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Turning men into machines?

Turning men into machines? Scientific management, industrial psychology & the 'human factor'

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'We are not mere machines; we are human beings, and protest against being discussed and considered as coequal with machinery.' (Duncan, 1911, p. 383)

'The human factor cannot be ignored in the industries.' (Frey, 1913, p. 300)

Introduction: Management and the labor problem

The introduction of technological thinking to shop management by Frederick W. Taylor spurred the articulation of what was sometimes called 'the human factor'. Taylor's inclusion of workers in the ambit of his scientific management – the exact way they performed their job, how they worked together and with their machines, how, when and how much they were paid – raised the question whether one could treat people on a par with the machines in the shop, as Taylor appeared to be doing. To bolster their position, proponents as well as critics of scientific management formulated ideas about the human factor, and in particular about what makes people different from or similar to machines. Although the debate was at times almost philosophical, the point was always practical. How should men and machines work together? Are workers becoming the 'living appendages' of machines, as Marx had said? And how should the work in factories of ever increasing size be managed? What sort of practice should that management be? Is it a kind of

Turning men into machines?

engineering? If not, what is it then? At issue, in other words, were the relations between workers and machines as well as the relations between the various people in the shop (owner, managers, foremen, workers), and how these relations should be governed.

Psychologists, starting with Walter Dill Scott and Hugo Münsterberg, succeeded in positioning themselves as the experts of the human factor, and their instruments and expertise as the necessary complement of Taylor's psychologically flawed system. Traces of this boundary work can still be found. For example, Thomas Hughes sides with Taylor's critics when he writes that 'Taylor tried to systematize workers as if they were components of machines', judging him to have been 'naïve in his judgments about complex human values and motives' (Hughes, 2004, p. 187). Ludy Benjamin and David Baker similarly state that Taylor ignored 'human issues', issues that were 'the domain of psychology' (Benjamin & Baker, 2004, p. 130). John Benjafield compares Taylor and Elton Mayo, writing that 'Taylor's focus was on individual behavior seen as a collection of individual bodily movements, while Mayo's focus was on behaviour as determined by the quality of one's interpersonal relationships' (Benjafield, 2005, p. 138). I will argue that such contrasts ignore on the one hand the human factor in Taylor's thinking, and early industrial psychologists' mechanistic view of the worker on the other. In some ways, Taylor's ideas about the worker's mind and about the right way for managers and workers to work together, were similar to the 'Human Relations' approach that started making its name in the 1930's, long after Taylor had died. For their part, early industrial psychologists presented themselves as human engineers, offering techniques to measure and manipulate the mind of the worker. These developments are better understood if we do not take the 'human factor' as a given, ignored by Taylor but gradually uncovered by psychologists. The history of management from Taylor to Human Relations is not one of progressive humanization, but rather one of successive redefinition and realignment of the human and mechanical factors of production and their management. The way in which the human factor was conceptualized, in particular how it was similar to or different from machines, developed in close

Turning men into machines?

connection with ideas about its management, focussing on the question whether management was a form of engineering. In my interpretation of this history, I will revisit well-known terrain. I draw mainly on Taylor's work and that of Lillian Moller Gilbreth and Mary Parker Follett, and on the Hearings regarding scientific management of the United States House of Representatives. The main focus will be the period between 1910 and 1920, during which the relation between men and machines dominated the discussion about labour and management.

When Taylor wrote his first essay on management, 'A piece rate system', he gave it the subtitle 'Being a step toward partial solution of the labor problem' (Taylor, 1972). American industry was rife with friction in the 19th century, and in the 1870s the term 'the Labor Problem' began to be used to refer to the tensions between capital and labor, and the unrest – strikes, boycotts, violence – that they gave rise to (Kaufman, 2008, p. 58). Social relations on the shop floor were an important aspect of the labor problem. The growing scale of industry and the increasing mechanisation had separated the factory owners from the production process. On the shop floor, the foremen were the dominant figures, often de facto subcontractors. Many foremen abused their power by engaging in favoritism and 'driving', spurring on workers to a high pace with a combination of authoritarianism and physical force (Nelson, 1980, p. 8). Large scale industrial unrest often arose out of conflicts between foremen and workers. One approach to the solution of the labor problem was labor reform that focussed on improving the relations between employers and workers, and the working conditions of the latter. Such 'welfare management' could include measures ranging from the provision of a clean and safe working environment, to sport's clubs and cultural events, and pension and insurance plans. Taylor's 'Piece rate system' fell into another approach to the labor problem, one defended in particular by engineers, who targeted the restriction of output that they saw as the most pressing part of the labor problem. Taylor's essay, a paper he had presented to the American Society of Mechanical Engineers, proposed an improvement on the wage setting schemes that had been devised by Henry Towne and Frederick Halsey. Each of these three engineers based his ideas on the

Turning men into machines?

assumption that workers are primarily motivated by the desire to increase their wage, but their schemes were often rejected by workers, who still 'viewed the union as the proper antidote to the foreman's abuses' (Nelson, 1980, p. 16).

Frederick Winslow Taylor (1856 – 1915) came from an upper middle class Philadelphia family. Although he passed Harvard's admissions examination, he had his eyes on engineering and became an apprentice pattern maker at a foundry – getting his hands dirty with the ordinary workmen, as he would later often remind his critics. In 1878 he moved to Midvale Steel in Philadelphia, where he soon became a 'gang boss', the start of a career in management. At Midvale, Taylor distinguished himself with his experimental attitude, leaving no element of the production process unexamined in search of improvements. Apart from such aspects as the proper tools and machine speeds, and the routing of materials and products through the shop, payment schemes and their influence on worker productivity had Taylor's particular attention. When he presented his 'Piece rate system' to the ASME in June 1895, Taylor had become a management consultant, and the enthusiastic reception of his paper brought new clients to him. In 1898 Taylor's fame and that of his management system got him a contract with the Bethlehem Steel Company in Philadelphia, his most important client yet. At Bethlehem, Taylor and his assistants had to grapple with the resistance of both managers and workers to the changes that Taylor tried to introduce. Nevertheless, when he left in 1901, his authority fatally undermined by the constant obstruction, he could claim a number of successes. Moreover, high speed steel, an invention he had made at Bethlehem with his assistant Maunsell White, made them a fortune, and Taylor quit the consultancy business to become a full time propagandist for his own management system, leaving the consultancy to his disciples.

The core of Taylor's shop management could be said to consist of four elements: a focus on individual workmen; a strict separation of the planning and the execution of work; the exact timing of the constituent parts, the elementary units, of a job; and finally his differential piece rate. The first two prepared the ground for the last two. According to Taylor, managing labor scientifically

Turning men into machines?

required individualising it and concentrating its management in a dedicated department, workers generally being incapable of understanding the science behind their own work. With the work itself rendered calculable by analysing it into unit tasks performed by individual workers, one proceeded to measure the time it takes a 'first class man' to do a particular subtask (such as getting one shovelful of coal into the boiler), if necessary improving the efficiency of work by removing wasteful, unnecessary motions. By adding up the unit times for each job, Taylor then determined what the ideal performance of his workers was. Workers who performed at this level were guaranteed a piece wage set 30% to 100% higher than the average in the trade – those who failed were paid a wage somewhat below average. Because the resultant increase in productivity was higher than the increase in labor costs, the result was, in modern terms, a win-win situation – according to Taylor and his followers at least: higher wages, and lower relative labor costs.

Through Taylor's proselytizing and the consultancy work of associates like H.L. Gantt and C. Barth, the fame of 'Taylorism' continued to grow in the first decade of the 20th century. Although Taylor did not realize it himself at first, his ideas about management, and in particular the role of technical experts in organizing the processes in a factory, resembled the ideas of Progressive thinkers about the reform of society (Nelson, 1980, p. 169). The big breakthrough came in 1911, when the progressivist lawyer Louis Brandeis, representing before the Interstate Commerce Commission a group of trade associations that opposed the rate increases that the railroads were threatening to introduce, made 'efficiency' the central theme in his case. Almost overnight Taylor became a public figure and 'scientific management', a catchy name devised at Brandeis' request, became a household word. An 'efficiency craze' that would last several years had begun.

Not everyone was enthusiastic about scientific management, however. The Eastern Rate Case, as it became known, also galvanized the hostility towards efficiency measures that many workers, and their union representatives, harbored. Bonus and other wage systems in particular had long been met with resistance, because they were seen as forms of 'driving' or 'speeding': once workers had

Turning men into machines?

been tempted into higher productivity by some form of piece rate or bonus system, employers would often cut the rate, and then workers would have to keep up the same high pace in order to make their old, low wage. The unions' abhorrence of rate-cutting was matched only by their distaste for the "speed-up." (Nadworny, 1955, p. 24) For his part, Taylor was staunchly anti-union. Scientific management, he claimed, allowed to set tasks, working hours and wages in an objective, scientific fashion, and removed the need for unions and collective bargaining. With the spotlight on scientific management after the Eastern Rate Case, the unions mounted a counter-attack.

Workers and machines

It was Samuel Gompers, president of the American Federation of Labor, who led the charge. In February 1911, with the ICC about to rule on the rate increases, Gompers wrote the first of several vitriolic pieces against scientific management. In his editorial in the *American Federationist* Gompers called it a 'machinery to perfect the living machine' (Gompers, 1911a, p. 116). Two months later, in a longer essay reacting to the first installment of Taylor's 'Principles of Scientific Management' in *American Magazine*, he repeated the charge. Taylor wants to make 'high speed automatic machines' out of workers, and fit them into the shop as 'a cog or a nut or a pin in a big machine'. (Gompers, 1911b, p. 277) Gompers was not the first to employ this trope – a few months earlier naval constructor H.A. Evans had warned his fellow machinists that the Taylor-system 'is devised to make machines of them and cheap machines at that' (Evans, 1910) Both Gompers and Evans were probably inspired by Marx's characterization, in *Capital*, of the difference between manufacture and the factory. Whereas in manufacture the workers are part of a living organism, in the latter 'we have a lifeless mechanism which is independent of the workers, who are incorporated into it as its living appendage.' (Marx, 2007, pp. 461–462) Gompers had more clout with American workmen than Evans or even Marx (Gompers himself was not a Marxist) and it was his rhetoric that set the tone for the controversy about scientific management. As the fame of Taylorism spread, the

Turning men into machines?

charge that it reduces workers to machines seemed to follow in its footsteps. Alphonse Merrheim, of the French Fédération des Méteaux denounced Taylor because 'the worker must become, he has become, an automaton' (cited in Bloemen, 1988, p. 55).¹ The Dutch Jesuit J. van Ginneken, who in 1917 took it upon himself to save Dutch catholics of the scourge of Taylorism, warned them that it treats the worker 'as a merely material machine, the sole purpose of which is to yield the highest production' (Ginneken, 1918, p. 8). A young Kurt Lewin observed that there is something particularly capitalist about 'the way people are treated here not as subjects but as calculation factors, as if they are machines.'² (Kurt Lewin, 1920, cited in John, Eckardt, & Hiebsch, 1989, p. 10) The trope had two variants: sometimes it had the worker reduced to a machine, as in the examples above, sometimes the original, Marxian version was used, and the worker had been made part of a machine, as when John Frey of the Molders Union claimed that 'scientific management as applied to workmen moves with the smoothness of a well-oiled and perfected machine, in which each one performs his part with the accuracy of a mechanically and mathematically perfect tooth on a gear wheel, when it meshes with the teeth of another wheel in transmitting power.' (Frey, 1913, p. 297) The difference – machine or machine-part – was of no consequence in the discussion.

The element that distinguished men from machines, that which scientific management deprived the workers of, was articulated in many different ways. Gompers claimed that separating planning and execution robs the men of 'initiative' (United States Congress. House. Committee on Labor, 1911, p. 24), it is a system that 'preys upon the independence, the development, and the character of the worker' (1911, p. 27), his 'individuality, initiative and vitality' (Gompers, 1913, p. 525). The AFL's vice-president James Duncan wrote, in the *American Federationist*, that a task or task-setter would rob him 'of an individuality and self-reliance and reduce me to an automaton.' (Duncan, 1911, p. 383) Apparently taking his cue from Gompers, Merrheim rued the fact that 'the personality, the intelligence, even the desires of the worker are destroyed'³ (cited in Bloemen, 1988, p. 54). Van Ginneken simply called it their 'soul' (Ginneken, 1918, p. 22) but also pointed out that

Turning men into machines?

workers were stripped of their 'free will' (1918, p. 32). Commenting in 1933 on Soviet Russia's appropriation of scientific management⁴, the philosopher and social activist Simone Weil still lamented the way it made living cogs out of skilled workers with freedom, intelligence and initiative (Weil, 1958, p. 10). All in all, it was a common criticism that Taylor's system stripped workers of their humanity and reduced them to machines, but what humanity consists in was formulated in a rather diffuse, although familiar set of terms such as intelligence, personality, initiative, freedom, soul and individuality.

Scientific management, including the question of men and machines, soon became a federal matter. In April 1911 representatives of the machinists of the Rock Island arsenal came to Washington to protest against plans to introduce scientific management. Taylorism, they complained, is an attempt to speed up the worker to a 'terrific pace', by methods including '(s)tandardizing the movements of a workman, thus making an automaton of him.' (United States Congress. House. Committee on Labor, 1912, p. 1222) In response, the House of Representatives passed a resolution asking for an investigation. In the preliminary hearings, Representative Irvin Pepper, who had introduced the resolution, stated that '(t)he government should not approve a system which reduces the laboring man to a mere machine' (United States Congress. House. Committee on Labor, 1911, p. 5). When later that year a strike broke out at the Watertown navy shipyard over the introduction of scientific management, the House set up a Special Committee to investigate 'the Taylor and other systems of shop management' (United States Congress. House. Committee on Labor, 1912). The committee, made up of Representatives William B. Wilson, William C. Redfield and John Q. Tilson, heard a long list of critics and proponents of scientific management, including Taylor himself. The charge that Taylor's system made machines out of workers had their special interest. Chairman Wilson in particular was convinced that Taylor's system makes 'the workmen nothing more nor less than human machines to carry out the instructions that other intelligence has evolved' (United States Congress. House. Committee on

Turning men into machines?

Labor, 1912, p. 101)

The mechanism and the essence of scientific management

Clearly, Taylor and his associates needed to defend their work against the charge that they reduced workers to machines. Taylor developed two strategies. In his 'Principles of scientific management', written around the time of the Eastern Rate Case, Taylor introduced an analogy: was the surgeon, trained to work with precise motions and according to strict procedures any less human (Taylor, 1947a, p. 125)? When Wilson put the automaton criticism to him, Taylor used the same analogy: trainee surgeons have to do exactly as they are told, yet we don't consider them automatons. His associate Frank Gilbreth took the argument one step further. After publishing 'Principles of Scientific Management', the progressive journal *American Magazine* received hundreds of letters from fascinated, but more often worried and indignant readers. Taylor delegated the task of answering them to Gilbreth, who wrote a *Primer of scientific management*.⁵ The *Primer* is written in question and answer form, and one of the questions is 'does it not make machines out of men?' (F. Gilbreth, 1912, p. 49). Is a highly trained sportsman or soldier a machine? Gilbreth asked in return. He is simply trained to perfection. If it means doing the work in the one best way, then yes, scientific management tries 'to induce men to act as nearly like machines as possible' (F. Gilbreth, 1912, p. 50). And such "machines" (Gilbreth appears to mock the charge) are paid handsomely for their efficiency. '(W)hether or not the men may be called machines, they fare better and profit more' (1912, p. 50).

However, in the Hearings Taylor's main line of defense follows another strategy: emphasizing a distinction between the 'mechanism' (Taylor, 1947b, p. 33) of scientific management and its 'essence' (Taylor, 1947b, p. 7). Right from the start of his opening statement, Taylor takes great pains to convince the members that there is more to scientific management than mechanism and efficiency, that the precisely timed routine movements, the standardized tools, and the system of

Turning men into machines?

payment that it is famous for, are only possible on the basis of a 'complete mental revolution' (Taylor, 1947b, p. 27). Taylor apologizes for sounding a little 'highfalutin' (Taylor, 1947b, p. 49), but the essence of Scientific Management lies in the 'atmosphere' surrounding it, the 'sentiments' accompanying it (Taylor, 1947b, p. 7). Science is one aspect of this essence: Scientific Management does not consist in the specific techniques that are employed at any one time, and still less in the techniques that Taylor himself happened to have devised, but rather in the scientific attitude of which they are the result. If scientific experimentation proves that there is a better way to organize work, any technique will instantly be dropped in favor of it. Taylor has much more to say however about the other element of the essence of Scientific Management. This part of the mental revolution consists in workers, managers and employers substituting 'friendly cooperation and mutual helpfulness for antagonism and strife' (Taylor, 1947b, p. 30) Then even more than now, there was ample reason to be skeptical about the idea of friendship between factory owners and the men and women who work for them. Taylor himself treated the theme to some extent as a ploy, describing it in a letter to another witness as 'the most effective weapon that we have all of us found as a foil against inconvenient questions.' (cited in Kanigel, 2005, p. 477) It was a theme however that went back a long way in Taylor's work before the Hearings.⁶ Reading *Shop Management*, in which Taylor first expanded his ideas about the differential piece wage into a comprehensive management system, one is struck by his empathic analysis of the social and psychological processes at work in industry. Ultimately, the reason why Scientific Management is necessary, is the tremendous waste in industry, its inefficiency, and the root cause of that is soldiering, deliberately working at a slower pace than is possible. Soldiering proceeds from two causes, Taylor explains: from the workers' natural tendency to take it easy, which they have in common with everyone, but also from 'more intricate second thought and reasoning caused by their relations with other men, which may be called systematic soldiering.' (Taylor, 1947c, p. 30) Workers realize it is not in their interest to work harder than another for the same pay, and they also know (and if they don't, more experienced

Turning men into machines?

colleagues will tell them) that employers will rarely reward higher production with more pay. If the work is done for a piece wage, the rate will be cut when production goes up. Thus, workers carefully determine the precise pace of work that they can get away with, and make sure their employer remains convinced it is the maximum pace, by disciplining whoever exceeds it. To break this monopoly, the manager must employ time studies to determine the proper pace of work, but the essence of scientific management lies not in the use of the stopwatch, but in the relations between managers and workers. One can distinguish three aspects: cooperation, friendship, and teaching.

Cooperation

Strife has been the main organizing principle in industry, according to Taylor. Employers want low labor costs, workers want high wages, and from the apparent incompatibility of these two interests the main traits of contemporary industrial life follow: labor unions and strikes, soldiering by the workers, wage cutting by the employers, driving by the foremen. This strife is inefficient, but it is also unnecessary. Low labor costs and high wages are not incompatible at all. If the work is done in the scientifically determined most efficient way, the employer can pay high wages to fewer workers and still raise production, and the worker can earn more without being driven to exhaustion. Once they realize this, employers and workers can shift their attention from dividing the surplus to increasing, hand in hand, the size of the surplus.

Friendship

This principle of profit through peace cannot exist by its rationality alone. It has to go deeper than mere calculation. There must be real friendship between employers, managers, foremen and workers to make Scientific Management work. '(S)mall acts of personal kindness and sympathy' work wonders to 'establish a bond of friendly feeling' (Taylor, 1947c, p. 184), but companionship is sustained to an important degree by 'daily intimate shoulder to shoulder contact' (Taylor, 1947a, p. 27).⁷ Although scientific management pulls apart the thinking and doing of labor and has them embodied in different people, these people (managers and workers) should be together on the shop

Turning men into machines?

floor as much as possible. '(M)ore than all other causes, the close, intimate cooperation, the constant personal contact between the two sides, will tend to diminish friction and discontent' (Taylor, 1947a, p. 143). On the shop floor, managers and workers perform a precisely choreographed dance, the actions of the one dovetailing with those of the other. On the one hand, this close cooperation requires good relations, but on the other hand in such circumstances 'it becomes practically impossible to have a serious quarrel' (Taylor, 1947b, p. 45)

Essential to the relations between management and workers is honesty. In the old days in industry, deception and deviousness reigned in the battle between employers and workers. If workers knew there was a quicker way to do a job, they would never tell management, and employers could not be trusted to keep their promises and not cut piece rates at their own convenience. Taylor, on the other hand, tells the manager always to be 'perfectly straightforward' (Taylor, 1947c, p. 176) with the men. Time and motion studies should preferably be done openly, by fair-minded men, with full consent of the workers. Once a differential piece rate is set, it must be religiously adhered to. In return, the manager may expect fairness from the workers. And indeed, as long as the management does not engage in 'sneaking business' (Taylor, 1947b, p. 264), the men will cooperate honestly. Such is human nature.

Teaching

To bring about the mental revolution on which scientific management is based, the manager must be an orator and a teacher. Long passages in Taylor's works are devoted to descriptions of how a shop should be converted to scientific management. The technical, mechanical part of this process is a relatively minor concern. It is the mental part, winning over the minds of workers, owners and managers, that makes it such a difficult and protracted affair – one that may take years to complete. Both employers and workers must come to see the benefits of the new system, despite the drawbacks it may at first sight appear to have. Convincing the employers is a matter of patient explanation, but the rhetoric for the workers is built primarily on 'object lessons'. One should start

Turning men into machines?

by converting one man to the new system. Some force may be required at this point: the worker is given the choice to cooperate or leave. Only when this man has learnt to work in the new way, and has realized that it pays to cooperate with management under its regime, can one introduce other workers to it, one by one. Once about a fourth to a third of the workers have been over, the tide will rapidly turn, but it is imperative not to rush at first.

Although object lessons are the main rhetorical instrument, there is nevertheless a lot of talk involved in changing the minds of the workers. Taylor's preferred rhetorical form for this 'difficult and delicate task' (Taylor, 1947c, p. 182) is the one to one conversation, in which the characteristics and the advantages of the system are patiently explained, and the worker has the chance to ask questions. A lot comes down to the precise way the men are addressed. Taylor's favorite example was his conversation with 'Schmidt', a worker who was to be taught the scientific way of handling pig iron. In the talks he held in his mansion for entrepreneurs, engineers, and politicians, he would reenact the scene complete with imitations of Schmidt's mental sluggishness and Pennsylvania Dutch accent ('Vell, I don't know vat you mean').⁸

More talk is required in the instruction that is an integral part of Taylorism. With planning and execution separated, it becomes essential to communicate the ideas of the planners to the workers, so that they will execute the job in the manner and time that has been scientifically determined for it. Specially assigned 'functional foremen' teach each worker the proper way of doing a job, find out what's wrong when their production falls behind, encourage them and discipline them if necessary. Time and again Taylor emphasizes that it is the responsibility of management to not only select the best worker for each task, but also to train and develop them to do the work as required. 'It is only when we fully realize that our duty, as well as our opportunity, lies in systematically cooperating to train and to make this competent man, instead of in hunting for a man whom some one else has trained, that we shall be on the road to national efficiency.' (Taylor, 1947a, p. 6)

To an important extent, Taylor's discourse about the essence, the atmosphere of scientific

Turning men into machines?

management was mere talk. Historian Daniel Nelson (1980) has pointed out that in practice Taylor was not much interested in personnel management, had a strong authoritarian streak in the way he dealt with his workers, and preferred to consider them in terms of the amount of 'foot-pounds' of work they could be coaxed to do for a certain wage.⁹ Selection and training were of little actual importance, or took the form of 'weeding out the unfit' and disciplining the slow and lazy. Nelson however has also shown that something similar is true of the 'mechanism' of scientific management: that too remained to some extent mere theory. What was implemented of it in practice did not differ much of the 'systematic management' that was already widespread. The measures that were introduced under the flag of scientific management often did not include time study, for instance. Taylorism was significant first and foremost as an idea. In this respect the 'mental revolution' was no different from time study or the differential piece wage. Nonetheless, Taylor's defense of scientific management in his testimony at the Hearings was not successful. Rep. Wilson was not impressed by the comparison of a scientifically managed worker with a surgeon. The point is not, he said, that trainee surgeons, like workers under scientific management, are taught the current best practices. If they were scientifically managed, surgeons would not even be allowed to perform a diagnosis or determine for themselves the best way to operate; they would be given an instruction card from the surgeon in chief and be expected to follow it to the letter.¹⁰ In its final report the Committee underscored the distinction between people and machines: 'A machine is an inanimate thing – it has no life, no brain, no sentiment, and no place in the social order. With a workman it is different. He's a living, moving, sentient, social being (...) He would be less than a man if he did not resent the introduction of any system which deals with him in the same way as a beast of burden or an inanimate machine.' (United States Congress. House. Committee on Labor, 1912, p. 3 [Report])¹¹ Moreover, the Committee gave Taylor's fancy idea of a 'mental revolution' short shrift, arguing that a spirit of collaboration is 'too variable and insubstantial a basis upon which to rest the material welfare of the wage worker.' (United States Congress. House. Committee on Labor, 1912,

Turning men into machines?

p. 4 [Report])

Lillian Moller Gilbreth's psychology of the human factor

At the time the controversy over scientific management broke out, the discourse about industry already contained a term that indicated the role of labor in production as opposed to machinery: the 'human factor' or 'human element'¹² (Kaufman, 2008, p. 69). If one needed to point out for example that industry depends on workers, not just on machines, or that human labor is more important than machinery, one could refer to the 'human factor'. Although he didn't use the term 'human factor' himself, Gompers' charge that Taylor made machines out of men dovetailed with a distinction that was already in place. Others explicitly articulated Taylor's faults in terms of the human factor: Taylor overlooked the human element because he didn't appreciate the sensibilities and expertise of the workers (Anonymous, 1972), because he preferred automatons to skilled men (Peck, 1911), and considered workers as merely mechanical parts of the machinery of production (Frey, 1913). The human factor came to stand for the wide array of aspects that distinguished labor from machinery, men from machines, and that was ill served or even effaced by scientific management. Scientific management's perceived shortcomings regarding the human factor offered an opportunity for psychologists looking to develop psychology as a practical science. To increase efficiency in industry, it is necessary to consider not just the 'mechanical side of production', but also human efficiency, stated Walter Dill Scott, and this requires psychological study of the human factor (Scott, 1911, p. 3). Scientific management is useful when dealing with routine work, but it 'has done little for men whose welfare depends upon judgment' because they work in positions of responsibility (Scott, 1911, p. 255). Two years later, Hugo Münsterberg wrote that he believed the principles of scientific management would 'prove of lasting value' (Münsterberg, 1913, p. 50), but that he deplored its 'helpless psychological dilettantism' (1913, p. 56). 'The theorists of scientific management seem to think that the most subtle methods are

Turning men into machines?

indispensable for physical measurements, but for psychological inquiry nothing but a kind of intuition is necessary.' (1913, p. 53) Others followed his example. Whether they called their field psychotechnics or industrial psychology, when they first entered the domain of industry psychologists articulated their approach and skills in relation to scientific management, though not all as negatively as Münsterberg. In Lillian Moller Gilbreth psychology even had a representative who identified with scientific management. She believed that psychology and scientific management were quite compatible, that 'Scientific Management as laid down by Mr. Taylor conforms absolutely with psychology' (quoted in Lancaster, 2004, p. 120).

With her husband Frank Gilbreth, Lillian Moller (1878-1972) formed an efficiency team that was a considerable force in scientific management. In their work together Moller Gilbreth complemented her husband's energetic, practical attitude with solid methodological and theoretical expertise, and did much, if not most of the writing. Their work focused on the movements of the worker, rather than on the pace of work. Applying motion studies to bricklaying had been a longstanding interest of Frank, and *Bricklaying System*, written by Lillian but credited to Frank, appeared in 1909 (Lancaster, 2004, p. 95). By that time they had met Taylor and had been taken up into his circle of associates. They would remain on the periphery however. Taylor was ambivalent about Frank, didn't entirely trust him, but considered him useful because of his considerable rhetorical talent. Moreover, the Gilbreths' efficient system of bricklaying became a staple of Taylor's own propagandistic efforts. Frank considered Taylor 'a very great man' (Lancaster, 2004, p. 107) but didn't yield to his authority. To Taylor's increasing chagrin, the Gilbreths presented motion studies as an improvement on time studies. Lillian on her part never liked Taylor and had her doubts about the scientific character of his ideas. In 1914 Taylor had enough of their independent attitude and excommunicated them from the movement. The Gilbreths, who in 1912 had started a scientific management consultancy firm, were on their own, and began to cultivate an image of 'the good exception': scientific management, but with an eye for 'the human factor' (Lancaster, 2004, p. 149).

Turning men into machines?

Lillian's work on the psychology of management was an essential part of the Gilbreths' specific brand of scientific management. After getting to know scientific management through Frank, she had chosen to do a doctorate in educational psychology, reasoning that it offered a way into professional management and would give her expertise in an aspect that people like Taylor tended to neglect (Lancaster, 2004, p. 111). Taylor in fact was so impressed by her work on the psychology of management that he mentioned it in his keynote speech to the 1910 conference of the ASME and the British Institution of Mechanical Engineers (Lancaster, 2004, p. 115). Berkeley however denied her the PhD degree because she hadn't spent the last year of her doctoral program on campus. She decided to publish the book and look for another institution.¹³ At the request of its publisher, Moller Gilbreth published *The Psychology of Management* as 'L.M. Gilbreth', so as not to hurt sales by divulging it was written by a woman (Lancaster, 2004, p. 125). There is a sad irony in this, as she would arguably become more important in the history of psychology and management than Frank Gilbreth, but also in the light of the importance she assigns in her book to individuality. In frequently extravagant terms Moller Gilbreth impresses on the reader the importance of recognizing and acknowledging each worker's unique personality, making sure that the work he does is adapted to it, and arranging the processes in the shop in such a way that the personalities of the workers are allowed and encouraged to develop to the full. Unlike Münsterberg and most other psychologists of her day, Moller Gilbreth however felt no need to contrast scientific management and Psychology, in fact '(t)he psychological element of Scientific Management is the most important element,' (L. M. Gilbreth, 1921, p. 20) as it is built on the recognition of the individual, not just as an 'economic unit', but also as a personality (L. M. Gilbreth, 1921, p. 19) Moller Gilbreth made the core of scientific management psychological.

Moller Gilbreth repeatedly addresses the charge that scientific management reduces workers to machines. This is not so, she counters; on the contrary, it encourages and helps the worker's personality to develop. It starts with careful, scientific selection, which assures that each worker is

Turning men into machines?

perfectly suited for the work he does. '(F)ar from being "made machines of," men are selected to reach that special place where their individuality can be recognized and rewarded to the greatest extent.' (L. M. Gilbreth, 1921, p. 32) Once in that 'special place', each worker should regularly receive a record of his output, preferably relative to others, encouraging a feeling of personal responsibility, fostering competition, and impressing upon him that he is an individual, not an anonymous member of a gang. Again, '(t)his chance to be an individual, or personality, is in great contradistinction to the popular opinion of Scientific Management, which thinks it turns men into machines.'¹⁴ (L. M. Gilbreth, 1921, pp. 36–37) The effect is even greater if the worker makes his own records, which requires him to be 'conscious every moment of the time exactly where he stands' (L. M. Gilbreth, 1921, p. 40) and thus creates self-knowledge. Somewhat counter-intuitively, the standardization of work-processes that is so typical of scientific management also supports and strengthens individuality. It conserves the mental energy of the worker and allows him to focus on the parts of the job that are novel. He can then use his initiative to come up with a good way of standardizing them.¹⁵ In fact, Moller Gilbreth carries on, since standards are a way of externalizing memory, an ability that distinguishes us from the lower animals, therefore those who object to standardization apparently want to turn the worker into an animal. Against all appearances, '(s)tandards prevent men from becoming machines'. (L. M. Gilbreth, 1921, p. 177)

Moller Gilbreth thus translated the human element, that which distinguishes us from machines, into a psychological factor. What had been a diffuse set of terms in the criticism leveled at Taylor – brain and intelligence, initiative, free will, personality, soul – she articulated as one factor, individuality, which could be scientifically measured and managed with the help of psychology. Scientific management that is based on psychological laws and principles selects the individual best suited for each task and organizes the shop in such a way that each individual is enabled and encouraged to develop to the full. Thus, Moller Gilbreth puts forward psychology as a mediator between the mechanical and the human: by employing psychology's knowledge of the

Turning men into machines?

laws that govern 'the working of the mind' (L. M. Gilbreth, 1921, p. 2) one enables the worker to develop as an individual and be unlike a machine. Psychology connects the domain of causal laws with the world of feelings, morals and imagination, feeding the latter with its knowledge of the former.

Although it is individuality that makes us different from machines, there is a second theme in the book, that has less to do with individuality than with the relations between people. Moller Gilbreth adopts Taylor's emphasis on teaching and gives it a psychological basis.¹⁶ Teaching is ubiquitous, in industry as well as in the academic world, and it must be made the object of scientific management. '(E)very man going out into the world needs all the knowledge that he can get as to the working of the human mind in order not only to give but to receive information with the least waste and expenditure of energy' (L. M. Gilbreth, 1921, p. 2). To make teaching efficient, it must be based on psychological principles. The 'disciplinarian', one of eight kinds of foremen that Taylor had distinguished, must 'apply, at least unconsciously, and preferably consciously, the known laws of psychology, if he wishes to be successful.' (L. M. Gilbreth, 1921, p. 71) The laws and principles in question have a familiar ring to them: it is important, for example, to motivate the worker by explaining why he needs to know what he is taught, and it is crucial to gain his commitment by making him feel that he is 'a part of what is taught' (L. M. Gilbreth, 1921, p. 221), that he is being taught the laws underlying his own experiences. Moller Gilbreth combines such motivational advice with an emphasis on teaching the right habits, the psychological importance of which she supports by referring to William James. As in James' famous chapter of the *Principles of Psychology*, habit connects the structure of the brain with morality and a good and just society. On the one hand, the formation of proper work habits always starts with teaching the right motions (rather than abstract theory), resulting among other things in a fully developed brain (L. M. Gilbreth, 1921, p. 268), but on the other hand the benefit also lies on a higher plane, all the way up to the education of reason and will, the happiness of the worker, and a Taylorist 'spirit of coöperation' (L. M. Gilbreth, 1921, p.

Turning men into machines?

238).

Engineering and management

Between 1914 and 1920, the furor over scientific management gradually died down. Union resistance waned when more workers actually experienced scientific management and found out that time studies, touted by Taylor as the central part of the system, were in practice a minor element, most of the attention going to better management of machinery, routing, tools, shop lay-out etcetera. As Nelson has discovered, this had been true of scientifically managed shops all along (Nelson, 1974). The House report of 1912 recommended that time study should only be done with the consent of the workers, but did endorse standardization, systematization, and other efforts to eliminate waste in industry and raise efficiency. Scientific management, minus time studies, was reintroduced in the U.S. arsenals. Meanwhile, with the passionately anti-union Taylor having died in 1915, his disciples sought closer links with union leaders. Taylor's pupil Morris Cooke edited a collection of essays together with Samuel Gompers and Fred Miller, the president of the American Society of Mechanical Engineers, in which 'the scientists of industry and the representatives of organized workers' together considered the problems of industry (Cooke, Gompers, & Miller, 1920, p. 7). In the process, the 'workers are human beings, not machines' issue largely disappeared from the discussion of scientific management, instead becoming part of the common sense *topoi* of work on which Chaplin for example drew for *Modern Times*. At the same time, the dominance of engineers in management was gradually broken, when psychologists and accountants began to compete for the same ground.

It would be tempting to interpret this process of gradually diminishing influence of engineers and a growing role of psychologists as the humanization of management, culminating in the 'human relations' approach of the 1930's. The more psychologists had a say in management, it appears, the better the 'human factor' was represented, the more 'humane' management became and the less like

Turning men into machines?

engineering.¹⁷ One reason why such a story would be incorrect, is the psychological nature of some of Taylor's ideas. He never used the term 'psychology', but the mentality – the motives, feelings and thinking – of workers were of great interest to him. To say that Taylor was psychologically naive and Münsterberg and the psychologists who came after him increasingly sophisticated, is to uncritically adopt the boundary work instituted by that same Münsterberg. If anything, Taylor's perspective on the mind of the worker was broader than that of many early industrial psychologists and psychotechnicians. Whereas they focused on the individual worker – his or her personal traits and capabilities, their exact measurement using psychological tests – Taylor was equally interested in the social processes on the shop floor and in the relations of workers and managers. Some of Taylor's ideas have a distinct 'human relations' character to them. In one of his favorite anecdotes, Taylor relates how his associate Sanford Thompson had reorganized the quality control in a factory producing ball bearings. The process had had a beneficial effect on the wellbeing of the 'girls' doing the inspecting. Not only could the work be done better, by fewer girls working shorter hours, it also raised their spirits: 'Each girl was made to feel that she was the object of especial care and interest on the part of the management, and that if anything went wrong with her she could always have a helper and teacher in the management to lean upon.' (Taylor, 1947a, p. 96) When the Hawthorne study revealed that workers restricted their output to a very precise level to maximize earnings while avoiding rate cutting, it replicated one of Taylor's basic insights into the causes of soldiering. The analysis of the group processes that underlie the phenomenon (Gillespie, 1991, p. 162 ff.) extended Taylor's, but did not contradict it

Rather than management becoming more psychological with the advent of psychologists like Moller Gilbreth and Münsterberg, it is more to the point to say that the mind of the worker became technologically constituted by the theories and instruments they introduced: it became a machine working according to definite laws, a machine that could be manipulated using standardized techniques, and the operating parameters of which could be determined using scientific instruments.

Turning men into machines?

Taylor already made some steps in this direction. In the *Principles*, he wrote that management should not only include the scientific study of work (task time, tools, etc.), but also 'the accurate study of the motives which influence men' (Taylor, 1947a, p. 119), because there too there exist laws, even though human beings are very complex. Psychologists took it upon themselves to formulate the laws that governed the mind and behavior of the individual worker. What Moller Gilbreth writes about mind and management is not all that different from Taylor, except that she supports each claim with a reference to a psychologist's theory. In one important respect, however, her approach *is* different from Taylor's. Whereas Taylor had distinguished the mechanism of scientific management from its 'essence', the system from the atmosphere of cooperation and camaraderie that formed its heart as well as its precondition, Moller Gilbreth made the relational, emotional and moral aspects of management an integral part of the system, and grounded them in the firm reality of psychological laws. She applied the precept of standardization, for example, not only to the actions of individual workers, but also to 'the relationships between the foreman, the manager, and the worker' (L. M. Gilbreth, 1921, p. 179). As Moller Gilbreth's biographer Jane Lancaster puts it: 'Lillian, like all the scientific management experts, wanted a predictable and controllable labor force and was prepared to use her psychological expertise to get it.' (Lancaster, 2004, pp. 153–154) If anything, management was more like engineering in the theories of Scott, Münsterberg and Moller Gilbreth than it was in Taylor's work.

Around the Great War, engineering was a common term for the work of psychologists (Brown, 1992). Applied psychology stands to experimental psychology as engineering to physics, Münsterberg (1908) proclaimed¹⁸, and many expressed the analogy in terms like 'human engineering' and 'mental engineering'. In an era when the engineer epitomized the ability to construct a better society for all, such terms conveyed the sense of professionalism that applied psychology required. '(P)sychologists capitalized on the hard-won reputation of the engineer as a practical man of affairs' (Brown, 1992, p. 108). Thus, with more psychology, management did not

Turning men into machines?

immediately become less like engineering. It widened the field of application of what was still seen as a technical practice. Complementing management with a concern for the 'human factor' did not make it more 'humane' as long as the human factor was still a kind of machine. It is true that the mechanical model of the human factor was increasingly challenged in the interbellum, and that psychology became an important source of resistance against mechanicism. The British industrial psychologist C.S. Myers for example, who had been enthusiastic about scientific management in 1918 (C. S. Myers, 1918), soon began to protest against its mechanistic approach (C.S. Myers, 1923). During the decade that followed, psychology channeled approaches into management that were incompatible with an engineering model, including instinct psychology (Drever, 1929) and Gestalt psychology.¹⁹ Psychologists began to accuse scientific management of ignoring the complexity and uniqueness of people and organizations, and professed the impossibility of analyzing work and workers into their constituent parts. Thus, the increasing influence of psychologists on management thought and practice certainly developed the human factor into a much more diverse and complex aspect of work and management than it had been in Taylor's days, but the move away from mechanicism and engineering in management was the result of a change *in* psychology rather than being caused by the entry of psychology into management per se.

Managing freedom and responsibility

The increasing influence of psychology on management theory and practice continued a development that Taylor had started: psychologists extended the reach of science on the shop floor to include the individuality and the social relations of the workers. The influx of psychologists into management was consequential, because it brought the human factor in industry under the aegis of science, taking management further in a direction that Taylor had already vaguely indicated. An arguably more important turn therefore happened when the limits of the reach of science and engineering in industry were articulated. This happened when freedom and autonomy, rather than

Turning men into machines?

individuality, became the hallmarks of the human factor. Of the diffuse set of terms that had been employed to mark the human factor, freedom and autonomy had been used to differentiate men from machines, but even more to distinguish them from slaves. Didn't the worker under scientific management, forced to follow the instructions on an instruction card to the letter, his every movement precisely prescribed, lose his freedom and become a slave? The stopwatch, the object of much hate of the molders and machinists in the Hearings, was compared to the slave driver's whip. (United States Congress. House. Committee on Labor, 1912, p. 18) Taylor strenuously denied the charge: the foreman in scientific management is not a 'nigger driver', he is a teacher, a friend even, there to help the worker do the job in the best possible way, earning him the most money (Taylor, 1947b, p. 59).²⁰ Taylor emphasized that the system is sovereign in scientific management. If it had been objectively determined that the job had to be carried out in such a way in so much time, then everyone, including foremen and management, had to obey. Yet to workmen it was clear that science was a tool in the hands of management and employer, not vice versa. In practice, the boss remained sovereign, not science.

After the War there was a growing consensus that the old distribution of power in industry was unacceptable to workers and, moreover, did not 'work'. In the essays that Cooke, Gompers and Miller collected in 1920, the key words that describe 'the human factor as the heart of industry' (Cooke et al., 1920, p. iii) are freedom, cooperation, responsibility and democracy, and the authors emphasize that only by respecting workers' freedom and encouraging them to assume responsibility for their work can productivity really be raised.²¹ As 'labor manager' A.J. Todd put it, to really motivate workers to produce more they need to be able to assume 'industrial citizenship', and this means 'responsibility and some measure of self-determination and self-expression.' (A.J. Todd, in Cooke et al., 1920, p. 31) In the words of Gompers: 'Liberation is the answer, and only through liberation can there be a solution of our problems.' (Gompers, in Cooke et al., 1920, p. xii) An early example of the style of management that such a conception of the human factor requires is

Turning men into machines?

described in Mary Parker Follett's 1925 paper 'The giving of orders' (Follett, 1982a).

Parker Follett's interest in the social processes in organizations arose from her study in political science (she graduated from Radcliffe in 1898) and her experiences in social work in Boston.²² She started to express her ideas in lectures and in 1918 published a book, *The New State*, in which she presented self-government arising out of group processes as the solution to problems of government. Shifting her focus to business administration, she began to reflect on the role of managers in cultivating, rather than imposing, change in organisations. In her ideas on this subject the psychology of human motivation and interaction becomes an increasingly important subject. 'The giving of orders', from 1925, is one of her best known lectures on the topic. At a time when instinct psychology was under fire from behaviorists, Parker Follett notes that the exaggerated interest in human instincts is giving way to a study of habits. Like Moller Gilbreth, she advocates creating habitual behavior patterns in workers. With such 'prepared-in-advance behavior patterns' one prepares the way for 'the reception of orders' which will release these behaviors (Follett, 1982a, p. 24). The subsequent reinforcement of the response completes the behaviorist scheme. However, Parker Follett warns, preparing in advance is not what psychologists take it to be, a tactic. People do not like to be told what to do, they have a deep-seated wish to be self-governing. This instinct, in fact, is 'the very essence of human being' (Follett, 1982a, p. 33). A manager could only dispense orders in the way that psychologists envisage if it were a covert practice, otherwise employees would resist. 'If this prepared-in-advance idea were all that the psychologists think it, it would have to be printed privately as secret doctrine.' (Follett, 1982a, p. 32) Parker Follett's way to avoid the Scylla and Charybdis of 'bossism' and avoiding orders all together is to depersonalize the order.²³ Rather than the manager giving an order, inevitably eliciting resistance, the order is located in the demands of the situation, and the manager must engage the employee to discover it together. By putting everyone, manager as well as worker, 'under the situation' (Follett, 1982a, p. 33) the problem of resistance to authority is overcome. If it is the situation rather than the boss that rules,

Turning men into machines?

one may expect employees to follow orders and take responsibility for their work as well.

Obedience and liberty come together under the 'law of the situation' (Follett, 1982a, p. 35) Thus, Parker Follett took Taylor's insistence on the sovereignty of the system, and developed it further into the 'law of the situation'. Not in the interest of science, as in Taylor's case, but to accommodate the essential autonomy of workers.²⁴ Control must give way to self-control, distributed over the whole company. 'To get our affairs in hand, to feel a grip on them, to become free, we must learn, and practice, I am sure, the methods of collective control.' (Follett, 1937, p. 169)

Engineering is not a term that fits well such a form of management as Parker Follett proposes. In their calculations engineers certainly need to factor in resistance, but the friction they deal with does not arise from the fact that their machines are both expected to follow orders and supposed to be autonomous. That, at least, was not the state of the art in mechanical engineering in the 1920's. Locating orders in the situation is a paradoxical instrument to manage the paradoxical challenge of governing autonomous subjects. In comparison, scientific management has a very straightforward idea of control. Defending scientific management in his *Primer*, Frank Gilbreth argued that it may be so that under scientific management you have to do the work as the planners have determined, but at least you get a 'square deal', and not being lied to is also a kind of freedom (1912, p. 73). Although scientific management was in practice not free of deception (Taylor advised that time study was best done covertly if resistance was expected, for example), it is clear that this is a different idea of freedom than that of Parker Follett. For Taylor and his disciples, freedom, initiative, and independent thought had a place outside of the 'mechanism' of objectively timed, precisely coordinated tasks. Inside the system one had to do as the system required. It was a transparent, honest, 'square' deal. In Parker Follett's management on the other hand, freedom and obedience are brought together in an uneasy combination. In the process, the subject under management changes in step: from a being that shuttles between machinality and friendship, to a hybrid of freedom and responsibility, autonomy and order.

Conclusion

Frederick Taylor is commonly portrayed as both psychologically naive and callous in his neglect of the human factor and in the way he treated workers as mere machines. Management only became humane with the arrival of psychologists on the scene. I have argued this is too simplistic a view, and uncritically repeats the rhetoric that early industrial psychologists like Münsterberg employed to position their profession. It assumes that the human factor is a given, that was ignored by Taylor and uncovered and defended by psychologists. However, to understand this part of the history of management one needs to look at the ways in which the human factor was variously articulated. Certainly, the core of Taylor's scientific management, its 'mechanism' as he called it, was indeed a largely mechanistic affair, in which workers functioned primarily as bodies propelled by rudimentary motives, performing repetitive, precisely engineered tasks. But Taylor also emphasized that around this mechanism there had to be an atmosphere of friendship, honesty and cooperation. Moreover, managing the mechanism involved selecting, developing and teaching workers, processes that psychologists were to claim expertise on. Although it is clear from the historical record that Taylor's 'mental revolution' was to a large extent window dressing, 'mere talk' rather than practice, the same is true of other aspects of scientific management. It doesn't change the fact that at least in its theory, its principles, scientific management did formulate a mental side of shop floor management and industrial relations. On the other hand, the human factor that industrial psychologists articulated, beginning with Münsterberg, was as mechanical as the core of scientific management, albeit psychologically more complex, and managing the human factor psychologically was proudly presented as a form of engineering. The decisive change in management away from the mechanism at the heart of scientific management was therefore not the rise of psychologists as experts of the human factor, but the articulation of freedom and responsibility as the essence of the human factor. Workers were not machines but human beings, not because they had feelings, intelligence or a soul (although they do), but because they would resist being treated as machines,

Turning men into machines?

manipulated as cogs in a mechanism. They were free agents, demanding democratic rights and responsibilities. Parker Follett realized that governing such self-governing subjects required a new form of management.

Turning men into machines?

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- 1 '(L)ouvrier doit devenir, il est devenu, un automate' E. Pouget, of the French General Federation of Labor: '(I)t makes the worker an automaton, destroys his initiative, renders superfluous any effort of thought or reflection, and in brief makes him an accurate and unthinking extension of the machine.' (cited in Friedmann, 1955, p. 43)
- 2 'Wie hier Menschen nicht als Subjekte, sondern als Rechenfaktoren gleich Maschinen angesehen werden.
- 3 'la personnalité, l'intelligence, les désirs mêmes de l'ouvrier sont effacés
- 4 For the enthusiastic implementation of Taylorism and Fordism in Soviet Russia, see Hughes (2004 ch.6). He quotes the poet and union leader Alexei Gastev: 'Many find it repugnant that we want to deal with human beings as with a screw, a nut, a machine. But we must undertake this as fearlessly as we accept the growth of trees and the expansion of the railway network.' (2004, p. 258)
- 5 In all likelihood, it was written together with, or even entirely by, his wife Lillian Moller Gilbreth, about whom more below (Lancaster, 2004, p. 118)
- 6 Kanigel (2005, p. 283) sees the influence of Taylor's Quaker background in his social idealism.
- 7 See Oldenziel (1999 ch. 2) for the symbolic meaning of shop floor manliness for engineers of Taylor's generation. As engineers became managers, it became all the more important to mark their physical prowess and assert their authority by positioning themselves as one of the boys, yet also above the boys.
- 8 Taylor recounts the episode in *Principles of Scientific Management*; this quote on ([Principles]1947d, p. 44).
- 9 '(I)t is unlikely that he ever fully reconciled himself to the notion that that men could be as complicated as machines.' (Hughes, 2004, p. 43) On the other hand, the manly camaraderie that Taylor sketches as part of the essence of scientific management did reflect the way he actually related to the workers.
- 10 Wilson's nightmare resembles the standardised protocols of current evidence-based medicine (Timmermans & Berg, 2003).
- 11 The report was published in a separately numbered volume.
- 12 The two terms were synonymous.
- 13 She eventually went to Brown, and earned her doctorate in 1915 for a thesis on applying efficiency methods in schools.
- 14 Among the more outlandish arguments in the book is Moller Gilbreth's connection of output records and genius: 'The outcome of the records, and their related elements in other branches of Scientific Management, is to arouse interest. Interest arouses abnormally concentrated attention, and this in turn is the cause of genius. This again answers the argument of those who claim that Scientific Management kills individuality and turns the worker into a machine.' (L. M. Gilbreth, 1921, p. 43)
- 15 'Far from making machines out of the men, standardization causes a mental state that leads to invention, for the reason that the worker's brain is in most intimate contact with the work, and yet has not been unnecessarily fatigued by the work itself.' (L. M. Gilbreth, 1921, p. 180)
- 16 The chapter on teaching is by far the longest in the book.
- 17 See e.g. Friedmann (1955, p. 45) ('physiology and psychology [...] prepared the way for developing a science of industrial labor, aiming at gradually introducing into the workshops and extending there the consideration of the human factor'), and recently Van de Water (1997).
- 18 'The modern psychological laboratory disentangles the mental functions with a subtlety that surpasses the mere self-observation of practical life as much as the search with the microscope surpasses the viewing of objects with the naked eye.' (Münsterberg, 1910, p. 34)
- 19 And psychoanalysis: Myers (Charles S Myers, 1927, p. 166ff.) employed the concept of defense mechanisms to shed light on the psychology of industrial unrest.
- 20 See also Moller Gilbreth (1921, p. 217), who refers to Gantt in support.
- 21 Richard Gillespie, in his history of the Hawthorne experiments, describes the rise of personnel management as a response to a.o. the growing power of workers and their unions, and the resultant need to win their loyalty and commitment (Gillespie, 1991). The motives and attitudes of employees became a central concern of management.
- 22 Her papers are collected in *Dynamic administration*, edited by Elliot Fox and L. Urwick (Follett, 1982b). They also give an excellent introduction to her life and work.
- 23 Herein lies one of the greatest contributions of scientific management, she adds: 'it tends to depersonalize orders.' (Follett, 1982a, p. 30)
- 24 Cawley & Chaloupka (1997) argue that Parker Follett refined and elaborated tactics of management that Taylor had pioneered.