will achieve a level of output I ordain, and I'll pay you handsomely for it, beyond anything you might have imagined. All you have to do is take orders, give up your way of doing the job for mine.

If you went along with the bargain, the promise went, efficiency improved, production shot up, wages shot up. Decades of refinement lay ahead--generations of industrial engineers who would work out the details, conduct experiments, write books and treatises. In later years Taylor would get a laborer, immortalized as "Schmidt," to go from loading fourteen tons of pig iron a day to loading fifty-two and a half. But by about 1884, at Midvale Steel, most of the essential elements of the Taylor system were already in place. Ahead lay a harmonious new industrial future.

That, anyway, was the idea.

Taylor's disciples went on to install his system in factories around the country. Taylor lectured to rapt audiences of industrialists and was named president of the American Society of Mechanical Engineers. Yet he was still known only within his profession. That changed in 1910, when a group of Eastern railroads petitioned the Interstate Commerce Commission for a freight rate increase. In the hearings that ensued, the future Supreme Court Justice Louis D. Brandeis dismissed the petitioners' request; they could save far more than the millions they sought, he said, by embracing the efficiency methods of a Philadelphia genius named Frederick Winslow Taylor. Soon Taylor and "scientific management," as it became known, were on every industrialist's lips and efficiency was a national ideal.

Organized labor, however, saw Taylor as out to destroy the workingman's health and rob him of his manhood. The novelist Upton Sinclair observed how Taylor's showcase laborer, Schmidt, got just 61 percent more pay for 362 percent more work. A correspondent for American Machinist magazine pictured the Taylorist worker as "simply one of the gears in the operation of the machine." Samuel Gompers of the American Federation of Labor and other labor leaders denounced Taylor in bitter broadsides.

Finally, after workers at a government arsenal in Watertown, Massachusetts, went out on strike against time study, a Congressional committee held months-long hearings to "investigate the Taylor and other systems of shop management." The hearings were capped by four grueling days of testimony by Taylor, in which congressmen and labor leaders relentlessly interrogated him. When Taylor spoke of how the "first-class man" profited under his system, chairman William B. Wilson pointedly asked about the fate of those not first-class. When Taylor contended that a proper day's work was a matter of "accurate, careful scientific investigation," Wilson wondered how disinterestedly scientific it could be when the employer had a stake in the outcome.

Taylor came away drained. Three years later, after contracting pneumonia, he was dead at the age of fifty-nine.

In 1919, the French poet Paul Valery, looking out over a postwar Europe haunted by the ghosts of the dead and memories of mindless production in death's service, concluded a "Letter from France" by writing: "The world, which calls by the name of `progress' its tendency towards a fatal precision, marches on from Taylorization to Taylorization."

Taylor was dead, but his system, and his sensibilities, lived on.

The eruption of interest in scientific management in 1910 had fomented an efficiency craze that reached into home, farm and office as well as the factory. Its impact was heightened by the First World War, when the need to produce at levels once unheard of made Taylor's preoccupations those of the nation. Labor and capital were thrown into an unexpectedly intimate embrace. "From the bitterest sort of opposition to Taylor and all his works," Stuart Chase would write in The New Republic in 1925, much of organized labor now virtually embraced it. By 1929, in East Pittsburgh, Pennsylvania, the Westinghouse Electric and Manufacturing Company had a time-study staff of 120. At the United States Rubber Company, the International Harvester Company, the General Motors Corporation--the time and motion experts were everywhere. Something like a consensus had emerged that Taylor's methods represented the one best way to run

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a shop.

But not just the shop. In the late teens and 1920s scientific management split off into pieces and parts, factions, specialties, new disciplines, nascent social movements. One of Taylor's disciples, Henry L. Gantt, known for a system of critical-path scheduling using special charts, rounded up fifty engineers in a group he called the "New Machine." The group sought to establish an "aristocracy of the capable": engineers, efficiency experts and their friends would take the helm of society from know-nothing financiers and politicians. The New Machine proved short-lived, but out of it emerged a much broader technocracy movement, from which the word "technocrat" is derived.

William H. Leffingwell, a midwestern woodworker's son trained as a stenographer, applied scientific management to the office, experimenting with typists and clerks the way Taylor had with machinists and shovelers. There was one best way, he held, to insert paper into a typewriter, pin pages together or sit at one's desk--"well back in the chairs, with the feet placed squarely on the floor and head and shoulders erect." Leffingwell saw malingerers behind every file cabinet, just as Taylor did behind every lathe. He and his followers tracked how many minutes a day typists typed, fixed work standards of so many square inches of typed work per hour and awarded bonuses to those satisfying them.

Efficiency reached into the physician's office and operating suite too. "Where could the rationality of business better be joined to the rationality of science," wrote one historian of medicine, "than in increasing the efficiency of the hospital?" Frank B. Gilbreth, a bricklayer turned contractor, had come under Taylor's influence in 1907. With his wife, Lillian, a psychologist, he adapted photography to root out unnecessary worker motions. (They and their twelve children inspired the popular book Cheaper by the Dozen and the film of the same name.) Frank later went into the operating room himself, observing dozens of operations. "If you were laying brick for me," he told one surgeon, "you wouldn't hold your job ten minutes." Medical journals began carrying articles such as "`Efficiency Engineering' in Pelvic Surgery: One- and Two-Suture Operations," which told how to save time and motion through better suturing technique and operating-room organization.

By the late 1920s it had begun to seem that all of American society had come under the sway of a single commanding idea--that waste was wrong, that efficiency was the highest good and that eliminating one and achieving the other was best left to the experts. The 1928 election of a mining engineer, Herbert Hoover, secretary of commerce in the Harding and Coolidge administrations and author of the influential report Waste in Industry, brought scientific management into the White House itself.

Almost from the very beginning, Taylorism spread around the world. Within a few years of its American publication, Taylor's most popular work, The Principles of Scientific Management, had been translated into Chinese, Dutch, French, German, Italian and Russian. Mussolini embraced scientific management. So did Lenin and Trotsky. During the Weimar years, between the end of the First World War and the rise of Hitler, German Rationalisierung, or "rationalization," set out to fuel the entire national economy with order, system and efficiency. The aim was to bring together in a single heroically scaled idea both Taylorismus and the assembly-line techniques represented by Fordismus.

Among Taylor's foreign students were the Japanese. Yukinori Hoshino, a bank director from Osaka, was visiting the United States in 1911, when scientific management was much in the public eye. He sought and received permission to translate one of Taylor's books, which was published in Japan in 1913. Soon Japanese students, industrialists and educators were making the pilgrimage to Taylor's estate and touring his showcase companies. Japanese shipyards, cotton mills and government factories launched time studies and other experiments in scientific management.

In 1923 the Mitsubishi Electric Company reached a technical cooperative agreement with Westinghouse to send people to the United States to learn time-study methods. The delegates from Mitsubishi analyzed hundreds of the tasks involved in the manufacturing of electric fans and soon were spreading the new techniques throughout Japan. And Taylor's disciples visited Japan, to lecture, to inspect factories and otherwise to help guide the embryonic movement. In 1961, when Taylor's son Robert visited Japan, executives of the Toshiba Corporation implored him for a pencil, a picture, anything that had been associated with his father. "They wanted to feel or touch," he wrote, "something that Fred Taylor had touched or handled."

As Taylorism touched each of the world's industrial nations, the story was never quite the same, yet never altogether different: first the thrill among a few people smitten with Taylor's ideas; then letters back and forth to the United States; translation and publication of Taylor's writings; industrial experiments; a swirl of controversy; some form of institutionalization, and finally the spread of Taylor's ideas.

Of the two great American industrial movements, Taylorism and Fordism, Taylorism was probably the more

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all-encompassing. As the political scientist Judith A. Merkle of Claremont McKenna College in Claremont, California, has pointed out in Management and Ideology, Taylorism, compared with Fordism, has an "immense advantage in its ability to absorb new technologies and to adapt itself over time." The assembly line can be likened to a biological species adapted, through evolution, to its own peculiar ecological niche, like a Galapagos tortoise. Scientific management, in contrast, adapts the way a virus does, fitting in almost everywhere. In the words of one reporter, Taylorism was a "machine of universal efficiency."

Taylor saw knowledge, not muscle power, as the prime productive resource; today the "knowledge industry" is looked to as the source of most new jobs, whereas good blue-collar jobs that blend head and hand disappear. Robert B. Reich, the former secretary of labor in the Clinton Administration, lays the divorce of brain from brawn squarely at Taylor's feet, adding: "One cannot overstate the importance of this split to the way America organized itself." In the 1940s, when a labor union commissioned a study of Taylorist time-study practices, its author, William Gomberg, pictured a Brave New World-like future in which "the simplification of jobs at one end of the job-rating scale and the increasing demands for skills at the other end would soon create a society in which only the geniuses and morons would survive."

The coming of the computer has extended Taylorist sensibilities even further; computer programs embody the very split between thinking and doing that is the hallmark of Taylorism. More and more, work bifurcates into two streams--skilled programming, planning and analytical work at the top, and low-skilled program execution, in its various guises, at the bottom. Engineers, economists, planners and systems analysts extract the last fraction of a cent from a fast-food hamburger at one end, while legions of minimum-wage drones peck at cash register touch screens at the other.

Today Taylorism is at least intellectually out of fashion, and few admit sympathy with its precepts. In 1986 the Japanese industrialist Konosuke Matshushita predicted that the United States would lose in the race for international markets because it is infected with the disease of Taylorism, with its disinclination to tap the flexibility and intelligence of the average worker. When John Sculley, then the chairman and chief executive officer of Apple Computer, spoke at then-President-elect Clinton's economic conference in Little Rock before the inauguration in 1993, it was Taylor, along with Henry Ford, whom he invoked to represent the heavy hand from which the American economy must free itself.

And yet, even after. Much-bruited attempts to bring participatory democracy to the workplace, Taylorism survives. A manager at the automobile factory jointly operated by the General Motors Corporation and the Toyota Motor Corporation in Fremont, California, pinned its recent success squarely on "the intelligent interpretation and application of Taylor's time-and-motion studies." And in White-Collar Blues, the labor-relations expert Charles Heckscher of Rutgers University in New Brunswick, New Jersey, points to "a paradoxical reversal" in the modern workplace: For all the "effort to draw out the good will of blue-collar workers, middle managers are being treated increasingly as cogs in the machine." What's this, he says, but "a kind of Taylorization of management."

In Taylor's vision, man and machine work together like clockwork. In that vision lies the great paradox of modern life. Every day we reap the material benefits of the cult of workplace efficiency he championed; yet we chafe--we scream, we howl--at the psychic chains in which it grips us. When young people in the 1960s sniped at the System, it was in part the Taylor system itself, institutionalized in corporate America, that they opposed. It was Taylor, after all, who first wrote in 1911, explicitly and without apology:

"In the past the man has been first; in the future, the system must be first."

And, one might argue, it is.

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