

MUMFORD ON HOW MINING AND WAR CORRUPTED OUR VALUES: ON THE SOCIAL ORIGINS OF SOME UNSUSTAINABLE TECHNOLOGIES AND ACCOUNTING PRACTICES

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Lewis Mumford's definition of what constituted technology included not only tools, factories, material inventions and industrial processes, but extended to include language, ritual and other patterns of human organization. Mumford's studies of the development of technics throughout history and prehistory emphasized the "psycho-social transformations" with which "every technical advance was intermeshed . . . both before and after" (Mumford, 1967, p.163). In this paper, we will be particularly interested in Mumford's distinction between two fundamentally different styles of technology: the tool-making tradition springing from human productive needs, and what Mumford came to call the "megamachine," founded on an often pathological need for centralized control! More particularly, we will look at how the practices of war and mining have favored the latter style of technics over the former and contributed to the development of what we might term environmentally and humanly unsustainable values in our industrial cultures. Towards the end of this paper, we will examine how these unsustainable values have been reflected in accounting practices and the (in the view of many, faulty) system of national accounts used for measuring economic performance and well-being of countries. Accounting methods, after all, are the technical expression of the values they embody and an indispensable part of the regulation of complex systems.

Returning to the question of the tool-making tradition and the megamachine, this distinction seems to be much the same as one later espoused by Ursula Franklin between "holistic" and "prescriptive" technologies, a holistic technology being defined as one in which those involved in production have knowledge of and control over the final product, whereas a prescriptive technology is one in which many or most of those involved in production merely apply procedures prescribed by those responsible for the design and supervision of the overall process (Franklin, 1990, pp. 18-20). But while it is true that many of

the maleficent megamachine technologies are, in fact, prescriptive, and while it is true that, historically, the tool-making tradition has been dominated by holistic-type crafts and trades, Mumford's distinction concerns origins and motivations, history and teleology, we might say, whereas Franklin's distinction is more formal and structural.

Mumford, in any case, does not uniformly diabolize prescriptive technologies. On the contrary, many of these technologies represent for him some of humanity's highest achievements. He quotes John Ruskin's encomium of wooden "ships of the line," redirecting it towards that sublime product of the industrial revolution: the iron steamship. Into such ships, human beings have, still using the words of Ruskin:

. . . put as much of . . . human patience, common sense, forethought, experimental philosophy, self-control, habits of order and obedience, thoroughly wrought hard work, defiance of brute elements, careless courage, careful patriotism, and calm expectation of the judgment of God, as can well be put into a space 300 feet long by 80 feet broad. And I am thankful to have lived in an age when I could see this thing so done (Ruskin, quoted by Mumford, 1934, p. 208).

Ship-building, like bridge-building, is surely as prescriptive a technology as one is likely to find,

call[ing] forth [this time in Mumford's own words] all the latent military virtues of the regime. . . . The steamer and the bridge were the new symphonies in steel. Hard grim men produced them: wage slaves or taskmasters. But like the Egyptian stone carver many thousand years before they knew the joy of creative effort. The arts of the drawing room wilted in comparison (1934, p. 209).

In spite of the horrors which result when the pursuit of technics in the prescriptive style is accompanied by blindness to genuine human and biological needs, Mumford considers such collective realizations to be monuments to the human spirit.³ "Some of the discipline and and self-sacrifice of the army," writes

Mumford (1967, p. 227), "has proved a necessary ingredient for every great society that raises its sights above the village horizon." More importantly perhaps (but only perhaps), prescriptive technologies make possible the production of objects which we could not otherwise produce and the achievement of ends we could not otherwise achieve.

In his writings dating from the 1960s, it must be said that Mumford had really nothing positive to say about the future social effects of computer technology. If he were alive today, he might possibly admit that prescriptively produced computer chips make possible the democratic effect which results when individual private citizens have access to word-processors, printers, modems and faxes, not to mention to Email and the Internet. Even the non-production of certain objects and substances can be prescriptively organized to beneficial effect. The use of freon and similar gases is currently being curtailed by international agreement, in spite of their extreme usefulness as refrigerants, in order to reduce the deleterious effects on human health and agriculture due to the deterioration of the protective ozone layer in the upper atmosphere. Prescriptive technologies, one must therefore hope, are here to stay.

Historically, however, in Mumford's view, "the balance of mechanized power seems to have fallen on the side of destruction" (1967, p. 228); it has not typically been associated with enhancing democracy and human health but has, on the contrary, been both one of the major products and one of the major causes (1967, p. 178) of war, totalitarianism, conspicuous waste, neurotic anxiety and "compulsive . . . personalities afraid to cope with the embarrassing riches of life" (1967, p. 226). In many cases, the adoption of prescriptive technologies has resulted in the loss of many valuable holistic forms of technology⁴ and dramatic deterioration of both the environment and the quality of human life, especially during what Mumford calls the paleotechnic phase of development, corresponding to the horrors of early 19th-century industrialism.

According to Mumford's reconstruction of history and prehistory, prescriptive technology, in the form of the first "megamachine," came to assume a hegemonic role in human civilization just prior to and during the period of Egyptian pyramid-building—after which it declined,⁵ only to begin reconstituting itself again with the rise of the early modern European nation-state, characterized by standing armies of paid soldiers, the development of artillery, and the financial

arrangements which made all of this possible.

It is the purpose of this paper to look more particularly at the interaction between the new nation-states, financiers, mining and the perceived imperatives of war—and at how this interaction produced technical, social and environmental attitudes and practices of which Mumford thoroughly disapproved.

One of the tasks Mumford sets himself is the paradoxical one of explaining how what he sometimes calls the "authoritarian" or "totalitarian"⁶ form of technology arose in history—while at the same time he is at pains to point the way, forward or back as the case may be, towards a form of technology which would sustain and enrich human beings and terrestrial life in general. That technics should sustain and enrich life is a stronger requirement than that it should merely be sustainable in and of itself; it is also a stronger requirement than that of merely being "friendly" to the environment and to humans. Technics should, in addition, both spring from and be guided by human needs, aspirations and interests.

It need hardly be said that much of current technology is not particularly guided by such concerns, to say the least. How did such a situation come about? One of the important culprits, in Mumford's analysis, is organized warfare as practiced by the nation states which emerged from the European Middle Ages—or as it was practiced by the ancient states of Mesopotamia and Egypt.⁸ In short, according to Mumford, the often unfortunate forms of social organization which were eventually applied in the factory were first developed for the army and the mine. And the first factories organized according to the principles of mass production produced goods destined to be consumed by armies, such as uniforms and weapons.

At the beginning of what might be loosely called the modern era of history, medieval feudalism, as a system of military and political organization, collapsed with the introduction of cannons and paid armies. These developments resulted in an increased demand from the rulers of the emerging national states for both money and metal for weapons. Since the advent of metal arms and armor, it has been true that, while mining can presumably exist without war, war can hardly exist without mining. With the advent of artillery, however, the quantities of metal required for war became particularly large.

War and mining are thus twin pestilences.⁹ They have similar deleterious effects on the quality of human life. In addition, as we shall see, albeit briefly, the effects of the one were and are amplified in a synergistic way by the effects of the other.

Let us consider first of all the effects of mining. Mumford quotes to good effect the classic early 16th century text *De re metallica* in which Georg Bauer (Agricola) attempts to refute the arguments of the critics of mining. Bauer, in Mumford's words, "had the honesty to sum up his opponents' arguments in detail, even if he could not successfully refute them." Among the arguments advanced by detractors and reported by Bauer is the statement that, "The fields are devastated by mining operations . . . and . . . the woods and groves are cut down, for there is need of [an] endless amount of wood for timbers, machines and the smelting of metals." Bauer also mentions the loss of "beasts and birds," the poisoning of brooks and streams and the loss of fish, as well as increased "difficulty in procuring the necessities of life" and the increased cost of building houses due to the loss of timber (Mumford, 1934, pp. 70-71).

Miners, like soldiers, are brutalized by both their work and their play (1934, pp. 72-73). Like barracks and battlefields, mining areas tend to be cut off from the rest of society. Mumford writes:

. . . Barbarism colors the entire picture.

. . . In the main, . . . the mining and metallurgical arts were outside the social scheme of both classic and gothic civilization. That fact proved a sinister one as soon as the methods and ideals of mining became the chief pattern for industrial effort throughout the Western World. Mine: blast: dump: crush: extract: exhaust—there was indeed something devilish and sinister about the whole business. Life flourishes finally only in an environment of the living (1934, pp. 73-74).

"By the sixteenth century," writes Mumford, mining "had definitely set the pattern for capitalist exploitation" (1934, p. 74). Here is how it happened:

First, improvements in the technique of warfare,

especially the rapid growth of the artillery arm, increased the consumption of iron: this led to new demands upon the mine. In order to finance the ever more costly equipment and maintenance of the new paid soldiery, the rulers of Europe had recourse to the financier. As security for the loan, the lender took over the royal mines. The development of the mines themselves then became a respectable avenue of financial enterprise, with returns that compared favorably with the usurious and generally unpayable interest. Spurred by the unpaid notes, the rulers were in turn driven to new conquests or to the exploitation of remote territories: and so the cycle began over again (1934, p. 75).

Mumford continues:

. . . War, mechanization, mining and finance played into each other's hands. Mining was the key industry that furnished the sinews of war and increased the metallic contents of the original capital hoard, the war-chest: on the other hand, it furthered the industrialization of arms, and enriched the financier by both processes. The uncertainty of both warfare and mining increased the possibilities for speculative gains: this provided a rich broth for the bacteria of finance to thrive in (1934, p. 76).

The key words here are, I think, "industrialization," "uncertainty," "speculative gains." Uncertainty and the search for spectacular speculative gains are hardly favorable to the development of sustainable practices.¹⁰ But it was the bias given to our whole value system and to our future accounting techniques by the influence of mining that was perhaps even more decisive for the unsustainable track taken by our industrial civilization. Mumford writes:

The miner's notion of value, like the financier's, tends to be a purely abstract and quantitative one. Does the defect arise out of the fact that every other type of primitive environment contains food, something that may be immediately translated into life—game, berries, mushrooms, maple-sap, nuts, sheep, corn, fish—while the miner's environment alone is—salt and saccharin aside—not only completely inorganic but completely inedible?

The miner works, not for love or for nourishment, but to "make his pile." The classic curse of Midas became perhaps the dominant characteristic of the modern machine: whatever it touched was turned to gold and iron, and the machine was permitted to exist only where gold and iron could serve as foundation (1934, p. 77).

In an immediately preceding passage, Mumford advances a possible explanation for the effect which the practice of large-scale mining had upon the values of industrial civilization:

This was in the notion that economic value had a relation to the quantity of brute work done and to the scarcity of the product: in the calculus of cost, these emerged as the principal elements. The rarity of gold, rubies, diamonds: the gross work that must be done to get iron out of the earth and ready for the rolling mill—these tended to be the criteria of economic value all through this civilization. But real values do not derive from either rarity or crude manpower . . . (1934, p. 76).

It is hardly surprising, then, that in its development our industrial society has increased by several orders of magnitude its capacity to accomplish "brute work"—while at the same time rashly endangering the very capacity of the planet to support human and other forms of life and achieving only the most fragile progress in the areas of law, justice and general human happiness.

This brings us back to our earlier question concerning real wellbeing, real values and how to measure them. For Mumford, "real" values are the factors which sustain and enhance life. Such factors, however, as Daly and Cobb (1989) are at pains to point out, are fairly rigorously excluded from contemporary orthodox economic theory, which has great difficulty dealing with notions like the carrying capacity of an ecosystem and natural capital. Social costs are dealt with tangentially, as "externalities." Orthodox economic theory sees as perfectly rational the wiping out of an entire population of, say, fish, and converting the catch into money, whenever the income stream generated by a sustainable rate of harvesting the fish population falls below the real rate of interest paid on money investments (Daly and Cobb, 1989, pp. 155-156).¹¹ For authors like Daly and

Cobb, examples like this one prove that our current rates of interest (discount rates) are far too high, given the underlying biological realities (1989, pp. 152-158). Put in another way, we might say that we do not value the future highly enough, or that we do not distinguish properly between capital and income.

But what is "income"? The invention of modern accounting practices enabled industrialists, financiers and private individuals to know whether they were spending more than they were "making" or "taking in." As Daly and Cobb put it, "The purpose of income calculations in practical affairs is to give people an indication of the amount they can consume without impoverishing themselves" (1989, p. 147). They note further "that the central defining characteristic of the very concept of 'income' is nothing other than sustainability" (1989, p. 147).¹² One of the important questions, then, is in what terms we are to evaluate what we possess (capital) and what we can reasonably plan to consume (income). One of the reasons that modern accounting methods and markets under their current form have proved inadequate as tools for managing technical society, then, is that the values which are measured and distributed—brute force or work and scarcity—do not correspond exactly to the factors which sustain human and non-human life.

It is perhaps not coincidental that, "It was mobilization for World War II and the consequent demand for data relating to the economy as a whole that was primarily responsible for shaping the [national] accounts [including GNP³]" (Ruggles, 1983; quoted by Daly and Cobb 1989, p. 68). What is of paramount interest to those who are managing a war is not exactly the well-being, economic or otherwise, of the human population at large, or even of one's own population. The strategic objective in the world wars of the twentieth century seems to have been to try to ensure that collapse of the adversary's economy occurred before the collapse of one's own. The issue was not well-being, or even sustainability, but relative rate of approach to the brink. Self-infliction of damage practiced as a defense against invaders is perhaps a case in point.

Robert Repetto, in his 1992 *Scientific American* article, goes one step beyond the criticisms of Daly and Cobb. The problem is not just that natural capital is treated on an equal footing with mere money or that interest rates paid on money are too high. Repetto argues that in many crucial cases, the United Nations System of National Accounts (SNA) does not take natural capital and

changes in natural capital into account *at all*.¹⁴ The SNA "completely ignores . . . crucial environmental changes" (Repetto, 1992, p. 94). Applying Repetto's claim to Daly and Cobb's example, not only might we get a higher return on our capital by fishing out an entire population of fish, putting the proceeds in the bank and collecting the interest, but the whole amount of the proceeds (after harvesting and processing) would be credited to income. The asset which is lost, the self-reproducing population of fish which has disappeared, does not appear on the books at all. In Repetto's words, "Impoverishment is [thus] taken for progress" (1992, p. 94). The problem is that capital depletion is treated as income. Unlike Daly and Cobb, Repetto does not particularly object to the interconvertibility of natural and other forms of assets. On the contrary, "there is nothing wrong [in Repetto's view] with drawing on natural resources . . . to finance productive investments in industrial capacity, infrastructure and education" (1992, p. 96). His point is that "a reasonable accounting representation of the process . . . should recognize that one kind of asset has been exchanged for another" (1992, p. 96). The asset disposed of should be written off as a charge; its disappearance should not be ignored in the national accounts; otherwise the result "can be illusory gains in income and permanent losses in wealth" (1992, p. 96). To give just one of the many concrete examples cited by Repetto, drawn from the natural resource accounts compiled by the Tropical Sciences Center in Costa Rica and the World Resources Institute for the period from 1970 to 1989, we note that in Costa Rica, throughout the 1980s, "The value of forest capital destroyed greatly outweighed the value of forest products generated" (Repetto, 1992, p. 97). Judged even by the standards of mining, this is wasteful destruction.

I conclude with a quote from Mumford concerning paleotechnic¹⁵ society of the 19th century. The question we should ask ourselves, perhaps, is how far we have gotten beyond what is described. Mumford writes:

The state of paleotechnic society may be described, ideally, as one of wardom. Its typical organs, from mine to factory, from blast-furnace to slum, from slum to battlefield, were at the service of death. Competition: struggle for existence: domination and submission: extinction. With war at once the main stimulus, the underlying basis, and the direct destination of this society, the normal motives and reactions of human beings were narrowed down to the desire for domination and to the fear

of annihilation—the fear of poverty, the fear of unemployment, the fear of losing class status, the fear of starvation, the fear of mutilation and death. When war finally came, it was welcomed with open arms for it relieved the intolerable suspense: the shock of reality, however grim, was more bearable than the constant menace of spectres, worked up and paraded forth by the journalist and the politician. The mine and the battlefield underlay all the paleotechnic activities; and the practices they stimulated led to the widespread exploitation of fear (1934, p. 195).

Technology, however, even in its prescriptive forms, is not, in itself, inimical to sustaining and enriching life. If history teaches us a lesson, however, it is that the future well-being of the planet requires that all technologies be continually subjected to careful, critical analysis and democratic control. True democratic control of all forms of technics requires, among other things, a careful review of our system of values, and the implementation of these values through more adequate technologies of accounting.

NOTES

1. "The myth of the machine and the cult of divine kingship rose together" (Mumford, 1967, p. 168).
2. Mumford's account of the origin of war in the nascent urban civilizations ties it to the practice of human sacrifice observable in the neolithic cultural phase. While emphasizing the "large accretions of positive knowledge" and the "preliminary work of exploration" (1967, p. 135) of food sources and the development of horticulture and agriculture, attributable to the neolithic phase, Mumford, here as always, is attentive to the "mischievous and often dangerous outpourings of [man's] unconscious" (1967, p. 139) and "the intermingling of practical knowledge and causal insight with magical prescriptions often based on fantastic associations" (1967, p. 149). He quotes Mircea Eliade to the effect that "the edible plant is not given in nature; it is the product of a primordial sacrifice" (quoted 1967, p. 150). Mumford writes: "Human sacrifice, then, is the dark shadow, vague but ominous, that accompanied the myth of maternity and the superb technical and cultural feats of domestication. And as so often happens, this particular mutation, quantitatively restricted in the culture where it originated, dominated and debased the urban civilization that grew out of it, by taking another collective form: the collective sacrifice of war, the negative counterpart of the life-promoting rituals of domestication" (1967, p. 150).
3. Mumford thus certainly does not deserve to be, in the words of Langdon Winner, "flippantly dismissed" as belonging to the category of "romantics and pastoralists," along with "Henry David Thoreau, Henry Adams, . . . Paul Goodman, and a host of others." Winner

himself, however, uses the somewhat condescending term "woeful lamentations" to describe the reflections of this group (including Mumford) on how the idea that "industrial development might be shaped or limited by republican virtues . . . [had] dropped out of public discourse" (Winner, "Techne and Politeia: The Technical Constitution of Society," in Durbin and Rapp, eds., *Philosophy and Technology*, Boston Studies in the Philosophy of Science, vol. 80, p. 99).

4. Most of the mechanical trades and techniques described in Diderot's *Encyclopedie* published in the 18th century have disappeared. This is not because they were replaced by processes in respects superior to them. On the contrary, for example, far from being earlier and inferior versions of what came later, axes produced in the 18th century were of better quality, as tools, than axes produced in the 19th century.

5. "After the Second Millenium B.C. the use of the colossal labor machine became intermittent: it never again quite attained that apex of efficiency to which the fine dimensions of the Great Pyramids bear witness" (1967, pp. 226-227).

6. The terms "authoritarian technics" and "totalitarian technics" are both employed (cf. 1967, p. 236).

7. It is for the "guidance" of technology, we might add, that techniques of accounting become important.

8. Due to the limitations of the paper format, we will limit our analyses and our examination of Mumford's theses to the context of European history since the decline of the Middle Ages. In the first volume of *The Myth of the Machine*, Mumford argues that the pyramids were built by means of a totalitarian organization whose principles were similar to the organization of 16th century European armies.

9. "The curse of war and the curse of mining are almost interchangeable: united in death" (1967, p. 240).

10. Compare this gloomy picture with what Mumford later says about the tool-making tradition and what he terms "democratic technics":

All the praise of tool-making and tool-using that has been mistakenly applied to early man's development becomes justified from neolithic times onward, and should even be magnified in evaluating the later achievements of handicraft. The maker and the object made reacted one upon the other. Until modern times, apart from the esoteric knowledge of the priests, philosophers, and astronomers, the greater part of human thought and imagination flowed through the hands.

Under democratic technics, the only occupation that demanded a lifetime's attention was that of becoming a full human being, able to perform his biological role and to take his share in the social life of the community, absorbing and transmitting the human tradition, deliberately bringing the ceremonies he performed, the food he planted, the images he shaped, the utensils he carved or painted to a higher degree of esthetic perfection. Every part of work was life-work. This archaic attitude toward work was widespread; and despite all the efforts Western man had made, since the sixteenth century, to corrupt and destroy this basic culture, it still lingered in peasant communities, as well as in the surviving tribal enclaves that were intact at the beginning of the present century. Franz Boas noted the high regard for craftsmanship among supposedly primitive peoples . . . (1967, p. 238).

Mumford continues:

Machine culture, in its original servile form did not share these life-enhancing propensities: it centered, not on the worker and his life, but on the product, the system of production, the material or pecuniary gains therefrom. . . . The processes derived from the megamachine worked for speed, uniformity, standardization, quantification. What effect these objectives had upon the worker or upon the life that remained to him when the workday was over was no concern of those who commanded these mechanical operations (1967, pp. 238-239).

11. Daly and Cobb write:

Extinction by discounting . . . is often viewed as the rational consequence of well-functioning markets. . . .

The problem can be phrased as follows: "When is it economically rational to kill the goose that lays golden eggs? Any exploited species (fish, timber, etc.) managed on a sustained yield basis is like a goose that lays golden eggs in perpetuity. Folk wisdom says never kill it. Present-value maximization says to kill it under certain circumstances, namely when the rate of growth of money in the bank is greater than the reproduction rate of the exploited species (and the cost of capture relative to the price is not prohibitive). The owner of the goose has two alternatives: keep the goose and sell the eggs in perpetuity; kill the goose, sell it, and put the money in the bank and earn money in perpetuity. If the interest income stream is higher than the golden egg income stream, then kill the goose. Alternatively, the equivalent calculation in terms of the present value would be to discount the income stream of the golden eggs at the rate of interest, and if that discounted sum is less than the price you could get for the cooked goose today, then you kill the goose" (Daly and Cobb, 1989, p. 156).

12. "The true definition of income encompasses the notion of sustainability" (Repetto, 1992, p. 96).

13. GNP (Gross National Product) or GDP (Gross Domestic Product) is roughly defined as the total value of goods and services bought and sold during the relevant time period (usually a year). As an indicator of general welfare in a given country, use of the GNP produces some paradoxical results. For example, the expenses generated by hiring men and equipment to destroy Notre Dame Cathedral in Paris would cause the GNP to rise, creating the illusion that the French were now better off than when Notre Dame was still standing. A summer in which there was an unusual number of forest fires—destroying much of the natural wealth of the Canadian province of New Brunswick a few years ago—actually reduced unemployment and increased the GNP for that year. The general hypothesis of the close relationship between our accounting practices and war is perhaps confirmed by the fact that, "It was mobilization for World War II and the consequent demand for data relating to the economy as a whole that was primarily responsible for shaping the accounts [including the GNP]" (Richard Ruggles, "The United States National Income Accounts, 1947-1977: Their Conceptual Basis and Evolution" [1983], quoted in Daly and Cobb, 1989, p. 68). For a discussion of GNP and alternatives to GNP as measurements of economic and human welfare, see Daly and Cobb (1989, pp. 62-84).

14. Not only are natural resources left out of account, in Repetto's view, but human resources as well. Repetto writes: "The classical economists had regarded income as the return on three kinds of assets: natural resources, human resources, and invested capital. Neoclassical economists virtually dropped natural resources from their model and concentrated on labor and

invested capital. When these theories were applied after World War II to problems of economic development in the Third World, human resources were also left out on the grounds that labor was always 'surplus,' and development was seen almost entirely as a matter of savings and investment in physical capital" (1992, p. 94). Thus even the "brute force" component of the miner's value system has been amputated of its human aspect.

15. Mumford adopts Geddes's categories of "paleotechnics" and "neotechnics," to which he adds the preliminary category of "eotechnics" (1934). These terms designate stages in the development of technics. Although critical analysis of these categories is beyond the scope of this article, it is advanced as a working hypothesis that the ~~working~~ ^{working} tradition and tendencies towards the constitution of a megamachine are present in all three stages.

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