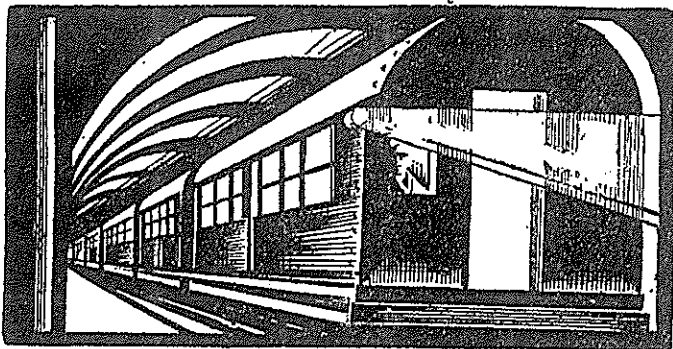


*Man and Machines, Stuart Chase
MacMillan, (May) 1929*



CHAPTER VI

THE WALL OF STEEL

WE have looked into the anatomy of machines; we have briefly traced their development from the valley of the Nile to the valley of the Ruhr. Our main concern, however, is not with their technology or history, but with their impact upon the day-by-day life of human beings. That impact is both direct and indirect. On the one hand, we are influenced by the machines that we see, hear, touch, use and operate; on the other, by the new commodities, services, laws, folkways, standards, philosophies, arts—which machinery has engendered. The second is probably more important than the first, but as many of the lamentations of the gloomy prophets center around robots and machine slaves, the direct impact needs careful consideration. This chapter attempts to summarize some of the direct effects of machinery on the people of the Western world today, particularly in the United States, and thus takes up

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the personal story with which the book began, and carries it further. You will remember that I doubted if machinery was enslaving me, doubted if it directly subjected the mass of my fellow citizens.

The common machines

Not counting simple tools, it is probable that there are more machines in the United States than there are people. The aggregate of motor cars, telephones, and plumbing systems alone, would start the list with about sixty million mechanisms, or the equivalent of half the population. The varieties are countless beyond description, running all the way from watches no bigger than a ten-cent piece, to a 200,000 horsepower turbine. The gross direct impact is of course the sum total of all existing mechanisms in all their variations. This leads us into regions beyond the possibilities of exposition, but fortunately such detail is hardly necessary to our purpose. Better than ninety per cent of all direct effects flows from less than one hundred varieties of mechanisms. In the following table they are listed. The accent here is not technical importance or power-generating capacity, but sheer quantity. These, so far as I can estimate, are the machines which we chiefly use, operate, or submit ourselves to; the mechanisms which directly affect the behaviour of the most people. The power plant at Niagara Falls has vast, far-reaching, indirect radiations, but only a handful of men are

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needed to operate the great turbines. The direct effect is accordingly negligible. A radio set is little more than a toy, the power it uses is minute, but some thirty million people in the United States are seated before it every evening. Its direct effect, due to sheer quantity, is thus enormous. On such considerations is the table constructed. An attempt is made to classify by occupations, and wherever possible estimates of total quantity are given. The machines of the first classification—those which affect us as citizens rather than specialists—are not repeated, though one or more of them belong in every subsequent class.

THE COMMON MACHINES OF AMERICA

Those which affect us generally

Clocks and watches	100,000,000 (at least)
Automobiles, buses and trucks .	25,000,000
Locomotives	70,000
Trolley cars	500,000
Steamships, ferries and motor boats
Telephones	18,000,000
Pianos	10,000,000
Radios	10,000,000
Victrolas	12,000,000
Electric lights
Dentist drills	150,000
Slot machines
Voting machines
Electric bells and buzzers
Filling station pumps

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Housewives

Plumbing installations	15,000,000
Gas, oil and electrical ranges . .	10,000,000
Central heating systems	10,000,000✓
Sewing machines	10,000,000
Electric irons	8,000,000
Vacuum cleaners	5,000,000
Washing machines	2,000,000
Mechanical refrigerators	1,000,000

Farmers

Tractors	600,000
Pumping systems, windmills	
Plows	
Harvesters	
Harrows	
Cultivators	
Mowers	
Spraying machines	
Threshing machines	
Cream separators	
Guns	

Factory workers

Assembly belts	
Lathes—all kinds	
Looms and spinners—all kinds	
Printing presses	
Punches and shapers	
Planers and grinders	
Electric furnaces	
Milling machines	

Construction workers and miners

Drills	
Coal-cutting machines	

Construction workers and miners—Continued

Derricks and cranes
Steam shovels
Piledrivers
Swampers
Crushers
Riveters
Pumps
Cement mixers
Steam rollers
Blasting mechanisms
Stationary steam and gas engines

Transportation workers, including garage men

Safety signals
Travelling cranes
Track repairing devices
Baggage handling devices

Office and store workers

Elevators
Subway trains
Typewriters
Adding machines
Cash registers
Bookkeeping machines
Mimeographs and addressographs

Professional and military men

Instruments of precision—stethoscopes, thermometers,
X-ray machines, transits, microscopes, etc.
Battleships, submarines
Artillery, rifles
Airplanes
Tanks

These seventy odd machines, or machine clusters, are those which chiefly affect us as behaving organisms. We are, depending upon our jobs, continually seeing them, hearing them, smelling them, touching them, feeling them, steering them, riding upon them, oiling them, feeding them, and generally bumping into them. In the course of a year, about 50,000 of us are killed in the process of bumping, and some millions of us injured, but at the same time they save us an incalculable number of steps, and an incalculable amount of dull, hard work. Generally speaking, these same machines dominate all Western civilization. They are now proliferating in Japan; expanding in Russia, Turkey, even in China.

While it is impossible to count all the common machines, the list itself, including the items which can be counted, makes it evident that a tremendous mass of metal is forever around us. A wall, which grows higher every day. But that it imprisons the majority of us tightly is not even open to question. It certainly does not, and cannot, for decades to come. It is far too low a wall not to be readily jumped over. If my direct contact with machinery does not exceed two hours a day, the average for all my fellow countrymen is probably even less. For children and housewives it is most certainly less. For farmers, storekeepers, office workers (except typists and calculating machine operators), professional workers, and the bulk of unskilled construction and transportation workers, it is presumably about

the same; leaving a higher ratio only in the case of factory employees, and certain groups, largely skilled, among the transportation, mine, and construction workers. If I am not psychologically undone by contact with my quota, it stands to reason that most people will not be undone. The evil effect, if any, must come in that relatively small fraction of the population which confronts machinery for two, five, eight hours a day—textile operatives, men on the assembly belt, locomotive firemen, taxicab drivers, derrickmen, steel workers. For the rest of us, contacts are casual and temporary. We are bound to no rigorous machine rhythm; we use a device as it serves our turn, only to drop it again.

Varieties of contact

At this point, it is necessary to probe deeper into the meaning of direct contact. I go from Times Square to Yonkers, in one case in the subway, in the other driving my own car. In both cases I am in direct contact with a machine, employing it over an identical area for transportation purposes. Are the physiological effects the same? Indeed they are not. On the one hand I submit to bad air, an ugly environment, and control by somebody else. My role is entirely passive. In the second case, I dominate my own mechanism, guide it through complicated traffic patterns, speed it up along the fine vistas of Riverside Drive; slow it to a walk when occasion warrants. My role is active and psychologically stimulating.

To say that one confronts a machine is to say something but not very much. The kind of behaviour which results from the contact is a far more important consideration, and as an instant's thought will disclose, all manner of reactions are possible. Despite the diversity, it is possible to reduce these reactions to seven basic classes.

1. Operating machines with a large measure of individual responsibility in guidance and control. (Running a motor car, an airplane, or a locomotive.)
2. Operating stationary machines with responsibility only for speed or direction control. (Running a turret lathe; controlling the engines of an ocean liner; operating a vacuum cleaner, or an adding machine.)
3. Tending machines with no responsibility for control. (Feeding a punch; mending yarn on a loom; tightening bolts on an assembly line.)
4. Inventing, designing, repairing and inspecting machines. (The work of the planning and inspecting staffs of any large factory—say Ford's. The day-by-day work of a good garage man.)
5. Playing with machines. (A child with an electric train; his father building a radio. Playing the saxophone, trap-shooting.)
6. Being carried by a machine with no responsibility for its control. (Riding in an elevator, a train, steamship, or a Ferris wheel.)
7. Submitting to a machine process in someone else's control—a variation of point 6. (Sitting in a dentist's

chair; facing an enemy's barrage; crossing a traffic-laden street.)

We touch here the roots of the whole problem of machinery and man. Only to read the above makes it obvious that certain machine contacts are as lethal as others are wholesome and invigorating. To make simple, sweeping conclusions about anything so varied in scope is downright nonsense.

The fact of operating a powerful machine with full responsibility for its control, far from being a monotonous, depressing, soul-destroying job, is, as a rule, precisely the opposite. It tends to expand the ego, establish self-confidence, break down inhibitions, keep one out of a rut. One needs no further proof than the health records, both mental and physical, of locomotive engineers as a group. A finer, more courageous, better-balanced body of men is not to be found in this or any other civilization. Indeed no more proof is needed than one's own reactions to driving a motor car, if the runs are not interminably long or over-complicated.

The same applies, but with diminished force, to the operation of machines whose movements are limited. Here control is not complete, but responsibility for a powerful monster is still marked. The builder of the Mohawk Trail told me that every man who came on the job wanted to run a pneumatic rock drill—to the observer a dusty, noisy, devilish device. Engineers on steamships, skilled machinists, are not normally broken

and ailing men, but the reverse. The case is far more dubious with elevator operators.

When we descend to plain machine-tending, however, the story changes—particularly when the machine sets a remorseless rhythm to which the worker must adapt himself. In Chapter VIII these changes will be described in some detail. Here we can only observe, that without responsibility, without the possibility of letting something of the power of the machine into one's own veins, the process has the chance of becoming very monotonous, fatiguing, and even mentally dangerous, while the chances for physical accidents markedly increase.

In respect to inventing, inspecting and repairing machines we have a skilled, often a very highly skilled occupation, where routine tends to be at a minimum, and one's creative or observing faculties at a maximum. It is replete with change of pace, and in many cases is as exciting as controlling a motor bus or a locomotive.

In playing with machines we are subject to no threat of monotony, because, by definition, when play becomes burdensome, it ceases to be play. Machine recreation can hardly develop serious neuroses or inhibitions, but it can unfortunately hold the spirit of play to very low levels. Some machines, as we shall see, help us to play better, but others—perhaps the bulk of them now operating in this field—tend to make us into second-hand watchers and listeners rather than into active participants.

Finally, in respect to submitting to machines—either to be carried upon their backs, or to feel their steel tongues and fingers upon our bodies—here again no sweeping generalizations are permissible. To cross the ocean in a great liner is a stimulating experience, to cross it in a Zeppelin is even more so; to ride for five miles in a New York subway at six o'clock at night is a dreadful experience. Certainly there is nothing degrading or harmful per se in submitting to the ministrations of a machine. How many souls has the pulmotor brought back from the further shore? And so far as degradation is concerned, I, for one, would rather be carried by the turbines of the *Leviathan* than by four score of galley slaves, handcuffed to their oars. . . . But when we stumble, as we must in this last category, upon mechanized warfare, we touch a buzz saw of the first dimension.

Machine-made habits

Another approach to the problem is a consideration of the direct effects of machinery on traditional habits. One hundred and thirty years ago when my great-great-grandfather was living in the town of Newburyport, Massachusetts, there was hardly a steam engine in all New England. The people of Newburyport were concerned with eating, sleeping, mating, working, even as are the people of the town where I now live. What has the machine done directly to change those basic functions?

In respect to eating, we still sit at table and consume much the same sort of foods with the same implements. By virtue of machinery we have the priceless boon of the tin can, which gives us a greater variety of softer and less succulent material, but the process of eating itself is little changed. No machines grace the table, save an occasional electric toaster or coffee percolator; courses do not come smoking from the kitchen on endless belts; no automatic stokers displace knives and forks; and despite much talk at the annual conventions of learned chemical societies (moderately ridiculous talk it is), no synthetic laboratory mixtures have yet appeared in any quantity to atrophy the muscles of our jaws.

In public eating places the change is more marked. The cafeteria, the automat, and the soda fountain, all exhibit the impact of the machine. In the modern soda fountain, we have a double line of nicked mechanisms tended by white-robed specialists of a very pretty skill; and what amounts to a whole new set of high-speed eating and drinking habits on the part of its clientele. The phenomenon has been very competently analyzed by Mr. Charles Merz, to whom the curious reader seeking further information is referred.

The machine has not been able to do much with sleep—save possibly to render it more fitful. We use the same old beds; and what we gain in steel springs initially, is lost as age overtakes them and they falter in their middle parts. For the copper warmer, an electric

pad is substituted, while on sultry nights a motor-driven fan may manufacture a draught to rival the harbour breeze of Newburyport in 1800. Meanwhile, it is safe to say that for every person lulled to slumber by the radio, three more are given a longer period in which to lie staring at the ceiling, contemplating their day's transgressions. A new method has been invented to inculcate foreign languages by feeding the patient's subconscious process while he sleeps by means of ear-phones attached to a victrola—but I do not hope much from it.

In respect to mating, we have matriculated from park benches to parked motors; we have speeded up the exchange of tender nothings by virtue of standardized telegrams; flowers, it is alleged, may be wired to any part of the planet; honeymoons cover more geographical area (though Niagara Falls and Atlantic City still stoutly hold their own); there is rumour of a new contraceptive, whose spermatocidal function depends upon the generation of an electric current. Ladies who slept in the minor agony of curl papers night after night, can now get it over with in the one great agony of a permanent wave—conducted by a sinister machine which looks like nothing so much as a device for wholesale electrocution.

The telephone, particularly on party lines, has done much to extend the area of gossip. Entertaining is still entertaining, and parties, parties; though new machines have stepped into the place of old machines in furnish-

ing the music. Children still go to school houses as they did in Newburyport, and sit at desks in front of blackboards, globes, and nervously exhausted teachers. The schools are larger and better ventilated, the rattan (worked on the lever principle), has disappeared, pedagogic methods are greatly changed, but save for a few moving pictures and typewriters, there are no more machines in the educational process than there ever were.

We go to church (in diminishing numbers it is true) in a motor, rather than a horse and buggy; the organ is furnished wind by a motor instead of by a perspiring organ boy; sermons by radio are multiplying; the parson has an adding machine in his sanctum, or wishes he were in a position to have one—but by and large it is the same religion, accompanied by the same hymns, nor have we, in a century and a half of machinery, caught up with the Buddhists and invented a praying wheel. If we had really cared about speeding up religion we might have had a turbine.

Two great habit complexes remain in which drastic changes have occurred; changes which would boggle the eyes of the good burghers of Newburyport. I refer, of course, to work habits and play habits. My great-great-grandfather could make something of the work of masons and carpenters building a modern house, but the Chevrolet factory would paralyze him; while an evening at a motor-fed roadside jazz house would inexpressibly shock him, even as slow movies of

a high diver would delight him. In these two departments, the machine has engendered something in the way of a real revolution; here its impact has been most pronounced.

Mr. and Mrs. Lynd in *Middletown* note the following sequence in the rapidity with which habits have been changed in the last generation. Their study is undoubtedly the most authoritative ever made of a Power Age community.

1. Work habits (the greatest change)
2. Play habits (also very great)
3. Educational activities
4. Community activities—clubs, social work, etc.
5. Home-making habits
6. Religious habits (the least change)

The phenomenon of the direct impact should not be left without a word or two concerning noise and smoke. Some scientists believe that the Western world is slowly going deaf because of the cacophony which day and night assaults its ears; a concert in which chief place is assigned—after careful study with an instrument which measures sound—to the motor truck. Most street accidents are the results of nerves unstrung by noise. London, because of its smoke—we have a smoke measurer too—loses fifty per cent of the sunlight, and practically all of the ultra-violet radiation which is its natural due. Pittsburgh, which long held the grime championship of the United States, has lately given way to St. Louis. Boston, which burns anthracite, has

only 5,360 dust particles per cubic foot against 17,600 in St. Louis.

Yet when all is said and done, we must remember that two hours a day of direct contact, which is my personal average, is still probably a maximum for the wayfaring man of the Western world. And above all we must remember that even for those minority groups—particularly factory and transportation workers—whose average contact is much higher, the fact of confronting a machine may mean exaltation and delight, even as it may mean degradation and despair.

