

► **The social shaping of
technology**

Second edition

Edited by

Donald MacKenzie and **Judy Wajcman**

Marx, pp. 156-157

Braverman, pp. 158-160

Thomas, pp. 199-121

© 1999

Open University Press
Buckingham • Philadelphia

12 ► The machine versus the worker

Karl Marx

The instrument of labour strikes down the labourer. This direct antagonism between the two comes out most strongly, whenever newly introduced machinery competes with handicrafts or manufactures, handed down from former times. But even in Modern Industry the continual improvement of machinery, and the development of the automatic system, has an analogous effect. 'The object of improved machinery is to diminish manual labour, to provide for the performance of a process or the completion of a link in a manufacture by the aid of an iron instead of the human apparatus.'¹ 'The adaptation of power to machinery heretofore moved by hand, is almost of daily occurrence . . . the minor improvements in machinery having for their object economy of power, the production of better work, the turning off more work in the same time, or in supplying the place of a child, a female, or a man, are constant, and although sometimes apparently of no great moment, have somewhat important results.'² 'Whenever a process requires peculiar dexterity and steadiness of hand, it is withdrawn, as soon as possible, from the cunning workman, who is prone to irregularities of many kinds, and it is placed in charge of a peculiar mechanism, so self-regulating that a child can superintend it.'³ . . .

But machinery not only acts as a competitor who gets the better of the workman, and is constantly on the point of making him superfluous. It is also a power inimical to him, and as such capital proclaims it from the roof tops and as such makes use of it. It is the most powerful weapon for repressing strikes, those periodical revolts of the working-class against the autocracy of capital.⁴ According to Gaskell, the steam-engine was from the very first an antagonist of human power, an antagonist that enabled the capitalist to tread under foot the growing claims of the workmen, who threatened the newly born factory system with a crisis.⁵ It would be possible to write quite a history of the inventions, made since 1830, for the sole

purpose of supplying capital with weapons against the revolts of the working-class. At the head of these in importance stands the self-acting mule, because it opened up a new epoch in the automatic system.⁶

Nasmyth, the inventor of the steam-hammer, gives the following evidence before the Trades' Union Commission, with regard to the improvements made by him in machinery and introduced in consequence of the widespread and long strikes of the engineers in 1851. 'The characteristic feature of our modern mechanical improvements, is the introduction of self-acting tool machinery. What every mechanical workman has now to do, and what every boy can do, is not to work himself but to superintend the beautiful labour of the machine. The whole class of workmen that depend exclusively on their skill, is now done away with. Formerly, I employed four boys to every mechanic. Thanks to these new mechanical combinations, I have reduced the number of grown-up men from 1,500 to 750. The result was a considerable increase in my profits.'

Ure says of a machine used in calico printing: 'At length capitalists sought deliverance from this intolerable bondage' (namely the, in their eyes, burdensome terms of their contracts with the workmen) 'in the resources of science, and were speedily re-instated in their legitimate rule, that of the head over the inferior members.' Speaking of an invention for dressing warps: 'Then the combined malcontents, who fancied themselves impreguably entrenched behind the old lines of division of labour, found their flanks turned and their defences rendered useless by the new mechanical tactics, and were obliged to surrender at discretion.' With regard to the invention of the self-acting mule, he says: 'A creation destined to restore order among the industrious classes. . . . This invention confirms the great doctrine already propounded, that when capital enlists science into her service, the refractory hand of labour will always be taught docility.'⁷

► NOTES

1 'Rep. Insp. Fact. for 31st October, 1858,' p. 43.

2 'Rep. Insp. Fact. for 31st October, 1856,' p. 15.

3 Andrew Ure, *The Philosophy of Manufactures*, London, 1835, p. 19. 'The great advantage of the machinery employed in brick-making consists in this, that the employer is made entirely independent of skilled labourers.' ('Ch. Empl. Comm. V. Report,' Lond., 1866, p. 130, n. 46.)

4 'The relation of master and man in the blown-flint bottle trades amounts to a chronic strike.' Hence the impetus given to the manufacture of pressed glass, in which the chief operations are done by machinery. One firm in Newcastle, who formerly produced 350,000 lbs. of blown-flint glass, now produces in its place 3,000,500 lbs. of pressed glass. ('Ch. Empl. Comm., Fourth Rep.' 1865, pp. 262-263).

5 Gaskell, 'The Manufacturing Population of England,' London, 1833, pp. 3, 4.

6 Fairbairn discovered several very important applications of machinery to the construction of machines, in consequence of strikes in his own workshops.

7 Ure, 1. c., pp. 368-370.

3 ► Technology and capitalist control

Harry Braverman

The evolution of machinery from its primitive forms, in which simple rigid frames replace the hand as guides for the motion of the tool, to those modern complexes in which the *entire process* is guided from start to finish by not only mechanical but also electrical, chemical, and other physical forces – this evolution may thus be described as an increase in human control over the action of tools. These tools are controlled, in their activities, as extensions of the human organs of work, including the sensory organs, and this feat is accomplished by an increasing human understanding of the properties of matter – in other words, by the growth of the scientific command of physical principles. The study and understanding of nature has, at its primary manifestation in human civilization, the increasing control by humans over labor processes by means of machines and machine systems.

But the control of humans over the labor process, thus far understood, is nothing more than an abstraction. This abstraction must acquire concrete form in the social setting in which machinery is being developed. And this social setting is, and has been from the beginnings of the development of machinery in its modern forms, one in which humanity is sharply divided, and nowhere more sharply divided than in the labor process itself. The mass of humanity is subjected to the labor process for the purposes of those who control it rather than for any general purposes of 'humanity' as such. In thus acquiring concrete form, the control of humans over the labor process turns into its opposite and becomes the control of the labor process over the mass of humans. Machinery comes into the world not as the servant of 'humanity,' but as the instrument of those to whom the accumulation of capital gives the *ownership* of the machines. The capacity of humans to control the labor process through machinery is seized upon by management from the beginning of capitalism as the *prime means*

whereby production may be controlled not by the direct producer but by the owners and representatives of capital. Thus, in addition to its technical function of increasing the productivity of labor – which would be a mark of machinery under any social system – machinery also has in the capitalist system the function of divesting the mass of workers of their control over their own labor. It is ironic that this feat is accomplished by taking advantage of that great human advance represented by the technical and scientific developments that increase human control over the labor process. It is even more ironic that this appears perfectly 'natural' to the minds of those who, subjected to two centuries of this fetishism of capital, actually see the machine as an alien force which subjugates humanity!

The evolution of machinery represents an expansion of human capacities, an increase of human control over environment through the ability to elicit from instruments of production an increasing range and exactitude of response. But it is in the nature of machinery, and a corollary of technical development, that the control over the machine need no longer be vested in its immediate operator. This possibility is seized upon by the capitalist mode of production and utilized to the fullest extent. What was mere *technical possibility* has become, since the Industrial Revolution, an *inevitability* that devastates with the force of a natural calamity, although there is nothing more 'natural' about it than any other form of the organization of labor. Before the human capacity to control machinery can be transformed into its opposite, a series of special conditions must be met which have nothing to do with the physical character of the machine. The machine must be the property not of the producer, nor of the associated producers, but of an alien power. The interests of the two must be antagonistic. The manner in which labor is deployed around the machinery – from the labor required to design, build, repair, and control it to the labor required to feed and operate it – must be dictated not by the human needs of the producers but by the special needs of those who own both the machine and the labor power, and whose interest it is to bring these two together in a special way. Along with these conditions, a social evolution must take place which parallels the physical evolution of machinery: a step-by-step creation of a 'labor force' in place of self-directed human labor; that is to say, a working population conforming to the needs of this social organization of labor, in which knowledge of the machine becomes a specialized and segregated trait, while among the mass of the working population there grows only ignorance, incapacity, and thus a fitness for machine servitude. In this way the remarkable development of machinery becomes, for most of the working population, the source not of freedom but of enslavement, not of mastery but of helplessness, and not of the broadening of the horizon of labor but of the confinement of the worker within a blind round of servile duties in which the machine appears as the embodiment of science and the worker as little or nothing. But this is no more a technical necessity of machinery than appetite is, in the ironic words of Ambrose Bierce, 'an instinct thoughtfully implanted by Providence as a solution to the labor question.'

Machinery offers to management the opportunity to do by wholly

mechanical means that which it had previously attempted to do by organizational and disciplinary means. The fact that many machines may be paced and controlled according to centralized decisions, and that these controls may thus be in the hands of management, removed from the site of production to the office – these technical possibilities are of just as great interest to management as the fact that the machine multiplies the productivity of labor.¹ It is not always necessary, for this purpose, that the machine be a well-developed or sophisticated example of its kind. The moving conveyor, when used for an assembly line, though it is an exceedingly primitive piece of machinery, answers perfectly to the needs of capital in the organization of work which may not be otherwise mechanized. Its pace is in the hands of management, and is determined by a mechanical device the construction of which could hardly be simpler but one which enables management to seize upon the single essential control element of the process.

▶ NOTES

- 1 'One great advantage which we may derive from machinery,' wrote Babbage, 'is from the check which it affords against the inattention, the idleness, or the dishonesty of human agents.' Charles Babbage, *On the Economy of Machinery and Manufactures* (1832; rept. ed., New York, 1963), p. 54.

14 ▶ Social choice in machine design:
the case of automatically
controlled machine tools

David F. Noble

▶ THE TECHNOLOGY: AUTOMATICALLY CONTROLLED
MACHINE TOOLS

The focus here is numerically controlled machine tools, a particular production technology of relatively recent vintage. According to many observers, the advent of this new technology has produced something of a revolution in manufacturing, a revolution which, among other things, leading to increased concentration in the metalworking industry and to reorganization of the production process in the direction of greater managerial control. These changes in the horizontal and vertical relations of production are seen to follow logically and inevitably from the introduction of the new technology. 'We will see some companies die, but I think we will see other companies grow very rapidly,' a sanguine president of Dat Systems Corporation opined (Stephansz 1971). Less sanguine are the owners of the vast majority of the smaller metalworking firms which, in 1971, constituted 83 percent of the industry; they have been less able to adopt the new technology because of the very high initial expense of the hardware, and the overheads and difficulties associated with the software (ibid.). In addition, within the larger, better endowed shops, where the technology has been introduced, another change in social relations has been taking place. Earl Lundgren, a sociologist who surveyed these shops in the late 1960s, observed a dramatic transfer of planning and control from the shop floor to the office (1969).

For the technological determinist, the story is pretty much told: numerical control leads to industrial concentration and greater managerial control over the production process. The social analyst, having identified the cause,