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THE TECHNIC FRAME OF MIND

"Each generation sees a new world, but it's all in the framing" (A movie producer).

Introduction

In this chapter I add a psychological dimension to the theory, outlined in the chapter on **Determinism**, that the apparent autonomy of technology is an illusion. I shall describe the process of psychological conditioning or mutual reinforcement between human actors and the artefactual world that they create.

Reciprocal bias

Under the heading "Bias of Technology" in the chapter on **Determinism** I described how technical ensembles and objects usually carry an intrinsic bias¹.

But the human actors are also biased. They are subject to a group psychological state or "spirit" characterizing a society at any given time. It is sometimes called the "spirit of the age" (*Zeitgeist*). I call the present technicist spirit "**The technic frame of mind**". Those who adopt an instrumentalist stance usually exhibit the technic frame of mind.

The point I want to make in heading this section "reciprocal bias" is that the biases of the actor and the object mutually reinforce each other, giving rise to the self-reinforcing circle comprising loops 2 and 3 in Figure 406 (**Determinism**). The actor, being biased toward technics, brings forth biased technical objects and practices. The objects and practices are then reflected back to the actors in the form of *metaphors* which structure their thinking and reinforce their bias. Excellent examples from the early days of the industrial revolution appear in the pornographic novel *Fanny Hill* where many sexual metaphors of engines, instruments, anvils and hammers are to be found. Sci-tech metaphors abound in contemporary speech: equilibrium, feedback, input, conservation of energy, quantum jump, memory bank. The bias given to our thinking by the use of scientific and technological metaphor is often slanted to the masculine. This has been well documented in techno-strategic studies.²

This theory of reflection was foreshadowed by Jean Baudrillard in his critique of Marx's labour theory of value entitled *The Mirror of Production*³ and by Don Ihde in *Existential Technics*⁴. The idea was somewhat anticipated by George Grant in the following passage:

"...we apprehend our destiny by forms of thought which are themselves the very core of that destiny.

The result of this is that when we are deliberating in any practical situation our judgement acts rather like a mirror, which throws back the very metaphysic of the technology which we are supposed to be deliberating about in detail."⁵

More recently, the same mechanism has been proposed by Robert Bellah and others to explain the relations of the American people to their institutions.

"...while we in concert with others create institutions, they also create us: they educate us and form us -- especially through the socially enacted metaphors they give us...."⁶

Institutions, such as the corporation, marriage etc. have, like technology, a mediating role. Bellah and his co-authors write, "It is fundamental to understand that institutions mediate the relations between self and the world." Just as I would say that technology mediates our action into the world⁷.

Neither the bias of the actors nor the bias of the media (including all technical objects) have escaped the notice of previous interpreters, although, for the most part, the *reciprocal* nature of the bias has not been emphasized. Arnold Gehlen had an inkling of it when he wrote, in 1957, "Through these similarities man interprets the world after his own image and vice-versa, himself after his image of the world."⁸ The first sentence of the following statement by Kevin Kelley is, however, quite explicit:

Just as our thought shapes technology, technology shapes our thought. The technology of language and knowledge particularly shapes what we can think. A blackboard encourages repeated modification, casual thinking, spontaneity. A quill pen demands care, attention to grammar, tidiness, controlled thinking. A printed page solicits rewritten drafts, proofing, introspection, editing.⁹

In the second and subsequent sentences of the above paragraph, Kelley is echoing the work of Marshal McLuhan in his famous aphorism "the medium is the message" and the still earlier insights of Harold Innis who coined the phrase "The Bias of Communications". Both these writers emphasized the bias of the technology.

Jacques Ellul admitted the reciprocal nature of the interaction, but gave overwhelming predominance to the technology and played down the bias of the actors, as I showed earlier¹⁰. Indeed, in the following sentence, he went so far as to use the

metaphor of consciousness for the technology, -- "All embracing technique is in fact the *consciousness* of the mechanized world"¹¹ Ellul's masterpiece *The Technological Society* is, in the words of his translator John Wilkinson, "a phenomenology of the technical state of mind."¹²

TABLE I

Calculating	Approach
Engineering	Attitude
Industrial	Consciousness
Machine	Dimension of mediation
Mechanical (istic)	Frame of Mind
Scientific	Frame of reference
Technocratic	Ideology
Technological	Imagination
Technic (al)	In head and heart
	Mentality
	Mindset
	Mind view
	Mode
	Orientation
	Pathos
	Spirit
	State of mind
	Thinking

The technic frame of mind

In this section I give an account of the terms in which the bias of the actor has been described and give reasons for choosing "the technic frame of mind" from the wide range of terms available.

The bias of the actor has attracted the attention of numerous students of technology, many of whom ignored the bias of the medium. Starting with William Blake - in a poem dated 1802 in which he referred

to "single vision and Newton's sleep", finding very full expression in Thomas Carlyle's

essay "Signs of the times." (1829)¹³- and continuing to this day, each author has given this bias a distinctive name, perhaps hoping, in the way that scholars do, to impress their distinctive trademark upon the concept. Some are neologisms such as Postman's "Technopoly"; others are surprising applications of terms from other disciplines such as Lasch's use of "the ego". But most of the synonyms have been drawn from various combinations of a virtual buzz word generator (Table I) comprising nine adjectives and 18 nouns or noun phrases. Future Ph.D. candidates will be pleased to learn that many of the possible combinations remain available for academic claim staking.

Framing

I chose "frame of mind" because I wanted to echo the German philosopher Martin Heidegger's¹⁴ word *Gestell* which he used to describe the essence of technology. Most English translations of *Gestell* render it as "enframing", though some (including myself) emphasize the connotation of "a system". The common interpretation of Heidegger's meaning is that "technology creates a 'frame' through which the functioning technologist views his world."¹⁵ The same idea is echoed by Scott Eastham when he says, "To-day, just on the verge of its collapse, western civilization is beginning to perceive the bias of its entire "frame" of reference."

I would like to emphasize that the assertion that people have a technic frame of mind does not imply that this is the *sole* mode in which they operate. As a Russian sociologist¹⁶ has observed, "The emergence of dual or multiple and often conflicting structures embedded in the personality constitutes the starting point and pre-condition for reflection on any situation and oneself." There is an extensive literature on multiple personalities as the pathological expression of this many-sidedness; and those familiar with Jungian psychology will know more than I about his "polycentric description of the objective psyche." Amongst the other facets of the personality which display themselves from time to time are the ludic or playful - so essential to creativity. As a link to our text-book *The Whale and the Reactor*, I suggest that a particular frame of mind corresponds to a particular form of life. Harry Collins has observed that individuals should be thought of as the sum of the forms of life in which they play a role.

Characteristics of the technic frame

In this section I describe the second-order characteristics of the technic frame of mind. Again, I observe that these characteristics would be treated by Ellul as characteristics of technology as a phenomenon, whereas I interpret them as characteristics of a particular style of human behaviour that is developed in the framework of technological society through a process of mutual reinforcement. The main characteristics identified are as follows:

- instrumental rationality (counterpart: irrationality) and one-dimensionality
- efficiency as the ultimate criterion
- quantification
- technological imperative
- mastery of nature
- techfixation (seeking the technological fix)
- fascination

- artificiality
- somnambulism

Rationality

The discussion of rationality has first to make clear the distinction which the great sociologist Max Weber made between substantive rationality (*Wertrationalität*) and formal, functional or instrumental rationality¹⁷ (*Zweckrationalität*). Substantive rationality is concerned with the ends and instrumental rationality with the means. The technic frame of mind is dominated by the latter -- the means is all. In fact the great moral criticism of technics as practice is the failure to consider ends or to remember, as Pascal said¹⁸, that "The heart has its reasons (substantive) of which reason (instrumental) knows nothing."

Reason for a long period meant the activity of understanding and assimilating the eternal ideas which were to function as goals for men. Today, on the contrary, it is not only the business but the essential work of reason to find means for the goals one adopts at any [particular] time. (Horkheimer, 1974, vii)

Max Weber thought that instrumental rationality was value-free and thus not subject to sociological explanation but Andrew Feenberg¹⁹, in a detailed examination of the arguments, has written, "Technological rationality is indelibly marked by the presumption that production requires social domination."

Here are some examples of instrumental rationality at work:

- The current hype about the Information Superhighway is typical. The *quality* of what is going to travel this highway is never discussed.
- The bureaucratic mind with its emphasis on the letter of the regulations --A "no headgear" rule used to keep a Sikh colonel out of a Legion beer hall..
- The lawyer fighting to free a rapist on a technicality.
- The social scientist constantly refining her statistical methods to manipulate utterly trivial data.
- The educational establishment teaching sloppy stuff with the best equipment.

All these are examples of instrumental rationality at work; but so is the painstaking elucidation of a genetic defect; the discovery of a vaccine against malaria; the solving of a complex fraud.

One question we have to ask ourselves is: what areas of the life world are appropriate for rational decisions and whether there are areas where the emotions *should* rule (in opposition to the "objectivist" philosophy of Ayn Rand, which some readers may have encountered). For example we generally agree not to apply rational economic criteria to the "economy" of a household (although ironically this is the origin of the word eco- from oikos.) We feed an aged parent even if they are non-producers.²⁰ Business is beginning to recognize the value of "E-intelligence" (where E stands for emotion) as well as calculating rationality. In other words, there is a sphere of life where non-rationality is appropriate.

But rationality sometimes goes over into irrationality in quite inappropriate ways. One of McLuhan's Laws of Media is that, when pushed to extremes, a technology reverses its effects. We build an atom bomb to give ourselves a sense of security and end up with 50 000 warheads --enough to terrorize the world. We save

lives by the technologies of public health even though we know it will bring about mass starvation. We build dams to harness power and bring prosperity to a region even though we know it will destroy the culture of a thousand tribal families. (See the chapter on Dams.)

In general we can say that rational means are often chosen to achieve irrational results. Consider the horrifying attention to technological matters by those bent on genocide, revealed in the Eichmann trial.

One-dimensionality

The term "one dimensionality" comes from well known book called "One dimensional man" by Herbert Marcuse . It became something of a cult book in the 60s. I personally think it is still of great interest, in spite of the fact that conditions have changed significantly since it was written in 1964. The single dimension in which Marcuse claims we operate is what he calls technological rationality -- essentially the same as instrumental, calculative or functional rationality in the terminology of other thinkers.

Efficiency

Efficiency is the maximization of some desired output or effect for the least amount of input, means or effort. In Ellul's definition of *La technique* he stresses the centrality of efficiency as the overriding criterion by which all aspects of life are judged in the "technological society". As explained in the chapter on Efficiency there are many kinds of efficiency and the achievement of one kind may only be possible at the expense of another kind. It is by no means a simple criterion.

Quantification

It is a characteristic of the technic frame of mind as it is for the classical economist that only what can be measured has real significance and, in a contrary sense, anything that has been measured thereby attains significance. Quantification of things qualitative is the counterpart of the transformation of quantity into quality which I have referred to as the Engels Effect (Ch. Introduction). A passion for statistics, the domination of sociology and psychology by the SPSS software program, the mantra-like recitation of figures to a populace that has no conception of what they mean (I have seen quantities out by orders of magnitude pass without comment in the Globe and Mail). These are all projections of the technic frame of mind.

Quantification is still further abstracted when all quantities are reduced to money values, a common procedure in cost/benefit studies. This has been called monetization.

Marcuse says that the statistics, measurements, and field studies of empirical sociology and political science are not rational enough. They become mystifying to the extent to which they are isolated from the truly concrete context which makes the facts and determines their function. His criticism of so many social studies is that they do not analyze the structure that holds the parts together. This abstraction leaves the social institutions undisturbed. I think he is saying that the numbers are worshipped for their own sake.

But I do not wish to be misunderstood on this subject. I strongly believe in the appropriate use of quantification. Garret Hardin has proposed three "filters against

folly" which we should use in the analysis of any technological proposal²¹. He calls them: the literate, the numerate and the ecolate. By this he means that we must study the verbal arguments, *we must check the numbers* (will Global Warming cause an ocean level rise of 40 cm or 3 m?), and we must ask what the impact will be on future generations.

Technological imperative²²

Francis Bacon described the goal of the New Science of the seventeenth century as "the effecting of all things possible." That, in a nutshell, is what Anatol Rapoport had in mind when he introduced the term "technological imperative"²³. He says, "The technological imperative (the belief that what is feasible will be realized) is a prime mover in the arms race." He explains more fully "What is seen as possible and at the same time as serving the needs of the technological system demands to become actual. The pressure for realization is what I call the technological imperative." His ideas "...stem from the observation that every technological system, like a biological species, is embedded in a habitat, consisting mainly of a professional community, attuned to its needs." "To say that a professional community is attuned to [its]needs means simply that persons with certain interests and skills... will be naturally attracted and recruited into that community."

A strong technological imperative depends on a strong professional community dedicated to a particular technological system. The technic frame of mind provides a generalized impetus to the adoption of technological solutions through the action of reciprocal bias. The technological imperative strongly reinforces a specific set of solutions e.g. warfare (by the military-industrial complex) over peace-making (whose constituency is diffuse, ill-financed and poorly organized).

To many users of the term "technological imperative" a certain inevitability is implied. Rapoport himself used the expression "quasi-determinist". Nevertheless, there are plenty of instances to refute any suggestion that this is a "law". The failure of the Japanese to adopt the arquebus for war²⁴ or of the Chinese to develop the gun after their discovery of gunpowder²⁵ have been cited as examples. The technological imperative expresses itself in the marketplace as "technology push".

Ellul, in his early work, declared that the technological system contained no feedback, by which he meant that there was no negative feedback. (See Appendix on "Feedback" in chapter on A Model of the Techno-Economic System.) There was nothing to brake the system. I should explain that he was unaware at that time of the expression "positive feedback" although he was fully aware of the phenomenon of self-reinforcing tendencies in the technological system. In his last book he changed his views, introduced a section called "double feedback, and recognized limits to technological expansion. One of them is simply the limited availability of investment capital at any given time²⁶ and the huge investment in existing capital equipment. There are other limits which send back negative signals as they are approached: exhaustion of resources, for example. But Ellul was correct in deducing that these forces of restraint were muffled. He was of course fully aware of moral and ethical restraints. The purpose of ethics is precisely NOT to do all that can be done, although for the most part morals and ethics seem both invisible and ineffective when they come up against the technological imperative. Ellul felt that the technic frame of mind

ensured that the ethical restraints always lost out. The relative strengths of the ethical and technological imperatives will be crucially tested as the human genome is further manipulated. In this context it is worth noting that, at the Asilomar Conference of 1975, workers in the field of genetics (the "professional community" of Rapoport's thesis) imposed a voluntary moratorium on certain types of experiments with DNA.²⁷ (See chapter on Human Reproductive Technology).

The relation of the *economic* imperative to the technological imperative seems not to have been investigated. Yet the same phenomena are explained by the one as frequently as by the other, depending on the stance of the critic. The least one can say is that this offers further proof of the powerful link between technics and economics. (See chapter on Determinism, p.2).

Mastery of nature

The essence of technology, said the philosopher Heidegger, is that it confronts every aspect of the world as a resource -- (*Bestand*) a "standing reserve" as it is usually translated. We shall come back to this when we discuss Winner's Chapter 7 The State of Nature revisited. It is particularly with respect to the mastery of nature that I see the operation of the "Faustian Spirit". As I said in the Introduction, the story of Faust that we associate with the Faustian Spirit is that told by Johann Wolfgang von Goethe, Germany's greatest poet. In Act IV of Part II of Faust the protagonist makes plans to reclaim land from the sea in an ambitious megaproject and in Act V he dies, imagining success but in fact blind (literally and figuratively) to the evil consequences of his acts. To Goethe, Faust was an expression of "das Dämonische" "the fearful and mysterious power that drives men in spite of themselves, sometimes to high achievement, sometimes to destruction".²⁸ I see an element of the "daimonic" in the technic frame of mind.

Techfixation

The response of the technic frame of mind to any problem, be it engineering, political, or social, is to find a technological fix. There are, of course, numerous situations (e.g. a broken pump) in which the only appropriate action is technological. This is not a fix in the sense intended here. *A technological fix always refers to a situation in which sociological or other non-technological solutions to the problem could have been attempted.*

The term "technological fix" was coined by Alvin M. Weinberg in the mid-60s in an essay entitled "Can Technology Replace Social Engineering?"²⁹ Weinberg was one of the pioneers of research into large-scale atomic energy for peaceful uses. He argues "that technology is capable of finding shortcuts (technological fixes) to the solution of social problems. For example, faced with a shortage of fresh water, he suggests, society can try either social engineering -- altering life styles and the ways people use water -- or a technological fix, such as the provision of additional fresh water through nuclear powered desalting of sea water."³⁰

A typical examples of a technological fix is the Intelligent Vehicle and Highway Systems (IVHS) research project on which the United States government intends to spend \$40 billion during the next 20 years. An analogous system in Europe is called PROMETHEUS. IVHS is designed to end congestion on American

highways. Southern Californians alone waste about \$9 billion worth of person hours a year sitting in cars and cause another \$5 billion in environmental damage.³¹ IVHS would put everything from traffic signals to individual automobile routing under the control of a computer system -- eventually the vehicle guidance would be automated. This project is crying out for the fulfillment of McLuhan's reversal law, that anything carried to its limit reverses the intended effect. As Marcia Lowe commented³²

Smart cars and highways risk magnifying the mistakes that America is already making. A nation of highways packed bumper to bumper can lead only to a 21st C. hell -- no matter how fast the traffic is moving.

Another example, which might be considered to have merit, is the proposal put forward by Alvin and Heidi Toffler as a peacekeeping invention. It is no coincidence that every civil conflict is characterized by a battle to take over the many TV and radio stations. Why should not the United Nations set up a satellite broadcast system beamed to send an objective version of what is actually happening to every household in the war zone? It would not cost very much to drop tens of thousands of inexpensive radios permanently tuned to the peace frequency all over Bosnia for example.

But one has to ask who is going to prepare the "objective news reports" -- not the US State Department I trust! We have learned too much from Noam Chomsky about the manufacture of consent to be comfortable with this proposal.

Woody Allen sums up the idea of technological fix by saying that we are relying on nuts and bolts and electricity to solve our problems³³, but, on a positive note Régis Debray referred to "the providential law that has technology offering the best remedy for technology."³⁴ An eloquent defence of the technological fix was mounted by Sir Peter Medawar in his Presidential address to the British Association in 1969. He said, "Anybody who denies that a technological remedy is possible for a technological evil is making a prediction of just the kind -- that a certain procedure is inconceivable or impossible -- that history most often and most easily falsifies."³⁵ But Medawar missed the point that technological solutions may, and often do, simply create new problems.

Fascination

F.G. Jünger writing in 1939 already referred to man as a gadgeteering species but exempted woman (presumably another species). Ellul devotes a major section of his last book on technology, published in 1988, whose title I translate as "Technological Hype", to "l'homme fasciné" or fascinated man. Scott Eastham took up the theme in 1990, saying³⁶ ".we are a society infatuated by its tools, and entranced by the seemingly unlimited possibilities each new tool promises to open up".

Evidence for this is not hard to find. Not so long ago there was an absurd hope to escape from the pollution and social problems of Earth by building colonies in space. The prospect fascinated millions of people. It seems to have succumbed to Reality-testing.

Currently the panacea is the Information Superhighway which is supposed to satisfy an as yet unmanifested desire for unlimited information -- presumably we have all utterly exhausted the resources of our libraries.

David Nye observes that (US) Americans are more likely than others to dwell with awe - even a quasi-religious sensibility - on technological feats such as the

Golden Gate Bridge.³⁷ But the present expression of the *American Technological Sublime* is no longer linked to feats of utilitarian engineering. Rather, it now centres on the likes of Las Vegas -- with its 6000 room hotels shaped like the Egyptian pyramids and offering the re-enactment of naval battles.

The fascination with computer games is self evident. The transformation of the role of games as a religious rite (from the Latin roots of *religio* meaning to bind together), through less sacred forms of social bonding, to an activity in which the bonding is between man and machine, is an extraordinary example of the dehumanizing effect of this fascination.

Even the fascination with bulletin boards, which daily multiply in number round the world, is not for the rare gems of information buried in the garbage of electronic chatter, but for the medium itself and its impersonality. As McLuhan said "The Medium is the Message" or indeed the massage. Ellul again: "For some electronic nomads, roaming the networks, they are more real than life."

Ellul³⁸ concluded that the most fascinated class were the intellectuals who subscribed to the myths of rationality, productivism, and lately the Japanese myth. Neil Postman³⁹ has drawn attention to the fact that those amongst us most fascinated by the computer are educators, some of whom "like Lewis Perelman, ... argue (for example, in his book, *School's Out*) that modern information technologies have rendered schools entirely irrelevant since there is now much more information available outside the classroom than inside it. This is by no means considered an outlandish idea."

The advertising industry, Ellul goes on to say, whose antennae are sharply tuned to the fascinations of the age, has moved from an early rationality, through a long period of Freudian technology, to the current extensive use of computer graphics which have an intoxicating (*délicant*) effect on the senses. .

The great significance of fascination is that it *breaks the technics-economics bond*. By this I mean that it causes technical paths to be taken that are not "economic". Consider the proliferation of programmable devices on common domestic appliances most of which are used by only a tiny minority of purchasers. Consider the complete overkill of a Pentium 100-Hz personal computer used to write letters and store recipes!

Artificiality

The technic frame of mind is committed to the production of the artificial. No natural process or product can be left without improvement: food, scenery, genetic constitution, sexual congress, childbirth etc.

We live in a world which is almost entirely artificial. Nothing within the range of your vision is not the product of technology. Nothing you see outside will have escaped alteration by machines.

More and more, TV establishes a screen between us and reality, resulting in a de-realization of the world. Virtual reality is just the next step in de-realization.

Artifice has an extended meaning suggesting trickery. And indeed we see more and more trickery made possible by technology. Lip-synch; the digital manipulation of photos; fake food including so called fat that cannot be digested; "lite" food which is food homogenized with water. Now that fish, once wild in the sea, are

almost universally replaced by farmed varieties -- we see the closing of the last frontier.

Early critics such as Mumford saw this artificiality (i.e. the displacement of the organic and the living by the artificial and the mechanical) as the clue to modern technology. We no longer have a firm grasp on what is real and what is ersatz.

When Peter Berger, the sociologist, spoke of "makeability" as a characteristic of the technic frame of mind, he had the idea that the world -- life itself -- could be made by human beings. That is, I suppose, our secret plan.

Somnambulism

The meaning of this word is walking in one's sleep. The idea that we are asleep within technological society was expressed by Ellul in 1964⁴⁰. The first use of the word *somnambulism* in this context that I have found is by McLuhan and Fiore⁴¹ who wrote "The portentous discovery that Pavlov made was that any controlled environment, any man-made environment, is a conductor that creates non-perceptive somnambulists." Its main exposition is in Langdon Winner's *The Whale and the Reactor*⁴². Since the technic frame of mind is a sort of narcotized state it was appropriately called **Teknosis** by Biram⁴³. Imagine an automobile rolling down a gentle slope, its driver asleep at the wheel. It will pursue a course that to an outside observer seems inexorable and deterministic. So technological society, while we are somnambulists, and in the absence of any other collective ends which might induce us to take the wheel, seems to pursue a deterministic course. Just as the course of the automobile is determined by the force of gravity and the terrain over which it rides -- so society, without conscious control and intervention, pursues a course determined by the ideology of progress and technical destiny. We have to wake up; grab the wheel, and -- dare I say it -- apply the brake.

Review questions

1. In the idea of reciprocal bias, what is the counterpart to the bias of the medium?
2. Give an example of another, equivalent, expression for "the technic frame of mind"?
3. I have described nine aspects of the technic frame of mind: rationality (counterpart: irrationality) and one-dimensionality; efficiency as the ultimate criterion; quantification; technological imperative; mastery of nature; techfixation; fascination; artificiality; somnambulism. Briefly explain five of these.
4. Are there areas of the life world that you would consider inappropriate for the application of instrumental rationality?
5. What do you understand by a technological fix? Give an example of one and evaluate it.
6. Identify a technology which is exerting a particular fascination on you at the present time. (If none, use someone else as the victim)

¹The term "bias" was introduced in this context by Harold Innis in his seminal paper "The Bias of Communications". presented at the University of Michigan in April, 1949. It is also found in Scott Eastham's "The Media Matrix" p.55 where he says "To-day, just on the verge of its collapse, western civilization is beginning to perceive the bias of its entire "frame" of reference."

- ²Carol Cohn (1987) Sex and death in the rational world of defense intellectuals. *Signs*, v.12, 690-707. (Cited in Carol Pursell, 1994).
- ³Baudrillard, *op. cit.* 1975 English translation by Mark Poser, Telos Press, St.Louis. Baudrillard says (19) "At the level of all political economy there is something of what Lacan describes as the mirror stage...Here man is embarked on a continual deciphering of himself through his works..."
- ⁴Ihde turned to some of the reflexive ways in which a growing technologically mediated experience of the world reflected back upon such phenomena as human self-interpretation and its cultural variants. "I argued that it was not at all accidental that the primary metaphors for explaining bodily functions should be technological ones - hearts are pumps, brains have wiring, language learning is pre-programmed." (*Philosophy of Technology: An Introduction*, Don Ihde, 1993)
- ⁵Grant, G. (1986).Thinking about technology. In *Technology and justice*. Toronto: Anansi, 32-33.
- ⁶Bellah, R. et al. "*The Good Society*" p. 12.
- ⁷Langdon Winner, in Ch.2 of *The Whale and the Reactor*, explains that Plato saw politeia as a techne.
- ⁸*Die Seele im technischen Zeitalter*. Rowohlt Taschenbuch Verlag, GmbH, 1957. (Man in the age of technique Columbia University Press, 1980) Gehlen's book is full of insights, many of which are similar to Ellul's in *La technique* published in 1954.
- ⁹Reprinted from The Guardian in the Globe and Mail, 2 July 1994, D8.
- ¹⁰Jacques Ellul (translated by Joachim Neugroschel) *The Technological System*. New York: Continuum 1980 (1977). Chapter 5, footnote 2, p.335. Quoted in the Chapter "Introduction".
- ¹¹Technological Society p.6. See also Katherine Temple's discussion (1980, 226-227).
- ¹²Technological Society, p.xiii.
- ¹³A Carlyle Reader. New York: Modern Library, 1969. 31-54.
- ¹⁴*Die Frage nach der Technik*.
- ¹⁵Robert Whelchel in IEEE Technology and Society Magazine December 1986 , p.4. I think this is a considerable oversimplification of Heidegger's subtle meaning, but it will serve my purpose here.
- ¹⁶Zinchenko
- ¹⁷Wertrationalität und Zweckrationalität
- ¹⁸La coeur a ses raisons dont la raison ne connait point. (*Pensées*)
- ¹⁹Feenberg, A. (1991). *Critical theory of technology*. New York & Oxford: Oxford University Press.
- ²⁰Note the affecting scene in the Video "*Running out of time*"
- ²¹Hardin, Garrett (1985). *Filters against folly*. New York: Penguin Books.
- ²²Daniel Chandler has a fuller description of this phenomenon at his Website (see header to this chapter).
- ²³Rapoport, Anatol (1986). THE technological imperative. *Man-Environment Systems*, v.16, p.47-54.
- ²⁴Withold Rybczynski *Taming the Tiger*
- ²⁵Shallis, Michael (1984). *The Silicon Idol: The Micro Revolution and its Social Implications*. Oxford: Oxford University Press. p.64-65.
- ²⁶OECD, 1996, Part 2, p.28.
- ²⁷ Peter B. Medawar (1990). *The threat and the glory: reflections on science and scientists*. HarperCollins. p.17.
- ²⁸Roy Pascal in Rose, W. (ed.) (1949). *Essays on Goethe*.
- ²⁹Reprinted in *Technology and the Future* 7th ed. 55-64
- ³⁰Teich, 6th ed. p.32
- ³¹Report on Business G&M January 1992 p.49 (Technofix 002)
- ³²MGW 2 Jan 1994 (Technofix 003)
- ³³"My spech to the graduates." McGraw Hill Reader, 1985 (courtesy Tiffany Self).
- ³⁴"The book as symbolic object." in Nunberg, Geoffrey, ed. (1996) *The future of the book*. Berkeley CA: University of California Press, p.145.
- ³⁵Medawar, Peter (1972). *The hope of progress*. London: Wildwood House, p.12.
- ³⁶*The Media Matrix* 1990, p.4
- ³⁷ David E. Nye "The American Technological Sublime" reviewed by Ivan Amato in *New Scientist* 21 Jan. 1995 p.41 (I have used Amato's words).

³⁸ Le Bluff, p.384.

³⁹Article for The Nation, posted to Internet Nov.1995.

⁴⁰ Author's foreword to the revised American edition of *The Technological Society*. Vintage edition p.xxxiii.

⁴¹ 1968,p.71.

⁴² 1986, p. 5-10, p.169

⁴³ This had been anticipated by Ellul in *op.cit* p.412 as "technical anesthesia".