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Technology and Life-Worlds:
Towards a Hermeneutics of Technologies

1. The experiences of Japan

In 1853 and 1854, American Commodore Mathew C. Perry visited Japan on warships with steam engines, causing an isolated Japan to open to commerce with the Western World. Japanese called these warships "*kurobune*" ("black ships") because they raised a dense cloud of black smoke. These powerful technological machines greatly impressed the Japanese people, who began to recognize, although reluctantly, the necessity of cultural exchange: Among the presents from the President to the Emperor, the magnetic telegraph and a one-quarter-scale model of a locomotive engine were the ones which especially stimulated their curiosity. But, among these technological items, it was the ten-inch ship's cannons carried by the ship which became the center of attention of Japanese officials, who soon understood the necessity of urgently introducing modern weapons in order to avoid a third or a fourth visit of "Perry." In the first cultural exchange in the modern age between Western countries and Japan, modern technologies played a decisive role.

This anecdote suggests that it is important to understand the status of technologies in culture when we want to clarify the characteristics of modern culture and cultural exchange. In fact, being stimulated by the experiment of the telegraph demonstrated by the crew of Perry's ship, Japanese people began to introduce telegraph machines from various European countries to learn its technology and to make machines based on them. As a result of this introduction process, a public telegraph service began between Tokyo and Yokohama in 1870. Railroad service with locomotive engines began between Tokyo and Yokohama in 1872. These

were the first epoch making events in the modernization process of Japan.

When we recall the well-known history of the beginning phase of the modernization process of Japan in this way, we are inclined to think as if this process of the introduction of the modern technology were inevitable and necessary, and that the "experience of Japan" could be taken as giving strong support for a traditional, popular view concerning the relation between technology and culture, namely technological determinism. But, I would like to introduce here another story of the "experience of Japan" which we can trace back to another encounter with Western technology about three hundred years before the above-mentioned story.

In 1543, guns were brought to Japan by Portuguese who had arrived at a small island in the southern part of Japan. Guns were adopted very quickly, innovations made in several important functions, and used widely for the next hundred years. Especially in the battle of Nagashino in 1575, Lord Oda Nobunaga brought 3000 of the best trained matchlockmen to win the battle against Lord Takeda. Probably, we could find few battles, even in European countries at that time, in which so many guns were used as in Nagashino. Lord Tokugawa Ieyasu also used many guns and cannons in battles to establish his rule over Japan. But, after the establishment of his rule, Japan gradually gave up guns. And after two hundred and fifty years of the "peaceful" Edo period, Western people found a few big guns at several places in Japan, which had not been used for so long a time that they did not function at all. Fascinated by this story, an American writer has written a book called *Giving Up the Gun, Japan's Reversion to the Sword, 1543-1879* and has drawn the following lesson:

> What the Japanese experience does prove is two things. First, that a no-growth economy is perfectly compatible with prosperous and civilized life. And second, that human beings are less the passive victims of their own knowledge and skills than most men in the West suppose. (Perrin 1986, p. 75.)

If this is what we can learn from the second anecdote of the Japanese experience, we need not to surrender to technological determinism and give up a hope of finding an alternative view concerning the relation between technology and culture.

In the following, I would like to propose an alternative view and to show the possibility and the necessity of a "hermeneutics" of technology with the help of the recent development of social studies of technology.

2. Technological determinism

1) Technology in advertisements

We can begin by looking at advertisements from the 1920s. For example, a 1920 advertisement for an electric iron, with the caption "Ironing Made Easy," shows a happy woman working with the machine on the left and an exhausted woman working by hand on the right (Smith and Marx 1994, p. 18) (cf. figure 1). In another 1925 example titled "Mother," General Electric promotes electric appliances such as electric lights, electric

[image omitted]

Figure 1.
"Advertisement for Simplex Ironer, *Ladies Home Journal,* April 1920. Photograph from Cleveland Public Libray".
(From Smith and Marx 1994, p.18, figure. 8.)

[image omitted]

Figure 2.
"General Electric had a long tradition of specifically addressing women in their advertising campaigns. Here, in a 1925 advertisement, the implicit message is 'The cost of electrical technology is so small that its price is irrelevant when compared with the value of children' (From Nye D. E., *Image Worlds: Corporate Identities at General Electric, 1890–1930*, Cambridge, MA: MIT Press, 1985, . pp. 130-131).
(From Bijker 1995, p. 235. figure 2.)

washing machines, etc., by showing a mother reading with her children (Bijker 1995, p. 235) (cf. figure 2). These advertisements show symbolically the images by which household machines were sold and bought at the beginning of this century. Further, they show how rational and convenient the use of a new technological instrument is, and that the use of various electrical appliances and the rationalization of housework are not just related to work such as cleaning and washing, but to the way of being a "Mother" as such. What is most important in being a "Mother" is made possible by the use of technology.

The message which we can read from these advertisements is to be taken as technological determinism for, according to these messages, technology is a main driving force for the progress of history and society; and, if one wants to live a rational, comfortable, and significant life, using new technological instruments seems to be inevitable and necessary. There seem to be only two alternatives: either we must accept new

machines brought about by technological innovations or we must give them all up. These advertisements encourage people to take the first choice.

2) Technologies as forms of life

This kind of idea or "ideology" about the relationship between technology and everyday life has been continuously strengthened up to now. While at the beginning of the last century it was a matter of choice to use various electric appliances and advertisements prompting their use were necessary, as we can see from these advertisements, it has become so self-evident today that not using them seems out of question. At least in the industrial countries, it becomes unthinkable to live without these electric appliances. American philosopher Langdon Winner describes this situation in the following words:

> We do indeed "use" telephones, automobiles, electric lights, and computers in the conventional sense of picking them up and putting them down. But, our world soon becomes one in which telephony, automobility, electric lighting, and computing are forms of life in the most powerful sense: life would scarcely be thinkable without them. (Winner 1986, p. 11.)

The concept of "forms of life," which Winner uses in this citation, comes from Wittgenstein. Wittgenstein criticized the traditional narrow view of language wherein its main function lies in naming things and events, and emphasized that there are many functions of language, such as giving an order, making a promise, exchanging greetings, and so on. These various "language games" constitute our forms of life. Just like these differing roles of language in our life, "technology games," such as talking on telephones, driving cars, and watching television, make up our forms of life. Perhaps, one thinks that talking on telephones is only using a new tool for the old familiar purpose, i.e., that of communicating with each other. But, with the introduction of telephony into our life, the way of communication is radically transformed, and a new form of communication comes into being with it, and it also influences other ways of communication as well. When everyone has come to use telephones, writing a letter acquires a different and new meaning. Think of

television as another example. Who would have predicted at the beginning phase of its invention that one of the most important roles of television today would be that of a universal baby-sitter?

In the above-mentioned General Electric advertisement titled "Mother," no technical devise was pictured in the situation of a mother's intimately being with children, but today a television set could be placed exactly at the center of such a situation.

Probably, we can see this kind of transformation of forms of life whenever new technologies are introduced to our life. In this sense, we could say that the use of a new technology in everyday life brings about not only new means to an old end but also a new end and consequently a new "form of action" (cf. E. Cassirer 1985/1930, K. Miki 1967/1941). From the stone age through the bronze and iron age to the present atomic age, we have constituted various kinds of new combinations of ends-means and new forms of actions.

In contrast, the usage of technological instruments today is not simply related to the "forms of life" in the sense of individual forms of action. As modern technological instruments are closely related to other kinds of technologies which belong to other spheres, the usage of a new technological instrument today is essentially dependent on the "forms of life" in the sense of complex and large technological systems and material infrastructures.

In our ordinary life, the use of tap water constitutes a fundamental form of life. In order to drink water, we need only to turn a faucet and need not to go to a well and draw water from it. But, the fact that water comes from a faucet "automatically" is only possible when everything concerning the water service functions without problems, meaning that it depends on a socio-technical system from the faucet through a water pipe to a water purification plant managed by a waterworks bureau, and this system, on its part, depends on the natural environment, i.e., the weather. We can see a similar situation in using a car. The use of a car presupposes a worldwide technological system of production and supply of oil, a system of construction and management of highways, and a system of production and selling of cars, and so on. In this sense, while a car can be seen as a means to a certain end, various large systems which make this means possible have already changed society and nature fundamentally. Feenberg describes this situation in the following way:

> In sum, modern means already change the world "immanently," independent of the purpose for which they are employed. Our tools have become a life environment; increasingly, we are incorporated into the apparatus we have created and subordinated to its rhythms and demands. Heidegger calls this the "peril" of the age. (Feenberg 1995, p.25; cf. p.228f.)

Technological systems having become our environment means that from a user's point of view we need not consider these preconditions in our normal use of a technological instrument. We rather dwell in and move in these systems which make a horizon of each of our actions, and which remain concealed, so long as they function well.

From what we have seen, we can say that technological determinism has pointed out an important aspect of modern technology: a technology cannot be considered as functioning neutrally as a means, and so long as it constitutes our environment, it is not a question of choice but rather that we are from the beginning "thrown in" ("*geworfen*") the technological being in the world.

It is exactly this characteristic of modern technology in our Life-World that makes us see the history of technological development from the deterministic point of view. The picture "American Progress" (by John Gast 1872) shows this deterministic standpoint very impressively (cf. figure 3). "The painting clearly conveys the dominant culture's attitude toward nature, Native Americans, and, more generally, linear change and improvement through science and technology" (Smith 1994, p. 10). The picture indicates that there is no choice but to accept this technology and "progress" which is transferred from the center of the East. "Fleeing from 'Progress' are Indians, buffalo, wild horses, bears and other game, moving westward—ever westward. The Indians... turn their despairing faces toward the setting sun, as they flee from the presence of wondrous vision" (Smith 1994, p. 9).

But, is technology really the only driving force for the development of history and society, as technological determinism insists? Are there really only two alternatives, namely to accept or flee from the linear development of science and technology?

We have seen a hint for another possibility in one phase of Japanese

[image omitted]

Figure 3.
John Gast, "American Progress" (oil on canvas, 1872).

history. In order to make this indication more persuasive, I would like to take another newly developed view concerning the relationship between technology and society into consideration and see the process by which the technological system is developed, before it has been established.

3. Challenges of social constructivism

In recent studies of technology, a theory called social constructivism has become popular, influenced by the current view of the sociology of science. According to the post-Kuhnian philosophy of science, it is not possible to utilize a concept of an objective nature or objective truth in order to explain the success of a scientific theory. We need the same kind of factors in explaining the success of a theory as in explaining the failure of a theory. That means a sociological explanation of a theory must be as valid in the case of a success as in the case of the failure of a theory.

This "symmetry thesis" concerning a sociological explanation is one of the most important outcomes of the recent current of the sociology of science, and this thesis has been extended to the realm of technology. According to this thesis, the success of a technology, for example, the fact that some technological machine has been invented, used and diffused, can and must be explained not only by technological factors but also by social factors exactly as in the case of explaining the failure of a technology. There is not a determined "rational" logic of technology, which can be identified before a certain technology has been realized successfully.

The developmental process of a technology is often characterized as a linear process characterized by the following scheme: scientific investigation – technological conception – invention – production of models – innovation – social use and diffusion. But in reality, there are always several other possibilities in every step of the development, and in order to make the process from one step to the other possible, not only technological factors but also social factors play an important role.

Pinch and Bijker, representative social constructivists, have demonstrated the "open" process of this technological development with the example of the technology of bicycles very impressively. In the last half of the 19th century, the type of bicycle that we see normally today was not yet established and remained only one type among many others. The type which first acquired popularity was that with an extremely large front wheel and a small rear wheel, called a "penny-farthing." This type of bicycle was preferred mostly by young men for enjoying sport, because one could enjoy a high speed with it. But, it was unsafe and consequently not considered appropriate for women. That means it was in conformity with the Victorian morality, against the current of emancipation of women. The type which we use now was superior with regard to safety and was highly reputed in everyday use, especially for use by women. In the end, the type we use now has become dominant through various influences of several social groups (of young men, of old men, of ladies and of racers) and technological factors (using an inflatable tire or not, etc.) (Pinch and Bijker 1987).

Once a certain type of bicycle has been constituted, used, and become natural in our life, it seems as if it were usable in any society and under any value judgment. But, when we inquire into the process of its constitution, it is clear that social and value factors play a decisive role in

determining even the structure and form of a bicycle. In this sense, the constituting process of a bicycle is not only related to a bicycle as a means but also as an end or as a certain value. The developmental process of a technology is value laden. In the developmental process, the technological instrument is not closed but open to various factors. It becomes a closed "black box" only after technological, social and value factors are unified in a certain way and consequently stabilized and determined.

D. MacKenzie describes such an open process with the example of technological testing of US intercontinental ballistic missiles. At the beginning of the nineteen sixties, there was a controversy concerning the feasibility of missiles with nuclear warheads. In actual testing, either testing of a missile without a warhead or testing of a warhead in a fixed location above or below ground had been carried out, but no missile test up to that point carried a live nuclear warhead. In this circumstance, there arose skepticism about the credibility of testing missiles, along with the "challenge hypothesis" that American missiles would not function in real use. But, after 1963, when the Partial Test-Ban Treaty was concluded and real testing was made impossible, the challenge hypothesis paradoxically lost its credibility; rather, a positive evaluation of the results of separate testings up to that point had been established. "Paradoxically, it may be that the political impossibility of replicating the one live firing test—because of the entrenchment of the Partial Test-Ban Treaty—has contributed to the decline of the challenge's credibility, even while it has maintained its 'abstract' status unaltered" (MacKenzie 1989, p. 422). A change in the international political situation influenced how the results of a technological test would be evaluated and what would be recognized as technological fact.

From these examples and analyses of social constructivism, we gain a very important insight into the relationship between society and technology. From this point of view, social factors influence technology not externally but rather internally, and they are related to the definitions of technological product and technological "fact" themselves. What a bicycle is and what a tested fact about an intercontinental ballistic missile is, that is, the meaning of a technological product and the meaning of a technological fact are determined by social and political factors. According to social constructivism, it is not that technology determines society, but it is rather that technology is determined by society.

In this way, we seem to have come to an extreme opposite position to the one we have seen in technological determinism. But, we must be careful and not be too hasty.

First of all, social constructivism does not propose that there exist social factors independently of technological factors. Actually, a society without technology is unthinkable, and if society is internally and immanently related to technology, the reverse must also be valid. Bijker emphasizes this situation:

> Purely social relations are to be found only in the imaginations of sociologists or among baboons, and purely technical relations are to be found only in the wilder reaches of science fiction. The technical is socially constructed, and the social is technically constructed. All stable ensembles are bound together as much by the technical and by the social. (Bijker 1995, p. 273.)

This point of view brings us very near to the view of an "actor network" developed by the French sociologist, B. Latour. According to Latour, we must recognize not only humans but also things like machines as members of our society, constituting our society as a necessary "actant." This "actor network" plays exactly the role of a socio-technical system which makes the functioning of each technical device possible, and which we have already seen in the previous section, when we emphasized the systematic character of present technology. In this way, we can see that the view of social constructivism is not opposite to the view of technological determinism, but rather very near to it, when we take the systematic character of technology into consideration. Bijker seems to support this understanding. "Society is not determined by technology, nor is technology determined by society. Both emerge as two sides of the sociotechnical coin during the construction process of artifacts, facts, and relevant social groups" (Bijker 1995, p. 274).

I would like to call this view a "double aspect theory" of the technology/society relation. Just as the double aspect theory of mind/body relation emphasizes that mind and body are not independent entities but inseparable aspects of one fundamental entity (person, according to one version), this theory indicates that society and technology are inseparable aspects of one fundamental socio-technical network. This does not

at all mean that the distinction between society and technology is meaningless. As there are actions in which mental functions are conspicuous, for example, contemplating, and actions in which bodily functions are dominant, for example, walking, there are various kinds of socio-technical networks and various phases of one socio-technical network in which either social or technological factors are conspicuous.

In any case, in the developmental process these two aspects interact with each other, and through the process of interaction there emerges a certain compromise and stability of a network. In the sense that we cannot predict the course of this development beforehand, and in the sense that there is no definite logic which we can identify beforehand, this process is essentially contingent and can be seen as a kind of process of self-organization. Only after the process is finished and seen from the point of view of an established network, could it be viewed as if it were deterministic.

4. A "hermeneutics" of technologies

1) Technology as political phenomenon

If the developmental process of technology can be seen as a process of the definition of machines and facts, or a process of their meaning constitution, then this process is also to be considered an interpretation process of technological devices. Every technological product is a result of a certain interpretation.

Sometimes it is clear who takes the initiative of this interpretation. In the advertisements about ironing and electricity at the beginning of the last century, engineers and producers were taking the initiative and consumers and users were considered only receivers of the proposed interpretation.

But, in the case of an interpretation of non-human technological products, not only is it sometimes unclear who takes the initiative, but also sometimes the interpretation process as such seems virtually concealed. That means, standing before some technological product, we are inclined to think that it has nothing to do with an interpretation, and that the products are neutral with respect to various interpretations because the interpreted meaning sometimes remains "silent."

Two examples from L. Winner help us again to think about this characteristic of a hermeneutics of technology.

There are bridges over the parkways from New York to Long Island. Many of them are extraordinary low, so low that normal buses cannot pass under them. The goal that the designer of this parkway wanted to realize was keeping poor people and blacks, who normally use public buses, off Long Island. The technological structure seems to be at first innocuous, but that structure itself embodies a meaning of social discrimination and realizes it perfectly.

In the 1880s, at McCormick's reaper manufacturing plant, a large, new molding machine, which could be used by unskilled workers, was introduced at a very high cost. It has been made clear subsequently that the machine was introduced, despite higher production costs, in order to destroy the strong labor union of skilled workers. The function of the machine in that context expresses a meaning of the destruction of a labor union and realizes it very well.

What is important is that these meanings are not given to technological products externally, but they are "embodied" in the structure and function of the products as such. According to Winner, "certain technologies in themselves have political properties" (Winner 1986, p. 20).

Concerning the political characteristics of technology, Winner carefully differentiates two kinds of technologies. First are the instances in which designs and arrangements of a technical device provide a means of realizing certain political purposes, as in the above-mentioned two cases, and in these cases, technologies have a relatively wide range of flexibility for changing designs and arrangements. Second are the instances in which technologies are more closely connected with a particular type of social structure, for example, democratic or authoritarian. As examples of this latter kind, Winner gives technologies of the atom bomb or nuclear power plant which requires necessarily a centralized, rigidly hierarchical social structure, and he calls these technologies "inherently political technologies" (Winner 1986, p. 22).

Surely, this difference is very important, especially when it comes to the political problem in the explicit sense concerning the relation between technology and society. Indeed, representatives of the latter kind are technologies which have been playing decisive roles since the last century and remain as one of the central problems of present political controversy.

However, when it comes to the question of the political character of technologies in general, i.e., political character in the wider sense, not only technologies of this kind but also technologies of other kinds must also be taken into consideration. After having considered the social constructivist view, we can understand Winner's thesis more generally. Not just certain technologies but all technologies have in themselves political properties. Bicycles of the present type were supported by and supported the movement of emancipation of women, and technological facts about intercontinental ballistic missiles constituted and were constituted by the international political situation. In this sense, we can say that these technologies have political properties as well. When the socio-technical networks, in which these technological products were constituted, become stabilized and a part of a normal environment, the political properties, which they originally had, become concealed, sedimented, and made tacit. This does not mean that they have vanished, but rather that they play their roles so well that they have become self-evident. The important role of a hermeneutics of technologies is to make us aware of this political character of technologies, i.e., to put what is self-evident in a stabilized socio-technical network into question and to destabilize and repoliticize it once again.

This hermeneutics does not always remain within a sphere of philosopher, historian, or sociologist. When a socio-technical system becomes unstable, producers or some important members of the system themselves apply this method. For example, a water service company can use this strategy by indicating that the use of tap water is only possible on the basis of the water service system as a whole and that the users have not simply a passive status but can actively commit themselves concerning how this system functions. In fact, Berlin Water Service once called on the people in Berlin to conserve water, publishing a pamphlet "Berlin spart Wasser," in which many kinds of suggestions for water conservation are designed and symbolized like political messages and slogans (Grote 1994) (cf. figure 4, 5). Even the use of water in general could be seen as a kind of political action.

2) Translation of technology

If we acknowledge the insight acquired in the above discussions, namely, that technologies are always interpreted and embedded in a certain

[image omitted]

Figure 4.
A pamphlet "Berlin spart Wasser."
(From Grote 1994, p.261)

[image omitted]

Figure 5.
A pamphlet "Berlin spart Wasser."
(From Grote 1994, p.265)

socio-technical network, then we must also recognize the following thesis: if a technology belonging to a certain socio-technical network is transferred to a different network, there must necessarily occur an encounter and a struggle between different interpretations and consequently some "hermeneutical" process between two networks. And consequently, a certain technological product, which is transferred into a different culture, cannot simply be considered to remain as the same thing.

In the late Medieval period of Europe, windmills became one of the important power plants. But, as Lynn White has explained, "In Tibet windmills are used only thus, in the technology of prayers; in China they

are applied solely to pumping or to hauling canal boats over lock-sides, but not for grinding grain; in Afghanistan they are engaged chiefly in milling flour" (White 1962, p. 86). In these cases, we cannot say that the use of windmills for prayers or for certain limited purposes is not a technological or rational way of using it, for what is technological and what is rational is defined by each socio-technical network, in which windmills are invented, used, and "defined."

In this sense every process of technology transfer is also a transformation and translation process of previous socio-technical networks, and consequently through this process, the contingent character of the networks becomes apparent in some way or other.

Once again, consider the picture "American Progress," which depicts one case of the struggle of interpretation between two networks very impressively. In the center of the picture, a beautiful maiden appears carrying a telegraph wire in her right hand, connecting her firmly with the center. From this, we can clearly understand why the "interpretation" belonging to the center of the Eastern U.S. is so one-sidedly strong. The girl is also accompanied by horse wagons, a steam locomotive, and above all, many people. Exactly these factors make up a socio-technical network, which firmly supports and defends one direction of interpretation and guarantees the validity of European science and technology.

> Facts and machines are like trains, electricity, packages of computer bytes or frozen vegetables: they can go everywhere as long as the track along which they travel is not interrupted in the slightest… Forgetting the extension of the instruments when admiring the smooth running of facts and machines would be like admiring the road system, with all those fast trucks and cars, and overlooking civil engineering, the garages, the mechanics and the spare parts. Facts and machines have no inertia of their own; like kings or armies they cannot travel without their retinues and impedimenta. (Latour 1987, p. 250.)

In this sense, we could say: the image of "American Progress" represented in the picture is not guaranteed from the beginning but depends wholly on the success of the socio-technical network, and as this success is essentially contingent, "American Progress" must also be seen as contingent.

In addition to this, as long as in the process of the technology transfer the connection between the periphery and the center of the network is necessary, the process of the transfer cannot be considered only one-sided. In order for the East to be the center of culture and power, it must be able to control the flow of information, machines, and people. That means the network of "American Progress" brings not only its own factors to the other networks but also it cannot but bring the factors of the other socio-technological network back into its own center. The moment of interaction remains, even though the two networks are unequal. According to D. Ihde: "For every contact the Euro-American technologized culture makes with the Other, there returns a countercurrent of the culture contacted. This is the phenomenon of what I shall call postmodern pluriculture" (Ihde 1993, p. 28; cf. Ihde 1990).

I am not sure whether this characteristic can be called postmodern. But in any case, in the process of the encounter between two different cultures it is inevitable that there occurs action and reaction and a kind of circular movement, which brings a transformation and a translation of each culture in some way or other. The "hermeneutical circle" is also inevitable in the case of technology transfer.