TRANSITIONS FROM FUNCTION-ORIENTED TO EFFECT-ORIENTED TECHNOLOGIES - SOME THOUGHTS ON THE NATURE OF MODERN TECHNOLOGY

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Summary

The chapter discusses the transition from a function-oriented technology to a technology unspecified in its results. Function-oriented technology will be described as "Technology I". "Technology II" includes communications technology, entertainment electronics, various household and kitchen technologies as well as vehicles. They are mainly technologies used in a networked context. Meaningful applications require social interaction. The technology is available and manageable for individuals and gives users possibilities of identification. The qualitative difference between the two can be determined via the different contextual relations each one has. Technology I is applied in conditions of clear contextual relations – with Max Weber we can speak of "*Zweckrationalität*" (instrumental rationality). To assert them, society has established

institutions that disseminate standards and norms. Consequently, the scope for (subjective) contextualization is limited. The world of Technology II is unaware of its consequences. Occasionally, in some relevant areas, it is indifferent to the conditions and consequences of its application.

In contrast, "Technology I" is modeled on rational, efficient and smooth operations. It became the ideal for rational organizations (e.g. bureaucracy). The assumption that technical processes can be run with high efficiency and without any friction has survived to this day. The widespread use of machines has created uniform social processes accordingly, and the homogenizing principle has been institutionalized. This can be seen in the principles of rational production which were established when industrialization began and which are based on the development and application of rules and regulations. Effects are ambiguous and depend on subjective perceptions. Technology is not simply defined in terms of its functions, but depends on the contextualization effort of individuals.

1. Introduction

First we explain the difference between purpose-oriented technologies and modern technologies which are unspecific in their functions. The social construction of technology depends on contextual appropriations. The more technical processes are part of the everyday life, the more important gets socialization by technology.

1.1. Function-oriented vs. Unspecified Effects

Only in retrospect were the completed phases of development considered to be clearly structured according to their purpose from the start. In actual fact, innovations always start from the prestige to be gained by their realization and application. How else can the construction of the first railroad in Germany from Nuremberg to Fuerth be explained? (The first German railway line was opened on December 7, 1835.) Only when individual, small and private railway companies established a network between them, worked out timetables and opened up a service according to schedule the transportation of goods and people could become an effective, useful and rationally calculable offer. Even where production machinery is concerned, success was not always calculable at the beginning of industrialization. It is indisputable, however, that in the case of production machinery the usefulness that could actually be achieved was eventually calculated. Unpredictable results are part of most new technological products. Production technologies, however, always presuppose clearly defined goals. Communications, consumer and office technologies are a different matter. Their purpose is not given from the start, but must be established by means of appropriate contextualization.

Initially, all product innovations are unspecified, since clearly defined purposes are not realized till later on. When it was introduced, the bicycle was an elitist vehicle just as the car was in the 1950s and 1960s. Even the telephone, the phonograph and the typewriter had to be put in a context defining their purpose before they became a generally usable product. The phonograph was meant to serve as a dictating machine and asserted itself only much later as a playback unit for sounds in the entertainment

industry. Probably, every technical innovation requires a "phase of vacillation". What does that mean? All innovations go through a phase in which newly developed functions and options have to be contextualized. Any change in the manufacture of a product means relinquishing tried and tested methods. The cultural embeddedness of technology acquires an outstanding significance in the process of technological development. Whenever technical processes are new, they are correspondingly complex and confusing and can only be controlled in certain conditions. Therefore, the history of technology tells us about various failures, but also about the marvelous performance of mechanics with clockwork-like precision and the ability to control the forces of nature. Steam boilers exploded, trains were derailed and power transmission was accident-prone. Therefore, successful technology always has an aura of perfection and precision. This fact is reflected in its development: tools, production machinery and production methods are continuously being improved; they become more adequate and manage to control nature. Ernst Kapp, in his "Philosophy of Technology" of 1877, says: "A close examination of the entire history of mankind ultimately reveals that it is the history of inventing improved tools [….]. Mathematical precision, the ability to reproduce processes and to control them, irrespective of their mechanical, chemical or electronic nature, are the essence of what hitherto has been impossible, and each new object prompts our admiration and approval." Thus, very different innovations can be sure to attract our keen interest.

A main feature of machines is the uniformity of processes. Corrective interventions are not required, e.g. to maintain the interaction of movement-creating machines, transmission mechanisms and machine tools. Instrumental processes have often become a model for the organization of society and the working world. Incidentally, one of the ways Giddens describes modern societies is in terms of their mechanical work processes. He says that 'Modernity' can be understood as roughly equivalent to the industrialized world, so long as it be recognized that industrialism is not its only institutional dimension. The author takes industrialism to refer to the social relations implied in the widespread use of material power and machinery in production processes. As such, it is one institutional axis of modernity.

When industrial societies evolved, scientific techniques and processes started to be used. Functional relations were dissolved, so that single functions could be deliberately improved. Technical and scientific functions have to be proved. Scientific concepts usually start from a type of knowledge that assumes functional relations to be sound, thus making it possible to take action. Experiments are expected to show what actions lead to what results. Evidence of controlled influence is given when functions are like a cause-and-result scenario and can be accurately reproduced. Increased application of technology stands for rational decisions. Consequently, actions are seen to be balanced and well-founded. An increase of secured knowledge and applied technology broaden the range in which action can take place and give more scope for action strategies. Traditional cultural rules and regulations disappear. Creative opportunities, but also constraints, open up, as well as the necessity to account for actual decisions made, and to do so both publicly and within an organization. Knowledge and still existing non-knowledge are marked by a problematic division line. Such a boundary between knowledge and non-knowledge is inevitable under rational conditions of discourse. More knowledge and more rationality lead not only to more security, but also to new

open questions and new forms of uncertainty.

In this regard, Latour remarks that the boundaries between causes and results disappear. Thus, in the case of Technology II, it is individuals who take the initiative since technology, or the contexts it is used in, are open. To a lesser extent, it is institutions that take on the task of producing the frames of use. Clear purposes can no longer be assumed. What suggests itself, rather, is a changeover from an examination of clearly structured purposes to unspecified classifications. If, in the world of Technology I, rationality and purpose dominate, the issue in Technology II is what effects can be achieved. "Effects" replace "purpose" and "rationality" with the consequence that knowledge about technology can no longer be transmitted via functions. Formerly, machines were judged according to their specific performance (as sewing machines, weaving or milling machines); what we have now is an unspecified global analysis. Technology is considered without including its concrete cultural, social, economic and ecological context. This change of perspective is paralleled by the process of civilization, as Elias describes it, considering it to be a process of informalization. Functional technology applications make for clarity, if only in the service of their implementation, whereas the transition to multiple options entails the disappearance of clear contours.

1.2. Appropriating Technology by Means of Contextualization

The unspecified use of technology goes hand in hand with far-reaching options for the user. The desired features of technology are only gained when it is applied and controlled by the user. Use and control require user and (comprehensive) technology competence. User competence refers to the proper operation of technical devices (toaster, video recorder, car). Technology competence means the ability to understand the functions and structures of devices. In the area of privately used technology, technology competence means, among other things, that subjects are able to give reasons for their choice of devices and, in the case of maintenance or repair, do not entirely depend on outside expertise.

The proper use of 'Technology I' builds up on knowledge about functional interrelations acquired along with professional qualifications. Therefore, elements of training in the field of mechanics are, for instance: which material is being processed; are certain tools required to process the material; how are shavings/filings going to be dealt with; what about heat conduction; what are the conditions for optimizing the quality of surface treatment. These questions are answered, for instance, during an apprenticeship. The standardization of tools and materials saves individual testing. By contrast, steel, for instance, always depends on certain characteristics in order to be used in a specific way. The external, seemingly cryptic standardization codes show for what purposes the material can be used, how it can be further treated and what the consequences would be for strength, toughness and processing. All kinds of applications have been clarified in advance by checking functional relations. Which effects can be achieved and which cannot, or why certain results have to occur and others do not – all this knowledge must be available, and clear functional dependencies given. Scientific training, training for technical professions and qualifications for modern industrial society in general, largely coincided with an education helping to cope with a technical

environment. Qualifying people meant teaching them to think and act in terms of functions.

As far as classical functional technology is concerned, it is appropriated by practicing relevant functions. The more open a technology is in its applications, the more important changing contextualizations become, with usable functions regarding one's own purposes. Actualizations and selections from many different application potentials are at issue. An open range of uses assumes "temporary ambiguity". Certain features of application potentials are produced by means of contextualization on the basis of unconventional application styles. Their use is by no means explicit, but more likely to be in a broad temporal range, casting people in diverse forms and changing their use of styles. Technology II implies not only increased speed. Rather, we are confronted, today, with radical cultural change. New technologies stand out through dynamism. What we observe are leaps and discontinuities. Free spaces are produced for flexible applications, and they should be exploited in an experimental manner.

In machine technology, the context analysis points out identifiable and clearly delimited functions as well as typical local applications. What is striking in the case of Technology II is that the link to local contexts is much weaker. Technology II can be transported and transferred. Locations are exchangeable. The layout of a text, the text itself, can be processed at home on any PC whatever. Performing a task at a given location is becoming obsolete; local contexts are no longer binding (Examples are telecommuting jobs or software-supported tax declarations saving tax offices the trouble of typing in data). The devaluation of local contexts can be observed. As long as there were clear local connections, unambiguous functions were assumed (In newspapers, for example, typing and layout were done by different people and different places). The "world of machines" and function-oriented Technology I are based on instrumental rationality and practiced everywhere in the same way. Newly established institutions have the task of implementing instrumental rationality, coordinating what can be expected and what is desired. By contrast, Technology II no longer involves instrumental-rational applications only. Table I summarizes how Technology I and Technology II differ.

1.3. Socialization in Different Technical Worlds

Sociology is interested in technology only to the extent that it is socially relevant, i.e. when social configurations and activities are given shape by using it. In reality, everyday life is characterized by different technologies simultaneously, i.e. by Technology I and Technology II. Technology I includes projects of mechanical and electrical engineering. Technology II is unspecified. It requires social interaction, i.e. social action patterns are common parts of relevant operations. In analogy to both technologies, Marshall McLuhan distinguishes between "cold" and "hot technology". This dichotomy is taken up by Larsen. He speaks of "cold" and "warm technology". Elements of unspecified "warm" technology are the following:

- Meaningful applications require social interaction. By contrast, a "cold" technology (T I as a function-oriented technology) does not require social interaction for its use. A desk calculator, for instance, can be used individually and without any simultaneous social reference: A calculator is a cold

technology, requiring absolutely no social interaction on its own merit. The calculator can be learned by reading a manual, trial and error, or personal instruction. The requirement of social interaction for its use is not fulfilled. In strictly operational terms, says Larsen, it is socially irrelevant to the calculator user whether this is or is not the only calculator in the world.

▪ The technology is available and manageable for individuals and gives users possibilities of identification.

▪ It is not thoroughly organized and specified (i.e. limited) in its use. This is demonstrated in that new technologies are formalized and standardized in their applications only to a qualified extent. Formal legal regulations have, so far, had no great significance either.

▪ Above all, these technologies ensure that new resources which, until now, have not been used, become applicable.

	Selected Examples	Technology contexts		Social Structures
		Location	Functions	
Technology I classic function-(machine)technology	Steam power machine Special machines (Lathes, milling machines etc.) Large machinery Monumental joining technology (casting, bolting on, riveting) Assembly line Massive vessels (Ships, locomotives, blast furnaces)	Technology is typically used in particular places (factory buildings, printing works)	In the sense of applications, learning, teaching Systematic functional knowledge for well-defined uses (e.g. drills for wood, metal, light metals, synthetic materials, ceramics, glass). Training and instruction coincide with the teaching of functional knowledge	Instrumental rationality rather than tradition and ethics Instrumental rationality as a superior structuring principle leading to the institutionalization of norms and standards according to rational considerations a la Max Weber
Technology II unspecified technology	universal machines NC, PC media writing and adding machines gadgets computer and communication networks modern mobile vehicles (car, airplane etc.) Multimedia	"Soft" references to location, since machines can be used at work and during vocational training as well as in private everyday life Working at home, planning for leisure time during working hours etc.	Learning about possible uses is playful and unsystematic and essentially incomplete	Rationality of effects Consistent, well-planned goal orientations are no longer generally meaningful What is important is: aesthetics emotions, acceptance

Table 1: A comparison of function-oriented machine technology (T I) and unspecified technology (T II)

The technology of machines (cold technology) coincides with mechanics, amplification, the expansion of bodies in space. It is comprehensible and, therefore, subject to classical laws of physics. As long as, in the sense of Technology I, the concern was with flywheels, drive technology, assembly lines and functional capital investment, it made sense to consider conditions (productive forces) and consequences. From the point of view of social sciences, the issue is institutions giving structure to developing industrial societies. Examples are the institutional relations of employees and trade unions, the principles of payment and social security contributions, but also institutions that standardize production technology and labor. Learning at school becomes formally organized education, and the objective of vocational training is not only the standardization of production, but also social classification (negotiated pay agreements, skilled work, wage groups). "Reliable" (i.e. controllable) labor market conditions were taken for granted. The prevailing assumption of industrial sociologists as late as the 1960s and 1970s was that machines led to de-qualification and to comparable (homogeneous) working conditions. The majority of employees needed fewer and fewer skills to accomplish what was required of them in the production process.

Moreover, in the 1970s and 1980s, developments in the service sector and in industrial production seemed to amount to centralized and standardized qualifications, management structures etc. In fact, important processes in the management of companies, in banks and public institutions were organized around central mainframe computers. "Warm technology" or unspecified technology (T II) allows the use of new resources in the context of newly developed application fields.

In modern service societies, there has been a steady increase in electronic labeling since the mid-1980s; thus, the entire field has been newly organized and economized. Nowadays, this form of labeling goods is common practice. It is found not only on items of daily consumption (beer, milk etc.), but also on cultural products (books and magazines). The service sector has been revolutionized and rationalized, since stock control, stock disposal and turnover developments can be dealt with "on the side" along with operating the cash register. Specially trained staff is not required. The electronic age has entered the homes of private consumers. What has also been confirmed is the spying out of consumers predicted in the 1970s when scanner tills were introduced.

Thus, we are at the threshold of a re-evaluation of clear technological references. Institutionalization is replaced by informalization: structural patterns become fluid. Instead of producing objects, we manipulate symbols. Technology destroys the structures of familiar circumstances. Sennett calls his book "Corrosion of Character" to make clear what it means to be an individual subject with one's own private relations in a world of reflexive modernity in which places, loyalties and tasks have only temporary significance. Rather, the ongoing issue is to execute projects, case by case. Loyalties can be exchanged just as places, tasks and people can. A flexibility prevails of which even Schumpeter was critical. Schumpeter says that property severed from people and from matter and having no function does not create moral loyalty as the vital form of property used to do. Ultimately, there is no-one left who really wants to commit himself: no-one within and no-one outside the confines of large companies.

If technology does not plan results in advance, then flexible individuals are required

who compensate for this deficit. In whatever way the working world was defined when industrial and service societies evolved, these definitions now seem to evaporate. Along with technology, societies are being refashioned. Consequences are far-reaching.: laptops instead of regular office workplaces, limited contracts instead of permanent jobs, project realization instead of skilled work. In such conditions, we can assume that proven institutions are in the process of vanishing. Institutional regulations, which of necessity form the basis for interpreting the world, are being reappraised. Luhmann gives a radical description of how reliable contexts disintegrate. He considers technology as a vehicle for communication possibilities in a world in which reliability is being replaced by options. Computers do not create norms, but vastly differentiated conditions of availability among many applications. Unspecified technology (Technology II) includes the changing significance of devices – today's communication systems make the transition inevitable. At the core, we find symbolic content and, less often, a clearly structured, purpose-oriented application. The concern is not only with handling different technologies, but with the role they play in everyday life and with a revised sociological view of technology and the rest of the world. When new technological possibilities lead to new blueprints of social reality, social relations, from a sociological point of view, can no longer be planned and explained through institutions only. After all, the institutions themselves are undergoing radical change because of developments in technology. This can be seen in schools where, currently, educational provision is becoming more and more informalized (Internet, CD-ROM, TV, DVD).

Socialization includes the ability to find one's way in the labyrinth of social roles, and it regulates relations to institutions. For Emile Durkheim, it makes integration possible. Sigmund Freud considers socialization to be the culturation of compulsive orientations. Mead sees it as a way of dealing with social symbols, i.e. in various educational phases people learn how to interpret and use relevant ("significant") symbols. Indisputably, the special achievement of the socialization concept is to be seen in the following: learning is no longer limited to a narrow institutional framework (school) or to a single life phase (children, youths, young adults), but has to be regarded as a lifelong process involving many different contacts. Learning to deal with problems takes place in entirely different areas of activity.

What does socialization look like when conditioned by new technological environments? Social subjects acquire the ability to act by means of social interactions, technology no doubt playing a large role in the development of social relations (work, education, leisure). In contrast to technical training which enables people to deal with technical objects and their functions, the issue from the perspective of technological socialization is an overall interdependence of motivational, linguistic, cognitive and emotional aspects of a person and his/her lifelong adaptation to change due to technological environments that influence interactions in everyday social life and give them objective shape. The influence of technology on socialization and living conditions at the end of the 20th century is described in the essay: "Growing up in technical worlds".

2. The Technology of Machines T I – Instrumental and Efficient

The world of classical machine technology is characterized by the implementation of rules, principles and processes. Calculability and predictability of processes are at issue. It is a world of bureaucracy, Taylorism and machine sheds à la Ford.

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Biographical Sketch

Prof. Dr. Claus J. Tully, unsalaried lecturer at the Free University of Berlin and lecturer at Free University of Bozen (Italia) as well as researcher at the German Youth Institute, Munich. He is doing research focusing growing up in mobile and communicative worlds, and the impact of mobility on lifestyle of young people.

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Current research project

"Alpine Awareness", environmental awareness of young people in four European alpine countries (France, Italy, Germany, Austria).