Labor and Monopoly Capital

The Degradation of Work in the Twentieth Century

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New Introduction by John Bellamy Foster

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from his testimony, a quarter-century later, before a Special Committee of the U.S. House of Representatives:

> Now, the machine shop of the Midvale Steel Works was a piecework shop. All the work practically was done on piecework, and it ran night and day—five nights in the week and six days. Two sets of men came on, one to run the machines at night and the other to run them in the daytime.
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> We who were the workmen of that shop had the quantity output carefully agreed upon for everything that was turned out in the shop. We limited the output to about, I should think, one-third of what we could very well have done. We felt justified in doing this, owing to the piecework system—that is, owing to the necessity for soldiering under the piecework system—which I pointed out yesterday.
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> As soon as I became gang boss the men who were working under me and who, of course, knew that I was onto the whole game of soldiering or deliberately restricting output, came to me at once and said, "Now, Fred, you are not going to be a damn piecework hog, are you?"
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> I said, "If you fellows mean you are afraid I am going to try to get a larger output from these lathes," I said, "Yes; I do propose to get more work out." I said, "You must remember I have been square with you fellows up to now and worked with you. I have not broken a single rate. I have been on your side of the fence. But now I have accepted a job under the management of this company and I am on the other side of the fence, and I will tell you perfectly frankly that I am going to try to get a bigger output from those lathes." They answered, "Then, you are going to be a damned hog."
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> I said, "Well, if you fellows put it that way, all right." They said, "We warn you, Fred, if you try to bust any of these rates, we will have you over the fence in six weeks." I said, "That is all right; I will tell you fellows again frankly that I propose to try to get a bigger output off these machines."
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> Now, that was the beginning of a piecework fight that lasted for nearly three years, as I remember it—two or three years—in which I was doing everything in my power to increase the output of the shop, while the men were absolutely determined that the output should not be increased. Anyone who has been through such a fight knows and dreads the meanness of it and the bitterness of it. I believe that if I had been an older man—a man of more experience—I

the case so baldly as did Taylor, in his naive assumption that all reasonable people, including workers, would see the supreme rationality of his argument and accede to it. What he avows openly are the now-unacknowledged private assumptions of management. On the other hand, most of the academic commentators on Taylor are of limited usefulness, since everything that is so clear in Taylor becomes blurred or misunderstood. Kakar's book is a useful exception, despite his conventional conclusion that "with Taylor's ends there is no quarrel."

> should have hardly gone into such a fight as this—deliberately attempting to force the men to do something they did not propose to do.
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> We fought on the management's side with all the usual methods, and the workmen fought on their side with all their usual methods. I began by going to the management and telling them perfectly plainly, even before I accepted the gang boss-ship, what would happen. I said, "Now these men will show you, and show you conclusively, that, in the first place, I know nothing about my business; and that in the second place, I am a liar, and you are being fooled, and they will bring any amount of evidence to prove these facts beyond a shadow of a doubt." I said to the management, "The only thing I ask you, and I must have your firm promise, is that when I say a thing is so you will take my word against the word of any 20 men or any 50 men in the shop." I said, "If you won't do that, I won't lift my finger toward increasing the output of this shop." They agreed to it and stuck to it, although many times they were on the verge of believing I was both incompetent and untruthful.
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> Now, I think it perhaps desirable to show the way in which that fight was conducted.
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> I began, of course, by directing some one man to do more work than he had done before, and then I got on the lathe myself and showed him that it could be done. In spite of this, he went ahead and turned out exactly the same old output and refused to adopt better methods or to work quicker until finally I laid him off and got another man in his place. This new man—I could not blame him in the least under the circumstances—turned right around and joined the other fellows and refused to do any more work than the rest. After trying this policy for a while and failing to get any results I said distinctly to the fellows, "Now, I am a mechanic; I am a machinist. I do not want to take the next step, because it will be contrary to what you and I look upon as our interest as machinists, but I will take it if you fellows won't compromise with me and get more work off of these lathes, but I warn you if I have to take this step it will be a durned mean one." I took it.
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> I hunted up some especially intelligent laborers who were competent men, but who had not had the opportunity of learning a trade, and I deliberately taught these men how to run a lathe and how to work right and fast. Every one of these laborers promised me, "Now, if you will teach me the machinist's trade, when I learn to run a lathe I will do a fair day's work," and every solitary man, when I had taught them their trade, one after another turned right around and joined the rest of the fellows and refused to work one bit faster.
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> That looked as if I were up against a stone wall, and for a time I was up against a stone wall. I did not blame even these laborers in my heart, my sympathy was with them all of the time, but I am telling you the facts as they then existed in the machine shops of this country, and in truth, as they still exist.

When I had trained enough of these laborers so that they could run the lathes, I went to them and said, "Now, you men to whom I have taught a trade are in a totally different position from the machinists who were running these lathes before you came here. Every one of you agreed to do a certain thing for me if I taught you a trade, and now not one of you will keep his word. I did not break my word with you, but every one of you has broken his word with me. Now, I have not any mercy on you; I have not the slightest hesitation in treating you entirely differently from the machinists." I said, "I know that very heavy social pressure has been put upon you outside the works to keep you from carrying out your agreement with me, and it is very difficult for you to stand out against this pressure, but you ought not to have made your bargain with me if you did not intend to keep your end of it. Now, I am going to cut your rate in two tomorrow and you are going to work for half price from now on. But all you will have to do is to turn out a fair day's work and you can earn better wages than you have been earning."

These men, of course, went to the management, and protested that I was a tyrant, and a nigger driver, and for a long time they stood right by the rest of the men in the shop and refused to increase their output a particle. Finally, they all of a sudden gave right in and did a fair day's work.

I want to call your attention, gentlemen, to the bitterness that was stirred up in this fight before the men finally gave in, to the meanness of it, and the contemptible conditions that exist under the old piecework system, and to show you what it leads to. In this contest, after my first fighting blood which was stirred up through strenuous opposition had subsided, I did not have any bitterness against any particular man or men. My anger and hard feelings were stirred up against the system; not against the men. Practically all of those men were my friends, and many of them are still my friends.* As soon as I began to be successful in forcing the men to do a fair day's work, they played what is usually the winning card. I knew that it was coming. I had predicted to the owners of the company what would happen when we began to win, and had warned them that they must stand by me; so that I had the backing of the company in taking effective steps to checkmate the final move of the men. Every time I broke a rate or forced one of the new men whom I had trained to work at a reasonable and proper speed, some one of the machinists would deliberately break some part of his machine as an object lesson to demonstrate to the management that a fool foreman was driving the men to overload their machines until they broke. Almost every day ingenious accidents were planned, and these happened to machines in different parts of the shop, and were, of course, always laid to the fool foreman who was driving the men and the machines beyond their proper limit.

* This particular bit of mythomania was typical of the man; there was apparently no truth to it. Kakar calls it "characteristic of the obsessional personality."[9]

Fortunately, I had told the management in advance that this would happen, so they backed me up fully. When they began breaking their machines, I said to the men, "All right; from this time on, any accident that happens in this shop, every time you break any part of a machine you will have to pay part of the cost of repairing it or else quit. I don't care if the roof falls in and breaks your machine, you will pay all the same." Every time a man broke anything I fined him and then turned the money over to the mutual benefit association, so that in the end it came back to the men. But I fined them, right or wrong. They could always show every time an accident happened that it was not their fault and that it was an impossible thing for them not to break their machine under the circumstances. Finally, when they found that these tactics did not produce the desired effect on the management, they got sick and tired of being fined, their opposition broke down, and they promised to do a fair day's work.

After that we were good friends, but it took three years of hard fighting to bring this about.[10]

The issue here turned on the work content of a day's labor power, which Taylor defines in the phrase "a fair day's work." To this term he gave a crude physiological interpretation: all the work a worker can do without injury to his health, at a pace that can be sustained throughout a working lifetime. (In practice, he tended to define this level of activity at an extreme limit, choosing a pace that only a few could maintain, and then only under strain.) Why a "fair day's work" should be defined as a physiological maximum is never made clear. In attempting to give concrete meaning to the abstraction "fairness," it would make just as much if not more sense to express a fair day's work as the amount of labor necessary to add to the product a value equal to the worker's pay; under such conditions, of course, profit would be impossible. The phrase "a fair day's work" must therefore be regarded as inherently meaningless, and filled with such content as the adversaries in the purchase-sale relationship try to give it.

Taylor set as his objective the maximum or "optimum" that can be obtained from a day's labor power. "On the part of the men," he said in his first book, "the greatest obstacle to the attainment of this standard is the slow pace which they adopt, or the loafing or 'soldiering,' marking time, as it is called." In each of his later expositions of his system, he begins with this same point, underscoring it heavily.[11] The causes of this soldiering he breaks into two parts: "This loafing or soldiering proceeds from two causes. First, from the natural instinct and tendency of men to take it easy, which may be called *natural soldiering*. Second, from more intricate second thought and reasoning caused by their relations with other men, which may be called *systematic soldiering*." The first of these he quickly puts aside, to concentrate on the second: "The natural laziness of men is serious, but by far the greatest evil from which both workmen and employers are suffering is the *systematic soldiering* which is almost universal under all the ordinary schemes of management and which

results from a careful study on the part of the workmen of what they think will promote their best interests."

> The greater part of systematic soldiering . . . is done by the men with the deliberate object of keeping their employers ignorant of how fast work can be done.
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> So universal is soldiering for this purpose, that hardly a competent workman can be found in a large establishment, whether he works by the day or on piece work, contract work or under any of the ordinary systems of compensating labor, who does not devote a considerable part of his time to studying just how slowly he can work and still convince his employer that he is going at a good pace.
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> The causes for this are, briefly, that practically all employers determine upon a maximum sum which they feel it is right for each of their classes of employés to earn per day, whether their men work by the day or piece.[12]

That the pay of labor is a socially determined figure, relatively independent of productivity, among employers of similar types of labor power in any given period was thus known to Taylor. Workers who produce twice or three times as much as they did the day before do not thereby double or triple their pay, but may be given a small incremental advantage over their fellows, an advantage which disappears as their level of production becomes generalized. The contest over the size of the portion of the day's labor power to be embodied in each product is thus relatively independent of the level of pay, which responds chiefly to market, social, and historical factors. The worker learns this from repeated experiences, whether working under day or piece rates: "It is, however," says Taylor, "under piece work that the art of systematic soldiering is thoroughly developed. After a workman has had the price per piece of the work he is doing lowered two or three times as a result of his having worked harder and increased his output, he is likely to entirely lose sight of his employer's side of the case and to become imbued with a grim determination to have no more cuts if soldiering can prevent it."[13] To this it should be added that even where a piecework or "incentive" system allows the worker to increase his pay, the contest is not thereby ended but only exacerbated, because the output records now determine the setting and revision of pay rates.

Taylor always took the view that workers, by acting in this fashion, were behaving rationally and with an adequate view of their own best interests. He claimed, in another account of his Midvale battle, that he conceded as much even in the midst of the struggle: "His workman friends came to him [Taylor] continually and asked him, in a personal, friendly way, whether he would advise them, for their own best interest, to turn out more work. And, as a truthful man, he had to tell them that if he were in their place he would fight against turning out any more work, just as they were doing, because under the

piece-work system they would be allowed to earn no more wages than they had been earning, and yet they would be made to work harder."[14] *

The conclusions which Taylor drew from the baptism by fire he received in the Midvale struggle may be summarized as follows: Workers who are controlled only by general orders and discipline are not adequately controlled, because they retain their grip on the actual processes of labor. So long as they control the labor process itself, they will thwart efforts to realize to the full the potential inherent in their labor power. To change this situation, control over the labor process must pass into the hands of management, not only in a formal sense but by the control and dictation of each step of the process, including its mode of performance. In pursuit of this end, no pains are too great, no efforts excessive, because the results will repay all efforts and expenses lavished on this demanding and costly endeavor.**

* In this respect, the later industrial sociologists took a step backward from Taylor. Rather than face the fact of a conflict of interests, they interpreted the behavior of workers in refusing to work harder and earn more under piece rates as "irrational" and "noneconomic" behavior, in contrast to that of management, which always behaved rationally. And this despite the fact that, in the observations made at the Hawthorne plant of Western Electric from which the "human relations" school emerged, the "lowest producer in the room ranked first in intelligence and third in dexterity; the highest producer in the room was seventh in dexterity and lowest in intelligence."[15]

At least one economist, William M. Leiserson, has given a proper judgment on workers' rationality in this connection: ". . . the same conditions that lead businessmen to curtail production when prices are falling, and to cut wages when labor efficiency is increasing, cause workers to limit output and reduce efficiency when wages are increasing. . . . If the workers' reasoning is wrong, then business economics as it is taught by employers and the business practices of modern industry generally must be equally wrong."[16] The Hawthorne investigators thought, and their followers still think, that the Western Electric workers were "irrational" or motivated by "group" or "social" or other "emotional" considerations in holding their output down, despite the fact that these very Hawthorne investigations were brought to an end by the Western Electric layoffs in the Great Depression of the 1930s, thus demonstrating just how rational the workers' fears were.

One of the most interesting inquiries into this subject was done in the late 1940s by a sociologist at the University of Chicago who took a job in a factory. He studied intensively eighty-four workers, and found among them only nine "rate busters," who were "social isolates" not only on the job but off; eight of the nine were Republicans while the shop was 70 percent Democratic, and all were from farm or middle-class backgrounds while the rest of the shop was predominantly working-class in family history."[17]

** Clearly, this last conclusion depends on Adam Smith's well-known principle that the division of labor is limited by the extent of the market, and Taylorism cannot become generalized in any industry or applicable in particular situations until the scale of production is adequate to support the efforts and costs involved in "rationalizing" it. It is for this reason above all that Taylorism coincides with the growth of production and its concentration in ever larger corporate units in the latter part of the nineteenth and in the twentieth centuries.

The forms of management that existed prior to Taylorism, which Taylor called "ordinary management," he deemed altogether inadequate to meet these demands. His descriptions of ordinary management bear the marks of the propagandist and proselytizer: exaggeration, simplification, and schematization. But his point is clear:

> Now, in the best of the ordinary types of management, the managers recognize frankly that the . . . workmen, included in the twenty or thirty trades, who are under them, possess this mass of traditional knowledge, a large part of which is not in the possession of management. The management, of course, includes foremen and superintendents, who themselves have been first-class workers at their trades. And yet these foremen and superintendents know, better than any one else, that their own knowledge and personal skill falls far short of the combined knowledge and dexterity of all the workmen under them. The most experienced managers frankly place before their workmen the problem of doing the work in the best and most economical way. They recognize the task before them as that of inducing each workman to use his best endeavors, his hardest work, all his traditional knowledge, his skill, his ingenuity, and his good-will—in a word, his "initiative," so as to yield the largest possible return to his employer.[18]

As we have already seen from Taylor's belief in the universal prevalence and in fact inevitability of "soldiering," he did not recommend reliance upon the "initiative" of workers. Such a course, he felt, leads to the surrender of control: "As was usual then, and in fact as is still usual in most of the shops in this country, the shop was really run by the workmen and not by the bosses. The workmen together had carefully planned just how fast each job should be done." In his Midvale battle, Taylor pointed out, he had located the source of the trouble in the "ignorance of the management as to what really constitutes a proper day's work for a workman." He had "fully realized that, although he was foreman of the shop, the combined knowledge and skill of the workmen who were under him was certainly ten times as great as his own."[19] This, then, was the source of the trouble and the starting point of scientific management.

We may illustrate the Taylorian solution to this dilemma in the same manner that Taylor often did: by using his story of his work for the Bethlehem Steel Company in supervising the moving of pig iron by hand. This story has the advantage of being the most detailed and circumstantial he set down, and also of dealing with a type of work so simple that anyone can visualize it without special technical preparation. We extract it here from Taylor's *The Principles of Scientific Management*:

> One of the first pieces of work undertaken by us, when the writer started to introduce scientific management into the Bethlehem Steel Company, was to handle pig iron on task work. The opening of the Spanish War found some

> 80,000 tons of pig iron placed in small piles in an open field adjoining the works. Prices for pig iron had been so low that it could not be sold at a profit, and therefore had been stored. With the opening of the Spanish War the price of pig iron rose, and this large accumulation of iron was sold. This gave us a good opportunity to show the workmen, as well as the owners and managers of the works, on a fairly large scale the advantages of task work over the old-fashioned day work and piece work, in doing a very elementary class of work.
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> The Bethlehem Steel Company had five blast furnaces, the product of which had been handled by a pig-iron gang for many years. This gang, at this time, consisted of about 75 men. They were good, average pig-iron handlers, were under an excellent foreman who himself had been a pig-iron handler, and the work was done, on the whole, about as fast and as cheaply as it was anywhere else at that time.
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> A railroad switch was run out into the field, right along the edge of the piles of pig iron. An inclined plank was placed against the side of a car, and each man picked up from his pile a pig of iron weighing about 92 pounds, walked up the inclined plank and dropped it on the end of the car.
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> We found that this gang were loading on the average about 12½ long tons per man per day. We were surprised to find, after studying the matter, that a first-class pig-iron handler ought to handle between 47 and 48 long tons per day, instead of 12½ tons. This task seemed to us so very large that we were obliged to go over our work several times before we were absolutely sure that we were right. Once we were sure, however, that 47 tons was a proper day's work for a first-class pig-iron handler, the task which faced us as managers under the modern scientific plan was clearly before us. It was our duty to see that the 80,000 tons of pig iron was loaded on to the cars at the rate of 47 tons per man per day, in place of 12½ tons, at which rate the work was then being done. And it was further our duty to see that this work was done without bringing on a strike among the men, without any quarrel with the men, and to see that the men were happier and better contented when loading at the new rate of 47 tons than they were when loading at the old rate of 12½ tons.
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> Our first step was the scientific selection of the workman. In dealing with workmen under this type of management, it is an inflexible rule to talk to and deal with only one man at a time, since each workman has his own special abilities and limitations, and since we are not dealing with men in masses, but are trying to develop each individual man to his highest state of efficiency and prosperity. Our first step was to find the proper workman to begin with. We therefore carefully watched and studied these 75 men for three or four days, at the end of which time we had picked out four men who appeared to be physically able to handle pig iron at the rate of 47 tons per day. A careful study was then made of each of these men. We looked up their history as far back as

practicable and thorough inquiries were made as to the character, habits, and the ambition of each of them. Finally we selected one from among the four as the most likely man to start with. He was a little Pennsylvania Dutchman who had been observed to trot back home for a mile or so after his work in the evening, about as fresh as he was when he came trotting down to work in the morning. We found that upon wages of $1.15 a day he had succeeded in buying a small plot of ground, and that he was engaged in putting up the walls of a little house for himself in the morning before starting to work and at night after leaving. He also had the reputation of being exceedingly "close," that is, of placing a very high value on a dollar. As one man whom we talked to about him said, "A penny looks about the size of a cart-wheel to him." This man we will call Schmidt.

The task before us, then, narrowed itself down to getting Schmidt to handle 47 tons of pig iron per day and making him glad to do it. This was done as follows. Schmidt was called out from among the gang of pig-iron handlers and talked to somewhat in this way:

"Schmidt, are you a high-priced man?"

"Vell, I don't know vat you mean."

"Oh yes, you do. What I want to know is whether you are a high-priced man or not."

"Vell, I don't know vat you mean."

"Oh, come now, you answer my questions. What I want to find out is whether you are a high-priced man or one of these cheap fellows here. What I want to find out is whether you want to earn $1.85 a day or whether you are satisfied with $1.15, just the same as all those cheap fellows are getting."

"Did I vant $1.85 a day? Vas dot a high-priced man? Vell, yes, I vas a high-priced man."

"Oh, you're aggravating me. Of course you want $1.85 a day—every one wants it! You know perfectly well that that has very little to do with your being a high-priced man. For goodness' sake answer my questions, and don't waste any more of my time. Now come over here. You see that pile of pig iron?"

"Yes."

"You see that car?"

"Yes."

"Well, if you are a high-priced man, you will load that pig iron on that car to-morrow for $1.85. Now do wake up and answer my question. Tell me whether you are a high-priced man or not."

"Vell—did I got $1.85 for loading dot pig iron on dot car to-morrow?"

"Yes, of course you do, and you get $1.85 for loading a pile like that every day right through the year. That is what a high-priced man does, and you know it just as well as I do."

"Vell, dot's all right. I could load dot pig iron on the car to-morrow for $1.85, and I get it every day, don't I?"

"Certainly you do—certainly you do."

"Vell, den, I vas a high-priced man."

"Now, hold on, hold on. You know just as well as I do that a high-priced man has to do exactly as he's told from morning till night. You have seen this man here before, haven't you?"

"No, I never saw him."

"Well, if you are a high-priced man, you will do exactly as this man tells you to-morrow, from morning till night. When he tells you to pick up a pig and walk, you pick it up and you walk, and when he tells you to sit down and rest, you sit down. You do that right straight through the day. And what's more, no back talk. Now a high-priced man does just what he's told to do, and no back talk. Do you understand that? When this man tells you to walk, you walk; when he tells you to sit down, you sit down, and you don't talk back at him. Now you come on to work here to-morrow morning and I'll know before night whether you are really a high-priced man or not."

This seems to be rather rough talk. And indeed it would be if applied to an educated mechanic, or even an intelligent laborer.

With a man of the mentally sluggish type of Schmidt it is appropriate and not unkind, since it is effective in fixing his attention on the high wages which he wants and away from what, if it were called to his attention, he probably would consider impossibly hard work. . . .

Schmidt started to work, and all day long, and at regular intervals, was told by the man who stood over him with a watch, "Now pick up a pig and walk. Now sit down and rest. Now walk—now rest," etc. He worked when he was told to work, and rested when he was told to rest, and at half-past five in the afternoon had his 47½ tons loaded on the car. And he practically never failed to work at this pace and do the task that was set him during the three years that the writer was at Bethlehem. And throughout this time he averaged a little more than $1.85 per day, whereas before he had never received over $1.15 per day, which was the ruling rate of wages at that time in Bethlehem. That is, he received 60 per cent. higher wages than were paid to other men who were not working on task work. One man after another was picked out and trained to handle pig iron at the rate of 47½ tons per day until all of the pig iron was handled at this rate, and the men were receiving 60 per cent. more wages than other workmen around them.[20] *

The merit of this tale is its clarity in illustrating the pivot upon which all modern management turns: the control over work through the control over the

* Daniel Bell has recorded this event as follows: "But it was in 1899 that Taylor achieved fame when he taught a Dutchman named Schmidt to shovel forty-seven tons

decisions that are made in the course of work. Since, in the case of pig-iron handling, the only decisions to be made were those having to do with a time sequence, Taylor simply dictated that timing and the results at the end of the day added up to his planned day-task. As to the use of money as motivation, while this element has a usefulness in the first stages of a new mode of work, employers do not, when they have once found a way to compel a more rapid pace of work, continue to pay a 60 percent differential for common labor, or for any other job. Taylor was to discover (and to complain) that management treated his "scientific incentives" like any other piece rate, cutting them mercilessly so long as the labor market permitted, so that workers pushed to the Taylorian intensity found themselves getting little, or nothing, more than the going rate for the area, while other employers—under pressure of this competitive threat—forced their own workers to the higher intensities of labor.*

Taylor liked to pretend that his work standards were not beyond human capabilities exercised without undue strain, but as he himself made clear, this pretense could be maintained only on the understanding that unusual physical specimens were selected for each of his jobs:

instead of twelve and a half tons of pig iron a day. Every detail of the man's job was specified: the size of the shovel, the bite into the pile, the weight of the scoop, the distance to walk, the arc of the swing, and the rest periods that Schmidt should take. By systematically varying each factor, Taylor got the optimum amount of barrow load.[21] In the face of so much circumstantial detail, one hesitates to inquire whether Professor Bell can imagine handling a 92-pound pig of iron on a shovel, let alone what sort of an "arc of the swing" one could manage, or how a "barrow" would handle a whole "scoop" of them. The point here is not that anyone may be tripped up by the use of secondary sources, or get his stories mixed, or have never seen a pig of iron; the point is that sociologists, with few exceptions, deem it proper to write about occupations, work, skills, etc. without even bare familiarity. The result is what one would get from a school of literary critics who never read the novels, plays, poems they write about, but construct their theories entirely on the basis of responses to questionnaires put to "scientifically selected samples" of readers. Bell's error is only the grandfather of a long line of such misapprehensions, which become truly extraordinary as more complex forms of work are dealt with. In this situation, management can—and gleefully does—tell academics anything it pleases about the evolution of work, skills, etc.

* In his classic study of scientific management undertaken in 1915 for the United States Commission on Industrial Relations, Robert F. Hoxie pointed out that most rate cutting in shops which had installed a formal system of scientific management took place indirectly, by creating new job classifications at lower rates, etc. He concludes that under scientific management "what amounts to rate cutting seems to be almost of necessity an essential part of its very nature." [22]

> As to the scientific selection of the men, it is a fact that in this gang of 75 pig-iron handlers only about one man in eight was physically capable of handling 47½ tons per day. With the very best of intentions, the other seven out of eight men were physically unable to work at this pace. Now the one man in eight who was able to do this work was in no sense superior to the other men who were working on the gang. He merely happened to be a man of the type of the ox,—no rare specimen of humanity, difficult to find and therefore very highly prized. On the contrary, he was a man so stupid that he was unfitted to do most kinds of laboring work, even. The selection of the man, then, does not involve finding some extraordinary individual, but merely picking out from among very ordinary men the few who are especially suited to this type of work. Although in this particular gang only one man in eight was suited to doing the work, we had not the slightest difficulty in getting all the men who were needed—some of them from inside the works and others from the neighboring country—who were exactly suited to the job.[23] *

Taylor spent his lifetime in expounding the principles of control enunciated here, and in applying them directly to many other tasks: shoveling loose materials, lumbering, inspecting ball bearings, etc., but particularly to the machinist's trade. He believed that the forms of control he advocated could be applied not only to simple labor, but to labor in its most complex forms, without exception, and in fact it was in machine shops, bricklaying, and other such sites for the practice of well-developed crafts that he and his immediate successors achieved their most striking results.

From earliest times to the Industrial Revolution the craft or skilled trade was the basic unit, the elementary cell of the labor process. In each craft, the worker was presumed to be the master of a body of traditional knowledge, and methods and procedures were left to his or her discretion. In each such worker reposed the accumulated knowledge of materials and processes by which production was accomplished in the craft. The potter, tanner, smith, weaver, carpenter, baker, miller, glassmaker, cobbler, etc., each representing a branch of the social division of labor, was a repository of human technique for the

* Georges Friedmann reports that in 1927 a German physiologist, reviewing the Schmidt experience, calculated that the level of output set by Taylor could not be accepted as a standard because "most workers will succumb under the pressure of these labors.[24] Yet Taylor persisted in calling it "a pace under which men become happier and thrive."[25] We should also note that although Taylor called Schmidt "a man of the type of the ox," and Schmidt's stupidity has become part of the folklore of industrial sociology, Taylor himself reported that Schmidt was building his own house, presumably without anyone to tell him when to stand and when to squat. But a belief in the original stupidity of the worker is a necessity for management; otherwise it would have to admit that it is engaged in a wholesale enterprise of prizing and fostering stupidity.

labor processes of that branch. The worker combined, in mind and body, the concepts and physical dexterities of the specialty: technique, understood in this way, is, as has often been observed, the predecessor and progenitor of science. The most important and widespread of all crafts was, and throughout the world remains to this day, that of farmer. The farming family combines its craft with the rude practice of a number of others, including those of the smith, mason, carpenter, butcher, miller, and baker, etc. The apprenticeships required in traditional crafts ranged from three to seven years, and for the farmer of course extends beyond this to include most of childhood, adolescence, and young adulthood. In view of the knowledge to be assimilated, the dexterities to be gained, and the fact that the craftsman, like the professional, was required to master a specialty and become the best judge of the manner of its application to specific production problems, the years of apprenticeship were generally needed and were employed in a learning process that extended well into the journeyman decades. Of these trades, that of the machinist was in Taylor's day among the most recent, and certainly the most important to modern industry.

As I have already pointed out, Taylor was not primarily concerned with the advance of technology (which, as we shall see, offers other means for direct control over the labor process). He did make significant contributions to the technical knowledge of machine-shop practice (high-speed tool steel, in particular), but these were chiefly by-products of his effort to study this practice with an eye to systematizing and classifying it. His concern was with the control of labor at any given level of technology, and he tackled his own trade with a boldness and energy which astonished his contemporaries and set the pattern for industrial engineers, work designers, and office managers from that day on. And in tackling machine-shop work, he had set himself a prodigious task.

The machinist of Taylor's day started with the shop drawing, and turned, milled, bored, drilled, planed, shaped, ground, filed, and otherwise machine- and hand-processed the proper stock to the desired shape as specified in the drawing. The range of decisions to be made in the course of the process is—unlike the case of a simple job, such as the handling of pig iron—by its very nature enormous. Even for the lathe alone, disregarding all collateral tasks such as the choice of stock, handling, centering and chucking the work, layout and measuring, order of cuts, and considering only the operation of turning itself, the range of possibilities is huge. Taylor himself worked with twelve variables, including the hardness of the metal, the material of the cutting tool, the thickness of the shaving, the shape of the cutting tool, the use of a coolant during cutting, the depth of the cut, the frequency of regrinding cutting tools as they became dulled, the lip and clearance angles of the tool, the smoothness of cutting or absence of chatter, the diameter of the stock being turned, the pressure of the chip or shaving on the cutting surface of the tool, and the speeds,

feeds, and pulling power of the machine.[26] Each of these variables is subject to broad choice, ranging from a few possibilities in the selection and use of a coolant, to a very great number of effective choices in all matters having to do with thickness, shape, depth, duration, speed, etc. Twelve variables, each subject to a large number of choices, will yield in their possible combinations and permutations astronomical figures, as Taylor soon realized. But upon these decisions of the machinist depended not just the accuracy and finish of the product, but also the pace of production. Nothing daunted, Taylor set out to gather into management's hands all the basic information bearing on these processes. He began a series of experiments at the Midvale Steel Company, in the fall of 1880, which lasted twenty-six years, recording the results of between 30,000 and 50,000 tests, and cutting up more than 800,000 pounds of iron and steel on ten different machine tools reserved for his experimental use.* His greatest difficulty, he reported, was not testing the many variations, but holding eleven variables constant while altering the conditions of the twelfth. The data were systematized, correlated, and reduced to practical form in the shape of what he called a "slide rule" which would determine the optimum combination of choices for each step in the machining process.[28] His machinists thenceforth were required to work in accordance with instructions derived from these experimental data, rather than from their own knowledge, experience, or tradition. This was the Taylor approach in its first systematic application to a complex labor process. Since the principles upon which it is based are fundamental to all advanced work design or industrial engineering today, it is important to examine them in detail. And since Taylor has been virtually alone in giving clear expression to principles which are seldom now publicly acknowledged, it is best to examine them with the aid of Taylor's own forthright formulations.

First Principle

"The managers assume . . . the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then of

* Friedmann so far forgets this enormous machine-shop project at one point that he says: "This failure to appreciate the psychological factors in work is at least partially explained by the nature of the jobs to which Taylor exclusively confined his observations: handlers of pig iron, shovel-laborers, and navvies." [27] He was led to this error by his marked tendency to side with the psychological and sociological schools of "human relations" and work adjustment which came after Taylor, and which he always attempts to counterpose to Taylorism, although, as we have pointed out, they operate on different levels. In general, Friedmann, with all his knowledge of work processes, suffers from a confusion of viewpoints, writing sometimes as a socialist concerned about the trends in capitalist work organization, but more often as though the various forms of capitalist management and personnel administration represent scrupulous efforts to find a universal answer to problems of work.