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ACTIVITY THEORY AS METHODOLOGY - THE EPISTEMOLIGICAL REVOLUTION OF THE COMPUTER AND THE PROBLEM OF ITS SOCIETAL APPROPRIATION [1]

From the 1430's on, Johannes Gutenberg worked on the technical realization of the distribution of written information. Twenty years later the technology has matured and an effective working organization has come into practice. The printing press can begin its triumphal procession. Fifty years after its invention, eight million books have already been printed and there are over 1100 printing shops using severals presses in more than two hundred and fifty places in Europe. The printing press has developed from a practical means for coming to grips with the great bulk of written material to a very necessary technology without which science, administration, organization of production and commerce are as unimaginable as is the realization of the cultural ideals and of those of educational policies of this era (cf. Giesecke 1991, pp. 63ff.).

But the printing press was neither a neutral medium nor simply the technological basis for communication and the processing of data. Rather, from the beginning it functioned as a processor of a fundamental transformation of knowledge and its social functions. At the outset this manifests itself in the development of the autonomy of knowledge. The coding, standardizing, and classifying methods brought into existence by typography contribute to the development of knowledge as an independent social reality. Knowledge becomes a text which appears as the autonomous representation of knowledge. But exactly the manifold methods of coding, standardizing, and classifying make possible a formerly unknown development and transformation of knowledge, its *dynamism*. Tables, diagrams, illustrations, and maps allow the discovery of contradictions, the formulation of relationships, the use of supplementary information and alterations, and the corrections of imprecision or mistakes. Finally, typography allows the role of intellectual devices (instruments of navigators, astronomers, surveyors, etc.) to become more apparent since they can now be presented as a *total system*.

If the printing press has, above all, modified the relationship of man to knowledge and thus the conception of knowledge in society, there is some indication that, at the present time, a similar revolution is taking place in a similarly intrinsically social way as in the 15th and 16th centuries. There is also some indication that we encounter the present social implementation with the same sort of blindness, with similar wishes and fears as did the social communities of the 15th and 16th centuries - an attitude which is a hindrance to an adequate understanding.

This is quite evident from the discussion about the New Technology in educational science. Aside from the arguments of a number of proponents which are often characterized by naive fascination, positions expressing a critique of culture prevail in educational science. The core of this criticism is composed of three arguments: synthetic or potential reality replaces reality; this promotes emotionally direct ways of confronting reality while impeding rational, more reserved ones; finally, it destroys the "literateness" of classical western education (Raeithel/Volpert 1985). On the other hand, J.-F. Lyotard, one of the protagonists of postmodernism, discusses a perspective related to the transformation of knowledge and to the problematic of the concept of the subject. He argues that knowledge has fundamentally modified its statute since the end of the 1950's, the end of the phase of reconstruction in Europe. Furthermore, he suggests that with the New Technology only that knowledge is processed which is transferable into information quantities and thus leads to a pronounced externalization of knowledge in reference to the person possessing this knowledge as well as to that person's economization. At the same time, according to Lyotard, it becomes apparent that the subject himself is only to be considered as a product of production and not as its producer (Lyotard 1986).

Thus, the relationship of the transformations of knowledge and of the subject concept become the central problem within the discourse of postmodernism: "The old principle that the acquisition of knowledge is indissociable from the formation (Bildung) of minds, or even of individuals, is becoming obsolete and will become ever more so. (...) Knowledge is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange. Knowledge ceases to be an end in itself, it loses its >use-value<." (Lyotard 1986, pp. 24f.)

Lyotard describes the transformation of knowledge as an inner "crisis of knowledge", as the deterioration of science as a form of communication, which results in the disintegration of philosophy of history with its concept of progress and in the abandonment of the concept of the subject. Like Lyotard, we are also interested in the transformation of knowledge, but above all as the transformation of its social functions and the transformation of the concept of the subject, not as the abandonment of the latter.

My main argument is as follows: *Similar to the printing press, the computer is to be understood as the processor of an extensive thrust in modernization and civilization which, above all, will effect a transformation of knowledge and its social functions and will result in a new notion of the subject.*

Regardless of how this thrust in modernization and civilization might be described in detail, it is evident that it has and will continue to have profound effects on education as a form of social practice. At present, these transformations are primarily being discussed as a crisis of public instruction and the promotion of personal development. But we wish to consider the possible perspectives of the origin and development of something new which could be involved in this matter.

2. THE COMPUTER AS PROCESSOR OF KNOWLEDGE TRANSFORMATION

The systematic combination of formerly separated communicative techniques (print media, telephone, radio, television, teleprinter) to automatic data processing in electronic computers is usually considered to be the decisive qualitative leap ahead manifested in the New Technology. With this development, formerly unknown possibilities of the establishment of a technical network involving persons and groups have come into existence, as well as fully novel possibilities for the simulation of various aspects of reality. From this viewpoint, the effects of the New Technology are described as a continuous intensification, formalization, and standardization of social and personal communication and are evaluated in widely divergent manner.

Rather than using this approach, I would like to take up a discussion of the computer as a "symbol machine" and thus as a means of making new possibilities available to knowledge and various forms of practice. Here, knowledge is not understood as an internal psycological reality, as cognition, but as an epistemological and social reality. In contrast to a psychological one, this discussion proceeds from an *epistemological conception of knowledge* which allows the analysis of problems of the social application of knowledge. The following aspects of this discussion are significant for our treatment of the question:

- every epoch or culture develops an implicit world view and self-concept which is based upon a particular conception of reality. The reality of knowledge is constituted within this context.

- Knowledge is a result of concrete (i.e. social-historical) human vital activity and exists only within these relationships. Knowledge is itself to be understood *as* a social relationship and not as some factor *supplementary* to social relationships.

- The entirety of man-made devices is to be comprehended as a system of objectified forms of knowledge detached from man. Subjective forms of knowledge such as perception, emotion, etc. can, on the contrary, not be separated from the persons involved. Both forms of knowledge must be understood in reference to their social character (Fichtner 1996).

I consider a thrust in the theorization of knowledge to be the primary instance of the new possibilities and dimensions which the computer as a symbol machine makes available to knowledge and the various forms of practice (Otte 1985). This means that knowledge is not becoming more and more abstract, but more and more universal. To express this point in a figurative manner: knowledge is becoming less and less a place to linger and more and more like a door one goes through without knowing exactly where it leads.[2]

Common sense presupposes that knowledge results from a quite direct description of the particular scope of reality and experience. Thus, common sense believes in a fixed relation between the form of presentation and meaning. By contrast, theorizing knowledge means that knowledge exists primarily as a form, as a coherent relationship among formal elements. Considering knowledge more and more as a formal and structural relationship also means that its contents, its meaning are not immediately apparent; only by the "application" of this formal aspect in the broadest sense can the contents be developed. Only when mediated by way of this formal aspect can knowledge be related to reality.[3]

With respect to knowledge the computer is, on the one hand, a means of theoretical reflection. It promotes the tendency of the theoretical to become more and more an independent reality. On the other hand, the computer is a means of a formerly unknown extension of the scope of application for knowledge. Thus, in addition to the indiependence of the theoretical, that of the practical, of the applications, of the effective operations also acquires totally new qualities from the computer's possibilities of simulation. M. Otte (1985) suggests that, in a way, the computer can help to overcome the alienation between theory and practice by making the distinctive features of theory and practice vivid and more self-evident.

3. THE COMPUTER: A UNIVERSAL MACHINE

Up to this point I have been describing the transformations of knowledge and of its social functions brought about by the computer. Now I would like to discuss the computer as a device and the social forms of the application of this device. The computer is comprehended in an incomplete manner if it is only considered as a means in itself and positive or negative effects are ascribed to it in an objectivist way, whereby the social forms of its application are ignored. The great variety of these forms can only be alluded to here. For production, service, and administration, the computer and its new technology have become an unquestioned and inevitable fundamental. Within the range of social intercourse it is causing continuously increasing intensification, formalization, and standardization of social and personal communication. The systematization of formerly separated communication techniques results in a more and more pronounced technical interconnection of all spheres of life - a phenomenon which is described as "telematics" (Nora/Minc 1979)

The computer is, however, not only a *constructive device*, but also a particularly *projective one*. It is not only the result of our behavior and thought, but also modifies these in a fundamental manner. In an ethnological study about the origin of the computer culture S. Turkle (1984) explains how we are forced to fundamentally modify our conception of ourselves.

The universal machine of our times does not only "work" in the sphere of production, but also, as mentioned above, in all the spheres of social life. This means that this machine is effecting a comprehensive socialization thrust in which people are becoming more and more dependent on one another. N. Elias calls this intertwining of dependencies "figuration" and, with this

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[2] Knowledge can be considered more and more as an open resource to which meaning and content are attributed only within the realm of its social application. If knowledge and theories are considered as means, one can agree with Bateson that "we are more concerned with the >directions< and >values< inherent in the means than with aiming at a planned goal and thinking that this goal justifies or does not justify manipulative means" (Bateson 1983, p. 221).

[3] The mathematical concepts of fractal geometry and their application in chaos research verify this in a variety of ways. Cf. Mandelbrot 1977.

term, means the cooperative social patterns which as a system of social forms in every society constitutes the whole-scale societal mode of communication (Elias 1976, Vol. 1, p. LXVII). At the present time, not only production, but also the production of the *coherence* of society, the whole-scale societal mode of communication is being modified by the computer.

I assume that thus our concept of ourselves as a subject will alter fundamentally. Computers as symbol machines allow us to observe our cognition itself or, more exactly, its algorithmic segment, in symbolic processes.[4] In doing so, the symbol machines call our attention to the fact that our understanding of our active cognition is still very inadequate. Every action which can be described by an algorithm can also be carried out by a machine or, to put it another way, every algorithm is a machine (Otte 1984; Raeithel 1985).

New perspectives of the machine-like aspects of man result from this trans-classical concept of a machine which is no longer related to a particular exterior appearance of the machine - primarily perspectives of machine-like aspects in spheres which formerly represented the actual subjective qualities such as consciousness, cognition, language, etc. (Turkle 1984, pp. 333ff.). This already indicates that not the *concept of the subject altogether*, but, rather, the *traditional philosophical subject concept of German idealism*, which is associated to the self-consciousness of an ego and its self-certainty, becomes obsolete (Lektorskij 1985, pp. 119-166).

Thus, it becomes apparent to what extent the computer presently functions as a processor which offers a formerly unknown variety of relationships to reality and at the same time is the clamp which holds this variety together. Making this assertion does not, however, already entail a statement about the profit and loss balance involved.[5] With reference to the various levels and social forms of application the computer can be considered to be the epitome of a *universal machine*. The universality of this machine is constituted by the fact that it is not applied in a specified sphere, as is, e.g., typography, but, rather, functions as a new device horizontally and vertically in all social spheres. In doing so, it connects all of these spheres, permeates them, and unifies them. The consequences of this universalization remain inestimable at the present stage.

4. THE SOCIETAL APPROPRIATION OF THE COMPUTER - ACTIVITY THEORY AS METHODOLOGY

Apparently, the point at which the potential, possibilities, and particular dangers of the computer as a universal machine, as a functionally controllable device for our social thought, action, and planning, has already been comprehended and actually socially appropriated, is still quite remote. The "societal appropriation" of this device is a pressing key problem of our times. But what is meant by societal appropriation?

By societal appropriation I do not simply mean the organized development of individual abilities to deal with the possibilities of this device in a technically adequate way. Nor does societal appropriation mean dealing with the many-facetted, media-related didactic problems concerning this device which arise at school, in the course of instruction, or under other circumstances.

Societal appropriation of the "universal machine" means the development of social patterns appropriate to the potential of this machine, the development of habitualizations, standardizations, as well as their preservation, reproduction, and transmission. Societal appropriation means a process by which we learn to consider the new technology as an essential part of ourselves, to integrate it consciously into our daily lives as our culture, and to develop and make use of it as a means of social self-direction.

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[4] Mathematically speaking, an algorithm is a procedure by which output data are drawn from input data of a specified area in an exactly prescribed manner (cf. Kondakov 1978, pp. 22ff.).
[5] So I do not agree with N. Postman's view that the "power of technologies" is necessarily related to making society dependent once again (Postman 1992).

I will attempt to approach the problem by drawing on the activity theory of the cultural history school as a methodological context. This school of thought is aimed at researching the connection between individual and social developments. In drawing on this context, I will be adopting the main line of inquiry of this school: "How does that which is objectively socially new in human development originate?" (Engeström 1986, p. 160). The general answer to this question, which organizes the direction of the search, is: "That which is new does not originate from the old, but from the vibrant movement which leads away from the old" (Engeström 1986, p. 161).

In order to make these processes available to scientific investigation in the first place, Engeström employs Vygotsky's concept of the "zone of the proximal development" and modifies it in its essential characteristics. For Vygotsky, the "zone of the proximal development" characterizes the social nature of *individual* learning. It designates the direction of development and describes the particular level of activity that an individual can only achieve in cooperation with adults. With the aid of Bateson's "learning levels" (1983, pp. 219-240; 362-399) Engeström relates the concept of the "zone of the proximal development" to learning and developing processes of groups and communities and thus makes these processes available to empirical investigation (Engeström 1987).

For Bateson „learning level III" encompasses a level of learning and development which is only rarely achieved by the *individual*. It necessitates calling into question the context, the prerequisites of one's own structure, and the premises of self-concept. Thus, the particular subject is exposed to changes involving a number of conflicts and, in this way, fulfills the conditions necessary for the formation of something new (1983, pp. 392ff.).

The motivation for putting oneself into a situation promoting insecurity, a situation that is threatening for the individual as well as for the collective subject, originates from the intensification of the contradictions which characterize the usual situation (Bateson 1983 pp. 390ff.). Now, there are various possibilities to evade these contradictions. Furthermore, contradictory situations do not at all necessarily bring about the development of something new. That type of development which does produce something new requires an intuitive or conscious control of the situation. For this to occur, a transgression of the individual level of action is of the utmost necessity: "Human development is a dialectic union of the individual and the social. It is real production of new social systems of action and not simply the appropriation of individually new actions perhaps combined with the individual production of original fragments of behavior'" (Engeström 1986, p. 166).

The cultural history school considers activity to be something produced by society in contrast to individual actions with their orientation to purposes (Leontjew 1982). Thus, the origin of a new social system of activity is to be considered as the decisive process in the subjective development of the subject. Here, the "zone of the proximal development" is something like the open dimension allowing for the formation of a new social system of activity: "We can now attempt a provisional re-formulation of the concept of the zone of the proximal development. It is the distance between the present daily actions of individuals and the historically new form of social activity, which can be collectively produced as the solution to potential double-bind situations in daily actions" (Engeström 1986, p. 166).

What follows from this discussion for our inquiry into the effects of the new universal device and the attempt of the individuals to appropriate this device socially - in the form of "conscious control of the situation"?

From our point of view, a perspective results that the societal appropriation of the computer as a universal device requires the construction of new social systems of activity. There is no such zone of the proximal development at the level of individual action.

The development of qualitatively new systems of activity can neither simply be derived from an extension of the everyday action of the individuals nor directly from a critique of the existing forms: "The zones of the collective level can be characterized as the distance between current everyday actions of the individuals and the historically new form of their social system of activity which can be produced collectively as a solution to the contradictions inherent in everyday actions" (Engeström/Cole 1991, p. 46). Thus, all the suggestions for solutions to the problem which assume that a change in the school system can be derived from the phenomena of altered educational action in daily life seem to be naive. The everyday actions of the

individuals are contradictory and little coherent. They do not indicate the direction the resolution of their contradictory nature could take.

One cannot invent new "social activities". Nor does it happen that they just occur to someone, and it is equally impossible to establish them in a normative manner, to postulate them or impose them by decree. They are quite literally worked out by society. They develop from the contradictions, oppositions, and conflicts within the cultural practices of a society. They are relevant to change in social relations which involves universal devices such as the written word or the computer.

We owe an informative suggestion to Karl Marx' theses on Feuerbach, a suggestion which was formulated in a more concrete manner in the later "Grundrissen": Change in social relations, as Marx states here, is always accompanied at first by a consciousness of dissolution and decline, of pessimism and an apocalyptic mood. According to Marx, this stems from the circumstance that the strangeness and independence of the inception of something new still exists in opposition to the individuals, even though they have actually created that which is new themselves:

"It is equally certain that the individuals can not subordinate themselves to their own social relations before they have created them. But it is absurd to consider that material relation as indigenous, as inseparable from and immanent to the nature of individuality (as opposed to reflected knowledge and will). It is their product, an historical product. It forms a part of a particular phase of their development. The strangeness and independence by which it seems to exist in opposition to them is only proof of the fact that they are still engaged in the creation of the conditions of their social life instead of having begun this life, using these conditions as a starting point." (Marx 1953, p. 79)

From this perspective one could say that at present the process of appropriation of the computer as a universal device is advancing in a more natural way, i.e., on the level of individual human action. The appropriation of the computer is geared toward a simple, naively technical use of the device and toward its often brutal implementation in daily life without any reflection upon its consequences and effects.

This implementation is accompanied by individual anxieties about the dissolution of traditional ways of life and the identity they guarantee. It is accompanied by a fear of the destruction of highly regarded elements of traditional culture and of the values associated with them. Former ways of life become fragile, contexts are changed, habits dissolved - all of this is experienced as a crisis and is reflected upon as a crisis.

The results of current research on the structural transformation of childhood, youth, and schooling in Germany and other countries seem to indicate a fundamental change in the way internal and external coherence of our society is produced in the first place (cf. Bracht/Fichtner 1993). On the whole, an image of many-facetted, differentiated, and somewhat diffuse actions within these realms of practice is depicted, and in the process distinctive contradictions become evident:

1. Parents, educators, and nursery school teachers are all presently engaged in intensive work on the autonomization of individuals as a conscious, reflective self-relationship of the individual, as the development of a conscious self-concept. However, a contradiction arises between this autonomization and pedagogization as an increasing structuration and control of youth's daily life with pedagogic intentions.

2. At the same time, the autonomization demonstrates the other side of the coin with its privatization and therapeutization in the sense of a concealment of systematic factors such as politics, society, and the external world.

3. It is accompanied by new dependencies such as alienation, mediatization and reification of human and social relationships. This is all contained within a social context that is characterized by sharp contradictions as, e.g., the individualization of life-styles combined, at the same time, with a social normalization, standardization, and conformism of behavior never before observed.

I consider these contradictions to be an indication of insecure, groping, searching actions in the course of everyday life on the part of individuals and social groups, actions directed

toward aligning oneself with some sort of "compulsory modernization". At the same time, it seems to me that exactly these contradictions also express something that reveals itself to be a process of the creation of something new.

If the assumption is correct that something new never originates organically or in continuation of, so to speak, as a prolongation of something old, but rather only as a result of a *dynamic, i.e., always contradictory movement that leads away from that which is already extant*, then one could inquire about the current processes in a totally different manner: Are they related to the social acquisition of new activities? Does this acquisition have a particular direction or perspective? If so, in what way is this relevant to developing the potential of our universal device? In the course of that process, how do the individuals express themselves as subjects who - to connect the inquiry with Marx' perspective - are engaged in becoming the proprietors of their social relations?

5. THE SOCIETAL APPROPRIATION OF THE UNIVERSAL MACHINE: A PERSPECTIVE

Cultural scientists, semioticians, and cognitive theorists all agree that man can only develop new possibilities for action with symbolic representations (media of presentation, language, writing, formal sign systems of any type). If symbolic representations or signs in the broadest sense are not simply considered to be psychological, internal realities, but, rather, primarily social realities which exist "between" persons, then they can be regarded as semiotic tools of the common social consciousness and of the social practice of these persons (cf. Vygotsky 1978). Then, the "historic self-modification of human activity", as Marx discusses it in his Feuerbach theses, can be pursued consciously only by means of the communicative and collective reflection of these "signs" as social patterns and structures of actions (cf. Raeithel 1992).

Where might there now be a perspective that, in its appropriation of the universal machine's potential, is directed toward developing new social activity systems? Suggestions for changing the educational and teaching practice at this or that point, for modifying one or the other aspect of schooling do not seem to contain such a perspective. I suspect that this perspective is contained in the potential of the new device itself.

Among the earliest developments of writing systems we find the erect inscription, which then leaned over to the slanted handwriting on the desktop and finally put itself into horizontal position in the letterpress. The computer has brought the characters back into vertical position. Users sit in front of "typeface", of which the characters and their image become more and more similar. Thus, the importance of seeing comes to the fore in a most significant way if one considers seeing to be not simply perception, but rather a "modelling conceptualization".

Arne Raithel has directed attention to the fact that computers render procedures, that is, something that is strictly formal, conceivable (1985). On their monitors the "universal machines" display moving views from formal worlds in process which in former times were only accessible as ideas to humans engaged in deliberating or discussing something. Computers are devices that objectify formal procedures and that allow one to situate oneself in reference to such procedures, to examine them, and to reflect upon them.

Accordingly, the computer requires a type of seeing that is more than purely sensual perception. It requires a type of seeing as a *modelling* conceptualization (cf. Judin 1978) or, as mathematicians or natural scientists express it, as the representation of something "qualitative" (e.g., with reference to chess: "seeing" a good constellation).

By means of this type of "*seeing*" as a modelling conceptualization, the computer can become an enormously important tool of theoretical reflection (as, for instance, in fractal geometry). By the same token, this type of "*seeing*" can allow the computer to become an instrument of a hitherto unknown expansion of the possibilities for the use of knowledge (as, for instance, in the area of computer simulation).

It appears to be a basic characteristic of any sort of human perception that its actualization has to do with something concretely real and at the same time imagined, and this in the sense of

the complementariness of, on the one hand, *taking and dealing with something directly, literally, rigidly, operatively* and, on the other hand, of *seeing something as something, taking and dealing with something metaphoricaly*.

I would like to conclude by formulating the thesis that with regard to the societal appropriation of the computer an astonishing topicality and actuality will be assigned to art, that in particular avant-garde art provides an arsenal that will become more and more important for the societal appropriation of the universal machine.

One can consider art history to be a history concerned with the presentation of the human ability to see something as something, of the possibilities of seeing as "modelling conceptualization", of seeing as "representation of the qualitative". Works of art are metaphors, concrete models, in which the competence to see something as something is crystallized. I call this competence a metaphorical one. We might say that in art and in works of art the metaphorical comes into its own.

However, this cannot be rendered comprehensible by means of a linguistic concept, but, rather, by means of an anthropological one like that developed by G. Bateson in his study 'Angels Fear. Toward an Epistemology of the Sacred' (1987). Metaphors are neither abnormal linguistic expressions to be understood in contrast to ordinary language, nor are they figurative meanings in contrast to literal ones. Nor are they illustrations, visualizations, or comparisons.

It is difficult to determine what metaphors are from a purely linguistic perspective because their linguistic form is only one possibility of their realization. Metaphors are not things, but, rather, systems of relationships.

A metaphor does not say: 'This is a tree' (a process of which the final result would be a concept). The metaphor says: 'The tree is a hero.' The metaphor says, 'A is B', which is not to be confused with 'A = B'. The metaphor says: 'This *is* that' and at the same time: 'This is *not* that'. It contends the validity of something and at the same time its invalidity. Gregory Bateson has very neatly worked out an explanation for this, maintaining that a pre-verbal logic is articulated in metaphorical competence - a logic of the type found in the grass metaphor: grass dies - humans die - humans are grass.

The logic of metaphors is amoral, non-temporal, and non-spatial.

We find the following metaphor in a novel by the Portuguese writer Saramago: „The moon, a silk sieve, strews a flour-like whiteness over the exhausted countryside".[6] This metaphor is neither a comparison nor an illustration, nor does it demonstrate a similarity between the moon and a silk sieve. Here, Saramago calls to mind a variety of associations connected with sieve, silk, and flour. Anyone who attempts to understand this metaphor constructs a new meaning for the moon, dependent upon his own concrete, individual context. Here, the moon is perceived, imagined, or experienced from a certain perspective.

With a metaphor, a phenomenon, a process, or some sphere is perceived and structured along the pattern exhibited by something else. The tension between these spheres is not eliminated, but, rather, put to productive use. Metaphors are strictly complementary; they cultivate oppositions such as those between coherence and difference, cognition and emotion, image and concept, object and subject. Metaphors organize an extensively effective perspective on reality in such a way that it is never dissolved into a direct referential relationship. The development of this perspective is a subject's achievement which is brought about by means of the momentary realization of subjectivity.

Metaphors are an expression of a fundamental human capability to make oneself, human experience, and the world in which people live understandable. This is achieved by producing relationships and contexts by means of metaphor in the first place. With metaphors, we construct imaginary conceptions as 'new images', as relationships between totally different spheres, phenomena, and processes. These relationships are of a systematic nature.

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[6] Cf. Saramago: Das steinerne Floß. Reinbek 1994, 344.

Metaphors are fundamental to the systematization of our experiences, but also to the alteration and restructuring of such a system. Metaphors can be highly innovative. The limits of a fixed experiential realm can be extended and a stereotype and automated relationship to reality can be broken down by means of metaphors. Metaphors do not alter reality, but they make its alteration possible.

Metaphors are like children. They affect their environment in a unique way. They are points of intersection, new relevant aspects of meaning that are oriented to the future.

From a metaphor-related perspective, works of art are specific models, more precisely, models of types of perception, of modes of vision or seeing. In this sense, every work of art is a metaphor: a work of art presents something and *at the same time* a mode, a type, of its perception. This seemingly simple observation actually involves rather complicated problems. From Cézanne to the present, modern avant-garde art has repeatedly treated these problems as its own major concerns and worked on their exploration.

Around the middle of the last century, the possibility of constructing an eye external to the human body was realized for the first time - a possibility that had been subject to various attempts at realization since the invention of the *camera obscura* (Leonardo) in the Renaissance. As far as the fine arts of the 19th century are concerned, photography initiated an incredible revolution. Suddenly, art was relieved of the task of reproducing the dominant culture - in whatever form this might be done - and transmitting it to succeeding generations. But what task can be assigned to the arts if photography is able to represent any situation, any power relationship, any significant moment that should be preserved for posterity much more quickly and precisely?

The reproducible technical images aim at a 'visual image of the world' that is mediated by 'visual machines' which induce two-dimensional linear vision. But human vision is more diverse, more complicated, and less settling than photography. Human vision is always vision of a complex, non-linear world, a vision that implies approximations. If it is free, it never fails to question, to compare, and to do many similar things. By no means does human vision imply a mechanical reflection of reality, but, rather, the problem of constructing reality.

This is exactly the problem that is a central theme of Cézanne's work.

He is concerned with the indivisibility of the objective and subjective dimensions of vision, with the indivisibility of the person who sees something and that which is seen. Such vision can never be passive; it is fundamentally a constructive act. Cézanne produces 'impossible pictures'. Similar to human vision, they contain numerous, simultaneously subjective and objective dimensions and perspectives. This implies much more than simply a formal aesthetic problem; it is an existential philosophical problem related to the cultural production of knowledge and, thus, to the historical and social development of mankind.

Practically every work that art historians have written on Cézanne contends that he was a genius. One could agree with this judgement, considering that he succeeded in breaking down the stereotype, canonized models of vision which are developed and established in any culture. In his own epoch, Cézanne's existence was only possible because he himself was an 'expression' of a society in a state of permanent change. His suggestions were accepted because the society had a need for them.

From Cézanne on, the fine arts demonstrate in all their various directions the possibilities of being abstract in a totally fundamental sense, of abstracting from reality and, *at the same time*, of being subjective. In 'Psychology of Art' (1925) Vygotsky describes this as a domain allowing for generalization, for a synthesis of knowledge about reality that, at the same time, offers the possibility to discuss and reflect upon one's own subjectivity.

At the beginning of the 20th century, the ways prepared by Cézanne very quickly became fixed clichés and trite formulas of such various 'isms' as expressionism, cubism, surrealism, and constructivism - especially when formal and technical problems were the sole considerations.

The work of M. Duchamp provides a response to this dilemma. Duchamp is confronted with a society that is in a particular situation: An industrial society is in the process of consolidating

itself into a capitalistic society which, for the first time, develops the structures of a consumer society with its double-bind mechanisms. This society has just experienced the shock of the First World War and is confronted with the October Revolution and its attempt to develop a new society and new men, as well as with totally contradictory social and intellectual trends.[7]

In the light of social changes which had never been known before in the entire history of mankind, this epoch forced the arts to reconsider their role in a fundamentally new way. How can art focus on a world so full of contradictions and how can this art refrain from simply providing new opportunities to ossify into stereotypes and formal clichés?

In 1912, Duchamp paints his last figurative picture, *Nude Descending a Staircaise*, and in doing so terminates his career as an artist. From now on, he is engaged in a battle against the hitherto prevailing concept of the artist and of the work of art as an object.

His work treats topics ironically, disrupts contexts, ridicules, considers, reflects upon and reacts to the problems of capitalistic society and its form of consumer society with its fetish of objective scientific knowledge as a seemingly solid basis - at the same time, though, a society that is deeply chaotic and torn apart with its false images and appeals, with its pretended securities.

For him, indifference with regard to social and political events is the only form that prevents his being formalized in some movement or becoming absorbed in some 'ism'. He calls himself - in analogy to the term anarchist - an 'an-artist' and he conceives of his works as a revolt against mechanisms and power structures of the art market, against the consecration and mystification of the artist and of the work of art as an object.

Duchamp returns to the crucial questions posed by Cézanne and transforms them. Cézanne treats his central theme of human vision as a diverse unity of the subjective and the objective by dismantling the traditional form of presentation and by clearing the way for new possibilities of materialising or representing ways of seeing. Duchamp destroys all the traditional genres of the fine arts from the picture to the sculpture and replaces them with *thought in the broadest sense as the basis of any representation of reality*, which for him is representation of society.

His works are no longer objects, but, rather, radical devices that allow reality as social reality to be reconsidered. His works demonstrate a world of images that poses questions or is itself to be interrogated. His 'multiples', 'ready-mades', and 'semi-ready-mades' activate the metaphorical dimensions of words, concepts, and of our subjective relationships to objects. The metaphorical basic structure of his work is no longer dependent upon prescribed hierarchic meanings of a certain culture. In a very intensive way his works become devices by means of which reality and the relationships between its phenomena and processes can be imbued anew with meaning.

In the onlooker he provokes curiosity and a metaphorical competence which enables one to treat each work as a metaphor in which something is seen and dealt with as something. At the same time, these devices provoke the onlooker - if he allows himself to be affected by them - to reflect upon himself.

In exemplary fashion Cézanne and Duchamp personify basic tendencies of modern art. A systematic characterization of such tendencies would seem to be in order before I return to the problem of the societal appropriation of the computer as a universal device.

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[7] Eric Hobsbawm has described these contradictions in his book "Age of Extremes. The Short Twentieth Century 1914 -1991" (1994). He begins his survey with the role played by the arts and concludes his assessment of the century with the death of the avant-garde.

Modern art is neither didactic nor pedagogic, nor is it technical. It is a way of thinking - thinking of something that has thus far gone unsaid. It is something that is at the bottom of what has so far been said. Above all, modern art is ambiguous; it doesn't provide any answers or simple formulas. It doesn't declare what it knows, and is nonetheless a form of knowledge.

Modern art shows us something which is not understandable at first glance. It becomes totally incomprehensible if, in the attempt to understand, we turn not to ourselves but to others, to the experts, the critics, and the art historians. Understanding something new always implies a qualitative change. Understanding something new implies understanding the future, a projection of the present and the past into a time that has not yet been experienced.

Modern art teaches us that works of art are no objects to be mystified or consecrated, but, rather, devices. But in contrast to all other devices developed by humans, these devices exhibit a special quality: *They mediate contexts and distance at the same time*. They are empirical, part of our concrete real world, and, **at the same time**, they are symbolic. They are of this world, yet, *at the same time*, they relate to us about this world. A work of art is fundamentally different from the reality to which it refers. At the same time, it is a comprehensive way of viewing this reality.

The avant-garde's excessive preoccupation with the forms of presentation teaches us that works of art are materializations of ways of seeing, i.e., that they have a metaphorical structure. This structure is to be found in the presentation or, more precisely, in the system of material forms of presentation.

With their materialization, ways of seeing, ways of perceiving provide possibilities to go beyond currently given conditions. But, *at the same time*, in every work of art something is taken literally as well as dealt with strictly, rigidly, and operatively. This is its mode of *presentation*, the system of its forms of presentation. The truth of a work of art does not consist in the content presented, but rather in the presentation. Primarily, a work of art is a formal, structural interrelationship; it is not a duplication of reality. Although it is a real object and thus a part of this reality, every work of art is, in principle, different from what we call reality.

The work of art represents a reality and with this presentation lets reality become something with which one is confronted. It is a highly astonishing device for creating a detached standpoint and at the same time establishing an interconnection to reality. It realizes this interrelationship as a model of a comprehensively effective way of seeing a reality. Thus, the work of art realizes interrelationship and detachment at once. In achieving this, the form, the system of forms, the mode of presentation occupies a key position. A work of art presents something and at the same time it demonstrates the way it presents something. This is exactly what is realized by its mode of presentation.

The greatness of a work of art might be seen in how successful it is in organizing and presenting its metaphor, its metaphorical structure. The metaphor is, as noted above, not to be localized within the content represented, but, rather, within the presentation itself.

Picasso considered his sculptures to be material metaphors. Instead of forming his figures from traditional materials such as clay or plaster of Paris, he made them primarily out of discarded junk like old vases, baskets, bicycle parts, and similar materials. By this means, his sculptures maintain a fascinating double orientation when, for example, instead of modelling the rib-cage of a goat out of clay, Picasso puts a wicker basket in place where the ribs would be. In that case, this *is* a wicker basket that is to be seen as a rib-cage, and the reverse is also true, if one examines the entire figure of the goat one can see its ribs as a wicker basket. Thus, we find here a metaphor going in two directions. If the ribs were formed of clay, then the vision of the observer would only be guided in one direction: one would see formed clay as the rib-cage of a goat (cf. Aldrich 1983, 144-5). Picasso described this situation in a very appropriate way as follows: "I retrace the path from the basket to the rib-cage, from the metaphor to reality. I make reality visible because I make use of a metaphor" (Gilot/Lake 1964).

My argument has now come full circle. In art, that sovereignty could be found that is required in dealing with the computer, that sovereignty which would make its specific potential accessible. For in art, in the unlimitable variety of its languages, there is that sort of autonomy and independence of the formal which the computer requires and which make it so useful.

Here, art is not being considered as a realm that increases our perception in an aestheticizing and formalistic manner, but, rather, as a unique synthesis of forms of knowledge. In art we learn something about the reality in which we live and at the same time it is a mirror in which we see our own image. Works of art are metaphors. I understand them as materialized 'modelling conceptualizations'. I find that sovereignty required by the computer in the ways by which these materializations are put into a form or into a system of forms of presentation.

Accordingly, the "zone of the proximal development" for working out those new social patterns and new forms of activity which correspond to the potential of that universal machine would be found in art. I do not believe that these new social activities can simply be postulated, prescribed, and then developed in an organized manner - for example, by means of new teaching methods for art instruction at public schools or new concepts of museum pedagogy.

New social activities develop - as noted above - from the contradictions and conflicts of the *cultural practices of a society*. My prognosis regarding the topicality and relevance of modern art for the process of a societal appropriation of the universal machine is aimed at regaining the computer's nature as a device and thus at our role as subjects of activity.

(Tranlated form German by Thomas LaPresti)

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