The Social Shaping of Technology *edited by Donald MacKenzie and Judy Wajcman*
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Many years ago, having interviewed an activist professor at MIT, I could not see how to use the interview, because it seemed to me that he had not said more than one very short sentence that was worth publishing. In retrospect, I should have given that one sentence a page of its own, in 72-pt bold italics: "The basic political question is, Who decides?"

Every technical change (descending now to the subject before us) is the result of conscious choice among technical possibilities by some person or persons. To find out why we have got the technologies we have, it is necessary to find out who decided (and how they got into that position), what motivated them, and what the physical alternatives were. This type of enquiry is of more than academic interest. No amount of concern about the quality of life, or conservation, or military destructiveness, will achieve anything without a practical knowledge of how the decisions are made, and hence how they may be influenced. The primitive theology of 'technological determinism' — which is equivalent to, but less forgivable than, the notion that volcanoes erupt when the gods are angry — betrays an ignorance both of machinery and of human institutions. As Ruth Cowan observes in one of the best contributions to this book, "the landscape of American technical history is littered with the remains of abandoned machines". (The 'American' here is superfluous.) It is also littered with bankrupt entrepreneurs, and their disappointed investors and other creditors. To know why a thing happened is to know why other things did not.

MacKenzie and Wajcman show that in fact quite a lot of work has been done on the who and why of technological change — as distinct from its effects — but it is only just beginning to be recognised as a subject in its own right. The chapters are mostly from publications of the last decade, although some are much older, and the topics range over eight centuries. The coverage, the editors say, is limited by the available material. The book is well structured, nevertheless. The three main sections are on 'the technology of production', 'domestic technology' and 'military technology' — a division which of course reflects the three main types of purchasers of equipment: industry, households and the public sector. There is also a 'general issues' section for things that were judged not to fit into the chosen categories: namely, the political biases that can be physically built into technologies (Langdon Winner), the biases particularly against women (Ruth Cowan, Cynthia Cockburn) and Edison's development of the electric light (Thomas Hughes). This last could have been included in the rather small 'domestic' section, where Cowan's other two chapters (one of which I've already quoted) are natural sequels to it.

The same could be said of Marc Bloch's chapter on the medieval watermill, which tells of the recurrent battles between landowners and tenants as to whether people should be allowed to grind their own flour or whether it had to be done by the power station. This conflict between consumers (as we now call people) and politically-backed local monopolies persisted until the Industrial Revolution, when public flour milling was one of the many functions that

private industry took over from the gentry. And this *locus* of conflict was in the end transformed by Mr Edison's copper cables.

Bloch's chapter in fact opens the 'production technology' section, the tone of which is set by a few well-chosen words from Karl Marx on production technology as capitalist weaponry in the class war: devices whereby the cost of labour is reduced, not simply by increasing productivity, but more particularly by — as far as possible — taking the control of the work out of the hands of skilled workers who can organise strikes and other inconveniences. The point is reiterated in a similarly brief extract from Harry Braverman's *Labour and Monopoly Capital* (quoting Babbage).

One of Marx's examples is the self-acting spinning mule. On this subject, the editors include two modern historians, Tine Bruland and William Lazonick, who find that, though a group of manufacturers certainly commissioned the development of a self-acting mule with the aim of dispensing with the skilled spinners, the upshot was not entirely as they hoped — the spinners had been more than machine-operators, and were still needed. The enduring lesson here is perhaps that decisions in favour of automation can easily be biassed by inadequate knowledge of the work that is allegedly going to be automated.

The same point — which has considerable implications for class history — emerges from the story of numerically controlled (NC) machine tools, told by David Noble (the splendidly titled Curator of Industrial Automation at the National Museum of American History). Noble reminds us that there was an alternative to NC: record-playback, whereby the machine automatically repeated a job that a skilled machinest had done once. Numerical control — an inherently much more difficult approach, entailing *eliminating* the machinest — might never have got off the ground without massive funding from the US Air Force. "The drive for total automation. . .," says Noble, "is not altogether rational"; for the Air Force, technical secrecy may have been a factor, but it seems that the 19th-century mill-owners dream of doing without workers has grown into a sort of religious principle, to be obeyed *regardless of cost.* And it's still only a dream: even with NC, "the intelligence of production . . . remains in the possession of the workforce", Noble concludes. The boarhound and the boar pursue their pattern as before, as Eliot put it.

The most infuriating chapter is the extract from Mike Cooley's (1980) *Architect or Bee?,* on the way that workers at Lucas Aerospace, in the UK, drew up a list of 150 new products they could make as an alternative to being 'rationalised'. As Cooley says, many of the staff themselves "used to believe that the only reason society didn't have nice socially useful products was that nobody had thought of them! The fact that these products are being built but are still being rejected, both by the government and the company, demonstrates in very dramatic terms the kind of priorities dominant in this society." Happen it does. So what priorities are demonstrated? How do those priorities manifest themselves? Who decides? Why? That is what the book is supposed to be about, and yet the editors make no attempt at a follow-up which would show us the specific conclusions of the Lucas experiment.

At this point I nipped out to my friendly neighbourhood anarchist book-shop and bought *The Lucas Plan* by H. Wainwright and D. Elliott (Allison & Busby), which takes the story up to February 1982 and which is not even referenced by MacKenzie and Wajcman, although its authors are both at the

Open University. One suggestion in Wainwright and Elliott is that the Lucas Aerospace management had grown so accustomed to military contracts that they were no longer "in the habit of looking for new markets". Could be. One of the limitations of the Marxist, labour-*vs*-capital way of seeing industry is that it tends to overlook the fact that looking for, and providing for, new markets is not a habit at all, but an exceedingly difficult game which is played only by rare eccentrics. Adam Smith called them projectors; J.S. Mill called them undertakers; Schumpeter called them entrepreneurs (a word which Mill regretted that he could not use because it was French). Such people would probably *not* be among the directors of a company that didn't need them.

Having referred twice to the military, let us then skip to the third section. It takes us into a world where technology indeed changes, but shaped by bureaucracies. And what bureaucracies! "Needless to say," says Michael Armacost in a footnote to his chapter on the contest between the US Army and Air Force for control of an intermediate-range missile, "neither the Army nor the Air Force was free to operate as a monolithic entity. . . No unanimity of either purpose or political tactics is to be anticipated in large multipurpose organisations like the military services". It may not be a coincidence that, at the conclusion of this particular Army/Air Force conflict, the USSR placed its land-based ballistic missiles in the hands of a separate service.

But for real insight into why the USA these days never takes on anyone bigger than Nicaragua, read James Fallows' chapter on the M-16 rifle. From 1966 to — apparently — 1969, US infantry in Vietnam were equipped with rifles that, with the type of ammunition supplied, were so utterly useless that the enemy did not even bother to take them from the dead. An excellent rifle, bureaucratically modified so that it wouldn't work. The motivation, it seems, was to protect the reputation of an Army-designed rifle, the M-14, and to keep up the orders of the usual ammunition supplier. While the nation's students were shouting 'NLF is gonna win!' the Pentagon was making quite sure of it. Fallows calls it 'the banality of evil', but it isn't banal; it's a giant step beyond *Catch 22*.

As regards 'weapon systems' — planes, tanks, ships — two chapers by Mary Kaldor contrast the US and USSR approaches, showing how the US systems evolve towards diminishing variety and increasing cost and complexity; while in Russia a policy is imposed of simplicity and inter-changeability of sub-systems among a wide range of systems. The West's arms industries, Kaldor argues, "drag the economy along their own technological cul de sac" — hence, partly, "the backwardness of arms-intensive economies like Britain and the United States compared with, say, West Germany and Japan".

Incidentally, this is one of only a couple of references to Japan in the whole book; a curious omission — it would have been instructive to learn something about the shaping of the Japanese gear we're all using every day. Gene Gregory's articles in *Journal of Asian Electronics Union* spring to mind. (One of Gregory's theses is that Japanese consumer electronics grew up in response to orders from US companies like Sears Roebuck — a curious echo of the role of the merchant at the start of the Industrial Revolution.)

Returning to military equipment: are there *any* American weapons that are intended to work, or has the whole business simply been ritualised like the Changing of the Guard? In his chapter on nuclear weapons, Alan Roberts argues that there has long been a school of thought in the US which holds to

the classic doctrine that weapons are means for achieving policital ends, and which has never abandoned the attempt to find a use for nuclear bombs. The accuracy of the latest missiles (MX and Cruise), he says, at last enables this school of thought to prevail: they can be used in the old gunboat style to back up current diplomatic positions; any subsequent escalation will be quite unintentional.

To show us, in contrast, what weapon development was like in the good old days, the editors include a chapter by William McNeill on the origins of mobile field artillery in pre-Revolutionary France. This, according to McNeill, was the beginning of "planned invention for war"; it was accompanied by much conflict within the military, occasioned by the entry of the rational bourgeoisie into a previously aristocratic world. "A weapon that could be used to kill soldiers impersonally and at a distance of more than half a mile offended deep-seated notions of how a fighting man ought to behave." But where are the rational bourgeois of yesteryear?

The purposes of military equipment are fundamentally simple; those of equipment for living are complex. We try to satisfy the full Maslovian range of needs and aspirations using limited disposable incomes. Corporations try to meet some of our requirements while making a profit out of us; Marxists make that sound easy. Ruth Cowan tells the story of the domestic refrigerator. By the end of the 19th century, adequate large-scale refrigeration equipment was available for industrial use, but domestic refrigerators had to be very much smaller, more reliable, and had to be automatic, cheap and safe — a very tall order indeed. There were two possible systems: absorption, using a gas-burning heat source, and compression, using electricity. Cowan traces the sequence of events that resulted in the triumph of the latter. Though it presented bigger development problems than the simpler absorption system, there was far more investible capital, and optimism, in the electricity industry than in the gas industry.

In another chapter, Cowan explores the effect of changes in domestic technology on the work of the middle-class housewife. A different domestic path, which was laid out but not taken, is described in Moyra Doorly's review of Dolores Hayden's *The Grand Domestic Revolution:* the attempts that were made at designing buildings and housing estates so as to collectivise housework, in the late 19th and early 20th century, following up on the earlier social experiments of Owen and Fourier. It appears that too few people were prepared to buy into these communities to take them beyond the pilot stage; and, as domestic equipment became cheaper, there was little economic incentive for sharing. Cowan finds that the nuclear family — contrary to wide-spread belief — was normal before the Industrial Revolution; not Owen, Fourier or the feminist architects who followed them could shift it; the power and appliance companies of this century have reinforced it. This selection of case studies is supplemented by reviews by the editors, of which the concluding one is particularly valuable. Altogether, the book should help to get people thinking about the processes of choice, and physical constraints, responsible for today's — and tomorrow's — technologies.

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