La tecnología digital y la mediación: un desafío a la teoría de la actividad[1*]

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Resumen
La tecnología digital tiene la capacidad de transformar la comunicación de las sociedades y ofrece nuevas posibilidades de conocimiento. Los sistemas digitales modernos deben entenderse como cualquier trabajo humano fundado en el conocimiento, una fuerza de producción nueva cuyo resultado son productos inteligentes que promueven organizaciones inteligentes. El fenómeno de la actividad social ayuda a explicar los cambios en la conciencia y fundamenta una teoría psicológica que unifica el comportamiento y la mente. El entorno social influye en la cognición por medio de sus instrumentos, esto es, de sus objetos culturales (como autos y máquinas) y su lenguaje e instituciones sociales (como iglesias y escuelas). El cambio cognoscitivo se logra al utilizar los instrumentos culturales en las interrelaciones sociales, de internalizarlas y transformarlas mentalmente. De este modo, las computadoras son sólo herramientas como muchas otras que han cambiado la actividad del ser humano. De ahí la importancia de hacer la diferencia entre herramienta y medio, ya que el concepto de comunicación sólo es atribuible al ser humano como parte de un sistema social y que utiliza herramientas como medios para transmitir un mensaje; de lo contrario, la tecnología sería un esfuerzo aislado.

Introduction

The Finnish scholar Yrjö Engeström, one of the best known theorists of present activity theory, wrote concerning mediation as a key: "It is somewhat amazing that in the recent theoretical discussion concerning the concept of activity, very little attention is paid to the idea of mediation" (2005, p. 28).

That is a correct perception, indeed, and therefore Engeström is also right naming the idea of mediation "the first prerequisite for any fruitful elaboration" when reflecting the importance of digital technology and its impact on the societal life as a whole. Even more important, however, is the emphasis, which characterizes the underlying theoretical understanding. Mediation is not only *a* key, as Engeström writes, but mediation is *the* key! However, Engeström speaks about Internet as an instrument or a means of mediation, but not as a medium which is by no means the same. The opposite of mediation is immediacy, and the meaning of mediation (in the sense of mediatedness) is to mark the middle or the centre between otherwise immediate things. A relation is immediate if there is no third factor, no means to mediate the two poles of the relation. However, mediating means are optional, the may function as such, but they do not necessarily belong to the relation they actually mediate. As opposed to that the concept of medium characterizes something necessary and indispensable (Schürmann, 2008

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and 2009). Water e.g. is the medium to all beings living in it. It is no mediating means, functioning as a centre between fishes, but their essential condition of life. In this sense of conditions of possibilities the Internet is primarily a medium –a leading medium, if we consider its integrating power against all other existing media– although sometimes it may also be reflected as a mediational means.

From this point of view it is clear –though still not yet obvious– that the global process of digitalizing and digitalized mediation of every aspect of human practice and activity is the hardest challenge activity theory has ever met.

At first let me emphasize that I do not intend to explain in great detail what terms like "digital technology" or "Web 2.0" or "New Media" exactly mean. Although I think that we probably have differences in practical competencies concerning them. I suppose that all of you know phenomena like facebook, youtube or other forms of social book marking, since dealing with new technical devices within teaching and learning in higher education is a special object of your investigation long since, as far as I know.

But I think it being absolutely necessary clarify what we are talking about, if we reflect on the difference between mediation and medium and the Vygotskyan or the activity theoretical approach to mediation in particular, leaving aside the differences between Vygotsky and Leontyev for the moment.

Therefore, first of all I'll start with some theoretical remarks on cultural-historical psychology and its model of mediation and try to analyse its structure and functioning. Secondly, I will turn to Leontyev and describe the different model of mediation in activity theory. (The difference between cultural historical psychology and activity theory is essential as we will see later on.) As a conclusion, I will focus on two theses, which I like to present to you as follows:

First: Neither cultural-historical psychology nor activity theory knows the concept of medium. They therefore are unable to solve the challenging task of conceiving the real societal importance of New Media or digital technology.

Second: Expanding the concept of medium by means of media theory and media history, and reflecting activity theory from a historian's perspective we can recognize digital technology as a medium of transformatory potential equal to the quality of book printing which revolutionary formed a global culture and lasted for centuries.

To experts in Vygotsky's theory it is supposedly sufficient to recall, that Vygotsky –at the beginning strictly adapting the terminology of behaviorism[2]– puts a third item into the scheme of stimulus-response, an auxiliary or "mediating stimulus", mediating between subject and object. This construction allowed him to hold on to the methodology of both physiology and behaviorism and at the same time to integrate it into his instrumental psychology. The third item still was a kind of stimulus, but a stimulus of its own, an artificial one, an instrument to mediate between humans and nature. Using "tools", originally invented to control other humans, now in order to control himself, man became aware of himself, and so freed from the determinism of nature.

This was the meaning of mediation in cultural-historical psychology. The intellectualization of behavior by mediation made a difference between "inferior" (or "natural", "rudimentary", "primitive" or "elementary") and "higher" ("artificial", "complex" or "instrumental") forms. The important factor of the difference is "its new, specific stimulus-response-relation": While the lower forms are "totally deter-

[2] All translations into English by the author.

mined" by immediate stimulation, the basic characteristics of higher forms consist of "self stimulation, that is in creating and using artificial mediational means and in controlling ones own behavior by those means". In the tide of social life man created the most complicated systems of psychic communication, "without which labor activity and the whole social life would be impossible." Among others, to Vygotsky the most adequate means for psychic self regulation are signs, language and scripture in particular. Signs are historical and societal both in origin and function. They evolve from the history of culture and served initially as "means of communication, means of influencing other humans" and later as "instruments of human activity": "These means of social communication therefore constitute the basis for the forming of those complex psychic relations, which emerge, when these functions come to be individual, that is the behavior of a person (Vygotskij, 2003, p. 330).

From this point of view, Vygotsky expresses his well known "genetical basic law of cultural development": "Every function in the child's cultural development appears twice: First, on the social level, and later, on the individual level; first, *between* people (*interpsychological*), and then inside the child (*intrapsychological*)" (1978, p. 57).

This is the origin of the concept of signs as mediating instruments, that is, as a solution of the problem of mediation in psychology, which Vygotsky himself called "instrumental psychology", and which was named "cultural-historical psychology" later on when the origin of those instruments ought to be emphasized.

But, considering Engeström's reception of Vygotsky's concept of mediational means and its transformation into "mediational artifacts" it should be added, that in 1930, Vygotsky certainly speaks of "psychic tools", but just one year later he used the concept of sign instead (and at a later date only the concept of meaning). He explicitly rejects the equality of tool and sign, and even criticizes the subsumption of tools (as a means of labor) and sign (as a means of communication) under the same concept of "artifact" (1992, p. 152):

> This is kind of unauthorized psychologization of phenomena, which certainly admit a psychological approach but actually do not belong to psychology as techniques for example. Their identification can only be explained by ignoring the different essence and the most varying historical role and nature of both forms of activity (1992, p. 152).

> Tools serve as medium for effects of man on objects of human activities. They are directed at the outside and aim at changes of the object. A tool is a means of the external activity turned towards the subjection of nature. Signs, however, do not change anything with the object of a psychic operation. A sign serves as medium for psychic effects on behavior –of others or of ones own–. It is a means of the internal activity, turned towards self control (1992, p. 154).

He sharply and explicitly criticized Claparède, Dewey, Wundt, and Ernst Kapp, a then well known German philosopher of techniques, for their literal use of e.g. "intellectual tools", "psychic tools" or "language as a tool of thinking" and so on. He solely agreed with a metaphorical use and emphasized: The basis of any analogy between tool and sign is their mediating function only (1992, pp. 152-153). Vygotsky's point is: tools and artifacts are no psychic phenomena at all!

What does that mean to our problem in question? It means that Vygotsky distinguishes between two forms of internal and external activity, and therefore consequently separates between two forms of mediational means –tools of the external or outer activity, and signs/symbols of the internal activity. In doing so he clearly insisted in his genuine psychological interest, that is, in psychic processes and their specific form of mediation. Referring to the analogy of signs and tools or inner and outer activity respectively, he intended to find an interface to dialectical and historical materialism.

But he sharply, even gruffly denied the simple-minded attempts of his ideological enemies to walk of with the problem by sheer deduction from dialectical or historical materialism or even by the economic categories of "Capital":

> The theory of dialectic materialism cannot possibly be applied directly to psychology no more than to history and sociology. […] Just as history is sociology in need of a mediating special theory of historical materialism, to show, of which particular importance to the respective groups of appearances the abstract laws of dialectic materialism are. For the same reason the up to now not yet existing but essential theory of a psychological materialism as a mediating science is required, which could explain, how the abstract guidelines of dialectic materialism have to be applied to a given section of appearances (Vygotskij, Bd. I, 2003, pp. 251-252).

Unfortunately Vygotsky was unable to realize this program of a meta-theory between historical materialism and psychology. Nevertheless, he seemingly speaks in words of modern media theory, when he depicts the effects of a leading medium on individual and social systems:

> The use of psychological instruments "changes the complete course as well as the entire structure of psychic functions" (2003, p. 310). "The use of mediational means […] restructures the total psychic operation through and through" (1992, p. 155). "Culture creates specific forms of behavior, modifies the activity of psychic functions, and builds new layers within the developing system of human conduct" (1992, pp. 60, 155).

But it is advised to carefully read and not misunderstand his rather vague use of notions like "instruments", "mediational means" and "culture". Taking into account the technological hierarchy of tool –machine–automat–computer, we soon become aware of the fact that Vygotsky mentions just tools, that only is the lowest level of that hierarchy. You will not even find the word "machine" within his writings, let alone automat or computer, digital technology respectively which he actually could not know. As for the epistemic hierarchy of data –information–knowledge– meaning we can realize that he refers to knowledge and meaning only, that is seemingly on higher levels of this hierarchy. But we may not ignore the fact that his understanding of knowledge and meaning actually meant language and scripture, that is, the semantic systems of the book printing society. He acknowledged only two: natural and artificial mediational means, exactly like we know from the myths of book culture. And equally like that he took scripture as the decisive divide, which separates one epoch of human mankind from the other, "namely barbarism and civilization"

(1992, p. 127): The missing contact with the Middle European "culture" of the book society is "primitive". As to the Middle Asia expedition of Lurija and its assessment by Vygotsky therefore Van der Veer/Valsiner write:

> They interpreted cultural differences in developmental terms and considered literacy and rational, abstract, scientific thinking as the highest achievements of human thinking. […] In the eyes of Vygotsky and Lurija the access to (western) culture allowed the Uzbek population to make "a leap of centuries" (Lurija) (Van der Veer/Valsiner, 1991, pp. 251-253; see also Van der Veer, 1996).

Also another and very important of the myths of the book culture mentioned above, I refer to the linear understanding of history, is typical to Vygotsky, as can be shown by a last example. Reflecting the issue of periodization of consciousness in his essay on "The socialistic transformation of man" (Vygotskij, in Varnitso, 1930, pp. 36-44), he quoted Trotsky (as he already did before) for his perception of "super man". Trotsky distinguished between "primitive man" and "modern type" which he conceived as a transition to the "forming of a new type of human" in communist society. According to Vygotsky the transformation will finally be realized by mastering not only psychic processes but all functions determined by human nature, and so finally by learning to consciously restructure even the "biological organization" of man into some kind of superman. The linearity of thinking is obvious. What changes are the form of behavior from direct to mediated, and the volume of the conscious behavior: from mastering the psychic to even mastering all physical processes. All this is an effect of mediational means, which, at all times, remains constant. Their form is irrelevant, only their function is important.

It is obvious that this theoretical framework is obliged to look at culture and printing as leading medium –although this is anticipation for the moment. Insofar we can describe this model of mediation as unhistorical in the end. Methodologically speaking it is unable to reflect its own historic dependence. At any rate, because of its dependency on the old leading medium, it can hardly serve as an adequate instrument to grasp the upcoming new leading medium, and to understand the full range of present systemic meaning of digital technology.

II

To Leontyev, however, the problem of mediation was still not solved sufficiently. He clearly followed Vygotsky, supposing that the mediatedness of human relations with the world marks the peculiarity of humans: "The development of human psyche has this mediatedness as its basis" (2005, p. 459). And he also accepted the mediating function of signs: "The sign mediates the consciousness, because the sign has meaning. *Sign is what matters*" (2005, 451).

On the other hand, he criticized Vygotsky –very early– because of his understanding signs/meaning being means of mediation which could not be questioned. Leontyevs argued: As far as the origin of signs/meanings cannot be explained, their emergence and function remains restricted to social, that is linguistical, communication, resulting in "*consciousness is a product of linguistic, actually of mental interaction*" (2005, p. 457), in other words: "The social mind [determines] the personal and the personal mind determines the social" (2005, p. 325).

That means, according to Leontyev, Vygotsky's solution of the problem of mediation ends in a circular reasoning like "classical French sociologism" (2005, p. 459): "Society effects on men and man effects on society" (2005, p. 325).[3]

To Leontyev, this conclusion was an affirmation that [American] *culturology* "relating to psychology, which could not be vindicated from the perspective of historical and philosophical materialism: [in that theory] the history of consciousness only joins the history of the social mind, not the material history of society", for "only those cultural-historical facts prove to be determinant" (2005, p. 459).[4]

Leontyev preferred an alternative solution. Instead of stalling with linguistical communication as the only mediating entity —and thus considering the word a "Demiurg"[5] of consciousness— he suggested to explore "what stands behind communication" (2005, p. 325). "Behind" the linguistical communication, however, now only stands the material activity itself.

Vygotsky's thesis, that consciousness is a product of the child's linguistical communication on condition of his activity in respect of its surrounding objective reality, has to be reversed then: The child's consciousness is a product of its human activity in relation to the objective reality, which takes place in condition of speech, of linguistical communication (2001, p. 304).[6]

His experiments in Char'kov yielded, that the appropriation of a meaning did not result from communication, but comes "originally from the child's external activity with material objects and in cooperative interaction" (1982, p. 138) Therefore, with Leontyev, the formula subject–activity–object replaced the formula subject–sign–object.

This resulted in the fact that the object now appeared twice: first, as an artifact and, later on, as a mediational means of activity. Hence the tool concept lost its Vygotskyan function, because:

- Human activity is object-oriented ever since "the term 'activity without object' is senseless" (1982, p. 85).
- The mediating object appears either as a tool, a goal or a motive of activity, according to the "status of structure within the system of an activity", of an operation, an action or an activity.[7] "Taken out of the system, they lose these characteristics" (1982, p. 108).
- The nature of tools "as a matter of course is not psychic" (1963, p. 18), in fact they are "a material artifact, in which just procedures and operations and precisely not actions, not goals crystallize" (1982, p. 106). That is true to all human tools, which are objectifications of operations, so as well "the words language, which comprise by their meaning the way of their use, and so finally the logical and mathematical laws and formulae" (1963, p. 18).
- Consciousness "is not the only existing, only possible, only imagina-

[3] See the in numerous texts identical formulations in Leontyev 2005, pp. 249, 257, 259, 331, 459.

[4] See Leontyev's criticism of the American culturology, 1982, pp. 79-80.

[5] Creator; see Leontyev 1982, p. 235; 2005, pp. 247, 276.

[6] Or in short: "Neither meaning, nor consciousness is the base of life, but *life is the base of consciousness*" (Leontyev, 1982, p. 98).

[7] "Only in the system of human activity the objects can obtain the quality of stimulus', goals and tools. Taken out of this system, they lose those properties" (Leontyev, 1982, p. 108).

> ble form of psychic reflection" (2005, p. 443). Every human activity is mediated by psychic reflection that is by internal activity, having the same structure as external activity. Therefore, "the activity, that is internal in its form, originating from external practical activity", cannot be separated from the latter, "but continues to preserve an essential, twofold connection with it" (1963, p. 18).

Tracing mediating reflection back to the material activity and genetically explaining reflection by activity itself, this point rendered superfluous the immediate internalization of the mediational means by communication, and thus avoided the intellectualization Leontyev saw in Vygotsky's work. But this caused a new form of immediacy between activity and consciousness. Leontyev solved this problem with the help of a strict historical analysis published in his famous book *Problems of the development of the psyche.* The central outcome of this book, with respect to our problem, is the difference between "reflection *within* activity" and "reflection *as* activity".

The animal's activity, that links it *in practice* with objective reality, of course is basic and predominant in this complex unity of reflection and activity; the psychic reflection is secondary and derivational" (1971, p. 131).

On the basis of this assumption, Leontyev formulated his own "basic law" of practical activity running ahead and reflection structure lagging behind:

> The evolution of animal's reflection of their environment […] as it were, lags behind the evolution of their activity. […] The development of the forms of psychic reflection is thus […] a step downward shifted in relation to the evolution of the structure of the animal's activity, so there is never a direct correspondence between them (1971, p. 157).

Leontyev consistently began to reframe all of Vygotsky's concepts from this point of view: Consciousness, the higher psychic functions, the genesis of speech, the emergence and mastering of scientific concepts, and learning.

He, of course, then met the same problem as that already pointed out in Vygotsky's case: the exigency of a philosophical foundation for his assumptions. In his posthumously published manuscript "Matters on consciousness" (2005, pp. 441-468). Leontyev explicated his understanding of Vygotsky's claim for a psychological materialism:

The philosophical issue of consciousness has to be distinguished from:

> A. The issue of societal consciousness and
> B. The issue of the consciousness of (societal) man.

The first is the subject of analysis of the historical sciences, of historical materialism. The second is the subject of psychology (2005, p. 443), and once more he repeats: "Consciousness belongs to the nature of man –to the real subject of consciousness".

Taken in its relationship to objective reality, it has to be reflected by philosophical science –epistemology, logic (query of truth); taken in its relationship to social life (considering the objective societal consequences), it has to be reflected

by sociology; taken in its relationship to the materializing life of men, it has to be reflected by psychology.

That means:

> The theory of consciousness is necessarily a subject of psychology, but by no means it does not and may not coincide with the theory of consciousness of Diamat or Histomat. To substitute psychology, that is concrete scientific assumptions on consciousness by epistemological assumptions or by assumptions of historical materialism is crassly erroneous (2005, p. 444).

But he held that psychology could only achieve its scientific assumptions *within the framework* of historical materialism, because it was the only way to give reasons for activity as an explanatory principle.

In reconstructing the genesis of consciousness, Leontyev resorted to speech and, in attempting to explain the emergence of speech, harked back on gesture and "kinetic speech". He treated both as independent media that are not identical with labor[8] and actually develop side by side in co evolution.[9] However, monism forced him to deny this idea and to subordinate gesture and speech to labor. Even though he occasionally conceded, that "the appearance of phonetic language was a revolution" (2005, pp. 475, 481), and that written speech "together with book printing" transformed into one of the most important, even "predominant forms of human speech" and thus into "a capacious creative power" (2005, p. 481), such appreciations remained accidental in the end. It does not imply, that Leontyev would have accepted either phonetic speech or printing like leading media in the sense of media history. Only indirectly he supports Giesecke's argument:

Modern book cultures tied 'intrinsic', 'true' information to human consciousness and gave to linguistic-conceptual knowledge a virtually absolutistic power on other, 'inferior' forms of information (Giesecke, 2002, p. 78).

Leontyev clearly focused on a "general psychology" (Leontyev, 2001) only, which had no need for a historical observation of itself. Therefore, in describing the real history of the psyche, he inevitably switched to the method of historical materialism. In other words, he switched to the identification of activity and labor. Obviously his discrimination between periods of historical structures of consciousness equals the well known periodization of societal labor: The phase of "primitive integrated" consciousness is still not yet separated into external and internal or practical and mental activity (manual and mental work). It is followed by the phase of "disintegrated", that is class consciousness (Leontyev, 2001), characterized by its alienation of personal sense and societal meaning. It is finally completed by the phase of "reintegration" with its "new relation between sense and meaning" and with "a new psychological structure of consciousness", caused by liberation of human labor through communist society. But, according to Leontyev, "class consciousness" is "*societal* consciousness" which is explicitly a subject of historical materialism, and *not* of psychology. The reception of Leontyev's work has ignored a central aspect yet: According to Leontyev, activity and labor are not identical, and even more: all categories of general psychology –activity, action; operation or motive, goal, condition or sense and meaning respectively– may not be combined, derived from or replaced

[8] See Leontyev, 2005, pp. 241f, 251f, 263, 283f.

[9] Speech, "which emerges together with the development of labour" (Leontyev, 2005, p. 267).

by the categories of historical materialism or even the concepts of political economy.

"Due to the existing relations between these sciences, which reflect the objective relations of their objects, such a substitution makes the psychology of consciousness not only lacking in substance, but would restricts the potentials for a further full development of the other sciences of consciousness …" (2005, pp. 444-445).

Nevertheless, since Yudin's essential and useful distinction between activity as an object and as a principle of explanation[10] it has been rather common to argue, that Leontyevs psychology and activity theory are one and the same. Actually that is by no means correct, and Yudin's distinction is very helpful in making that clear. Indeed, object of *psychology* is, according to Leontyev, activity. But that can only be legitimized in the framework of a *philosophy*, using activity as an explanatory principle. This is exactly Vygotsky's "psychological materialism" (2003, vol. I, p. 253) as philosophy or world view, as Leontyev expresses in an unmistakably clear way in his famous letter to Vygotsky:

> Today the developmental logic of the system of C[ultural] P[sychology] necessitates, to focus on the issue of the philosophical understanding of its basic concepts and principles (Divergence between the actual content of analysis and the level of elaboration of its philos[ophical] foundations, of its underlying world view…).
>
> This task […] cannot be coped with for the price of adapting the C[ultural] P[sychology] to the "standard", in other words, it may not mechanically be squeezed into this or that philos[ophical] context. –It is by itself a philosophical system (a psychological philosophy! –a world view!).[11]

In sum, Leontyev, too, stayed with the possibilities of mediation concept that is he did not get beyond the limits of the old leading medium. He remained —at least in his works before 1960— within the boundaries of the book printing medium.

On the other hand, beginning with the 60ies, when the Russian government forced the development of computer systems in order to enable the moon rocket flights, Leontyev was in charge of psychological research on problems of man-machine-relations. He then published various highly interesting articles which are rather unknown in the Western world. They can be considered as an approach to information technology. That is why it is worth to at least have a look on the consequences for the concept of mediation.[12]

In his first publications 1962, covering the psychological meaning of automatically controlled machines —by then the term "computer" was not common in the SU —Leontyev arrived at a conclusion, which was much more open-minded about digitalization than even the arguments of many contemporary scientists in the Western world. Above all, in his assessment of the psychological implication, he freed himself from most of the restrictions by the social theory of historical materialism, and focused exclusively on the psychological components of activity and the possibility of their technical modeling.

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[10] See Yudin, 1978, 1984, 2009 in German.

[11] Letter from 5. 2. 1932; Vygotsky, 2009, p. 270.

[12] Unfortunately those writings haven't been translated into English; so I will quote them from my German translation of the Russian texts.

According to Leontyev, tools are externalized operations. This understanding lends the tool a conceptual extension far beyond Vygotsky's idea. On the one hand, to Leontyev even "the most modern machines" —so his term to refer to 'computers'—are "just a technical means […] a method to realize the productive activity" or "'algorithmized' and 'automatized' actions". On the other hand he considered 'computers' to be "objectified *human functions*" (1963, p. 17). In operations, "only those interrelations of the action structure have been retained and fused, which replicate the objective relations of the objective conditions of their accomplishment" and therefore "as such can be uncoupled from man". Thus "the forming of operations, metaphorically speaking, equals the death of formerly inventive actions". In other words, such actions may in principle be modeled technically. So Leontyev did not balk at the then revolutionary consequence, which today still frightens many of his colleagues: "What today appears to human thinking as a not-to-be-formalized creative action, could tomorrow already be changed into an operation. Thus there are no limits to the development of always 'smarter' machines" (1963, p. 19).

Hence, according to Leontyev, all existing barriers for the technical modeling of actions are temporary. When he was asked to assess the limits of capability of computers, he always spoke of "at present *really existing* automatic machines", whose "actual success […] lies ahead" (1963, p. 7).

Surprisingly Leontyev had already in 1962 enunciated the idea that is customarily associated with Marshal McLuhan, namely, that man —by means of tools, "by which labor is carried out , generates in a way a new organ" which "he adds to the vital organs of his body" and thus overcomes "the 'biological idleness of his natural organs, powers and abilities" (1963, pp. 10-11). Very much like McLuhan in his comment on the socialization process of people by media, Leontyev wrote: "While learning to use tools man subordinates his motions to the societally evolved system of operations, which is materially ingrained in them. The tool changes the behavior of people, it builds new abilities in him" (1963, p. 11).

Then with reference to machines, including computers: "What machines contribute to human activity by their work, at the same time give rise to the emergence of new abilities of man –of new functional systems of his brain, which appear like the 'mobile physiological organs' (Ukhtomsky) of those abilities" (1963, p. 19).

Leontyev obviously supposed, that, with machines in general and computers in particular —seen as technically modeled human operations— quasi-human "organs" have been built and dislocated to the outside of the body —much as the brain today no longer serves the function of information storage to the extent that it used to, because we can relocate our memory in a computer. Although Leontyev, in 1962, viewed the state of affairs of the digitalization rather skeptically, he already anticipated the technical modeling even of brain functions, which today is available to anyone who has an internet account and adequate media skills. Software developments of Web 2.0, such as social book marking and socially interactive memory stores combine the memories of people, concerning a special class of objects, and make the combination available to everybody much like a collective brain. These are networks like flickr, splash, favr, del.icio.us, youtube, facebook, Gravatar or technorati, but also Amazon, Google and Ebay, whose products are much more than a sum of particular brains, and whose "collective results of thinking" cannot at all be noted by men, but automatically by machines, as

well as the results of "beta versions" or "open sources" concerning the collective improvement of software or the ranking of Google places.

Astonishingly, Leontyev did not see any implication for changing his general system of psychology: just abilities change, the system of consciousness remains the same. On the other hand —and although only in general and implicitly— his results characterize the basic dependence of consciousness as a totality of human potentialities on the actual social-historical system of human "tools". Even though the explicit concept of "medium" is still missing, Leontyev's approach provides us with an interesting and still useful interface with current media theory and media history respectively. However, the more digital technology continues strengthening and widening out interactivity as a principle of all Web 2.0 social services, the more our conventional understanding of technology as a mono-causal amplifier of intentional actions will become obsolete.

Conclusions

I

Refering to my first hypothesis let me resume my conclusions as follows. In spite of their differences, both Vygotsky and Leontyev limit themselves to speak about mediational means by neglecting to reflect on the medium that makes an object being a means. The reason is obvious: everything that is not mentioned doesn't need to be explained. Humans are air-breathing beings, but don't even realize it until the air is polluted. Even in big cities heavily polluted by smog, people first have to experience clear fresh air as a new form of the common medium to become aware of the difference. But only by getting under water —that means experiencing a completely different medium— they realize air as totally different. At the same time they understand that air is the leading medium to every land born being like water to every sea born animal. In terms of the same metaphor, we could argue that Vygotsky and Leontyev have never come under the water of digitalization as we have.

In the history of mankind, there are leading media as well. The most interesting ones, especially to human science, are communication media like language, scripture, and book printing. To claim them historical, means, they succeed each other. To say they are leading, means, they impact every other medium and build the decisive framework for all societal communication systems existing at a time. Therefore, media theory considers leading or predominant media in terms of societal formations or cultures, eras, epochs, or ages. Marshal McLuhan e.g. used the metaphor "the Gutenberg Galaxy", in order to characterize the book printing century as a long lasting era, which had been coined by book printing as leading medium. In the same way at present many scientists refer to digital technology as the new leading medium in order to characterize the drastic and comprehensive impact of digital technology on every existing communication system. They then use notions like Information Age, Connected Age (Anne Zelenka) or Digital Age (MIT). Others speak of Information Society (Giesecke), Media Society (Flusser), Network Society (Castells), Knowledge Society (Willke) or Meaning Society (Bolz).

Back to Vygotsky and Leontyev we first have to take note of the fact that Vygotsky lived at the end of the "Gutenberg galaxy". He was not able to even notice digital technology. Leontyev certainly lived in the years of emerging digitalization technology, but he couldn't anticipate the impact of computers nowadays. Up to

his death in 1979, people in general, and scholars in human sciences in particular, offered hard resistance to those inhuman and hostile robots. Therefore, we don't jump to conclusions about personal limitations when we state, that Vygotsky and Leontyev weren't able to reflect neither on digital technology nor on its revolutionary importance as a new leading medium of a new age.

But can we also come up with the statement that those historical and biographical restrictions are as well true to activity theory today?

One of the most interesting living scientist doing research in the tradition of Herbert Marshal McLuhan, Jack Goody, Erick A. Havelock, Walter Ong, André Leroi-Gourhan, Elizabeth Eisenstein or Jacques Derrida, is the media theorist and media historian Michael Giesecke.[13] To answer the question I have raised, I want to sum up the theoretical guidelines of Giesecke's voluminous historical research on media within 10 arguments pointing out the consequences for activity theory:

1. There is no information or communication between systems without a medium, may they be individual, social or cultural. Each new medium gives rise to a new epistemology, and this in turn leads to the discovery of new worlds. New world views emerge, that means, man's position in the world gets reformulated. Or as Postman puts it: "Each epistemology is the epistemology of a period within the development of media" (Postman, 1988, pp. 36/37).[14]

2. In reliance to the given leading medium, the perception of what could be a tool or a helpful instrument changes. Existence, form and function of tools and instruments, depend on the actually given medium and its information and communication systems, as well as the social rules of their application and use. There is no exception. If we take the notion of tools for example, we can see that it is based on linearity and causality, but not on interaction. In other words, actions don't give feedback; otherwise they are considered a failure. If the handle of a hammer breaks when using, the hammer is no good as a tool. Minimized feedback of a tool makes it a good tool. On the other hand, only by creating as many feedback options as possible, the interactive social networks become effective.

Every constellation of leading medium produces its own typical practices and products, activities and cooperation forms, its means, tools and devices as medium between man and environment. Symbolically generalized communication media emerge to steer the communication between individual or social systems like e.g. power, law, money, knowledge or networks. "Even the defining characteristics of what is human move and slip" (1988, p. 290).

3. The basic impact of media is on speech and thinking, feeling and knowledge, perception and cognition, esthetics, epistemology, social rules and ways of reflecting the world. This got the media historians to argue in terms of media formations history. With respect to book printing e.g., they call it rather unbelievable what obstacles and barriers have been put out of the way to push through the typographic communication system: All linguistic conditions were restructured completely, Latin lost its monopoly, new standardized national languages with specific oral and scriptural forms emerged, status and function of dialects within the hierarchy of languages changed fundamentally, age-old religious myths were replaced by quite new ones, social norms valid for thousands of years have been

[13] See Giesecke, 4/2006, 2/1998, 2002 and 2006.

[14] See also G. Bateson, 1981, pp. 245, 577ff. For more details see Giesecke, 2002, pp. 303-330.

smashed, the self image of the individual has been outlined through and through (Giesecke, 1991, p. 130). "New religiousness, enlightenment, democracy, and industrialization —everything has been given a push, accelerated and perfected by this medium. Each field of life has been made scriptural and is controlled by bookish knowledge" (Giesecke, 2002, p. 227).[15]

4. To make things absolutely clear Giesecke emphasizes that the privileging and accelerating of a new medium equally to digital technology in those days and today basically depend on the potential, viability, and power people expect of it in realizing their social utopia. In other words, a medium is a catalyst (McLuhan), not a cause. "In order to become a catalyst of social transformations a medium has to draw social attention and to attract social projections. The more total the demand of that projection is —it could also be said: their megalomania is— the more important the catalytic effects to societal transformation will be" (Giesecke, 1991, p. 156).

5. But there are always different competing technologies with different promises of sense and value, which force them to start a predatory competition by developing sense building processes, forming new semantic systems and ideologies. Because of the heavy cultural losses which unavoidably come together with a new medium cultures, the old media are forced to justify their self definition by glorifying their own aims and goals, and by making mysteries of their historical outcomes and achievements as if they were unchangeable characteristics of man and would mark the top of the development of mankind.

6. The failure of scrutinizing the mysteries and ideologies of the book printing culture has an adverse effect on the critical analysis and shaping of the potentialities of the new medium and of activity theory as well. Giesecke describes eleven myths and mystifications which build the specific tradition of book culture (Giesecke, 2002, pp. 223-257). I just want to mention those few which can clearly be found within activity theory as well:

- The myth of the rational linguistic information process: Logical thinking and reasoning are more important and valuable than emotional intelligence —what is important to activity theory as well.
- The myth of knowledge being a result of individual efforts. There is hardly a chance for Surowiecki's "Wisdom of crowds" (2004) in activity theory.
- The myth of learning being an individual process only. There is no place in activity theory for the concept of learning systems (even computer systems), learning organizations or learning cultures.
- The myth of the "true (or objective) reality" being the only possible. Thinking of reality in terms of communication is not the business of activity theory.

[15] To Giesecke that is effective even to production. Quoting McLuhan who called the invention of Gutenberg "the basic form of any further mechanization" and referring to other historians of technology who argue that the principle of Gutenberg's mould returns up to modern age in every machine, Giesecke concludes, that without the printing machine indefinitely producing identical perfectly fitting pieces neither the industrial mass production nor the market economy and its distribution mechanisms would have been possible (1991, pp. 80, 182; 2002, p. 225). Other than historical materialism he is convinced: "The typographical technology is the prototype of the production technology of the industrial era" (2002, p. 229).

- The myth of history being a steady linear process of accumulation of knowledge (2002, p. 252).
- The myth of the early cultures being "natural" and "direct", that is "non-mediated" and therefore minor, primitive or inferior, while books and reason are identified and privileged as "real" culture.

All these myths and mystifications are specific to book culture and its "imperialistic" (Giesecke) medium and cannot be found in any other earlier leading medium formation.

7. In every new medium formation —and that's true to the Digital Age as well— the sheer reproduction of the programs of a declining formation cannot, by no means, reproduce the achievements of the old medium, but is condemned to loose against the new challenges and potentials of the new medium.

8. In order to stand these challenges, we have to make those myths transparent, to understand their dependency and to grasp their historical necessity. That is the only way to get along with the challenges of transformation processes, concerning its characteristic of the concurrence of the in-concurrence of different leading media like e.g. book printing and Internet which both are still competing for their being privileged and generalized by our societies.

9. In order to identify those myths as implications of a certain leading medium, a scientific concept of medium is required. Neither tool nor sign or meaning are concepts adequate to identify and to distinguish different forms of cultures, societies or ages of a leading medium —or media formations so to speak. Likewise aren't they adequate instruments to grasp the revolutionary quality of the transformation processes of cultures and societies introduced by the change of leading media? The concept of medium —not of mediating instruments like tools, signs or meanings— provides us with the methodological means necessary to form the model, the stages und laws of transition between different leading media, which we urgently are in need of.

10. To understand the limitations and restrictions of activity theory concerning the problem of mediation it seems to be useful to notice, that —according to Yudin (Judin, 1978)— the century of activity as explanatory principle (in spite of all existing differences) moves within a closed "space of thinking", which is finally based on the same fundamental problem of mediation whose origin is historically far beyond the activity theory of the 20th century. This historical constellation fixed the margin for the perception of the evolution of media, which restricts the attempts of modern activity theory to clarify its dependence and to adapt its methodology.

Activity theory, in its basic structure, depends on book culture without noticing it, because of its loss of adequate concepts. Activity theory cannot escape its own theoretical limitations and methodological constraints. For now, during the ongoing transition processes, we are still forced to deal with the epistemological and communication theoretical structures of book culture because such an anachronism is rather unavoidable to the transition processes in all contemporary societies. But activity theory is urged to test its common grounds or interfaces with new emerging sciences seriously, like media history and media science. Activity Theory than has to check their specific potential in modeling the new forms of information processing and communication systems, if it aims to be still functioning in the future of the Digital Age.

II

As to my second hypothesis, I'd like to just outline three main thoughts concerning the new potentials of an activity theoretical oriented approach to digital technology. Let me start with a story.

It took place in 1485, about 30 years after Gutenberg had completed his famous invention and 49 years before Antonio Mendoza 1534 established the first printing machine in Mexico. Up to then, as you may remember, to hand copying of just one book took a monk's whole life, and together with those thousands of letters of indulgence being copied, it swallowed the church's money. So it was not surprising that the bishop of Regensburg ordered 500 copies of a missal, impressed by those incredible possibilities of saving time and money by the new printing technology. Just half a year later a loaded cart arrived with the whole number of books. The bishop was happy not only for the reasonable price, but also because of the quickness of the realization. But when looking at this enormous number of books, it made him wonder. He got suspicious, and after giving it some thought he called up a commission of clergymen and asked them to check all these 500 copies most thoroughly against the manuscript to see if they were really identical. After a long lasting and laborious work the commission came to the result: "As a wonder of God, it happened that in characters, capital and small letters, syllables, words, sentences, full stops, sections and all other things that are necessary the print of all copies in every respect goes together with the manuscript of our church. For this we praise God".

There are lots of similar reports in media history which can tell us much about the changing of perception and thinking, the losing of potentials of old and emerging potentials of new media.

Besides many other interesting aspects we learn from our story.

- It would totally be wrong to question the bishop's or his clergymen's intelligence. They were instead mentally unable to grasp the abstraction and generalization processes, which made the process of mechanical printing possible. I saw quite the same reaction with a cashier in Moscow who used her abacus first and put the result into her computer then. Similar problems we find depicted in Engeström's story of "the rise and fall of the Postal Buddy" (Engeström, 2005, p. 241ff).
- A medium is not the cause, but only the catalyst, which opens up new unknown options, but at the same time demands a totally new thinking and new learning. Just using it is definitely not enough.
- Thinking of the bishop's economic reasons, we may say: A new medium is relatively unspecific, that is, it may provide us with possibilities on quite different levels and in quite different areas.
- As for the handwriting consequences we see: A new medium frees from certain constraints, but couples with others.
- It socialized idioms, dialects, and scripture on one side and got socialized itself on the other side. The great demand for the new technology made Gutenberg reduce his more than 300 alphabetic letters at the beginning to only 25. And with the help of the new alphabet Luther formed the modern German language.

- The new medium started the process of democratization of the Holy Bible as central information storage by making it available to everybody, thus marking the turning point of predominant political structures.
- In times of transition we see old and new media in a fierce competition. It took about 400 years until it lead to consequences concerning school settings e.g.

I stop analyzing the example here and continue to focus on those three main thoughts I promised before, giving just a few arguments. These three thoughts deal with:

1. Mediation as a process of enlarging freedom (Vygotsky).
2. Transition of leading media as a special object of investigation.
3. Learning and learning institutions in times of transition.

1. Mediation as a process of enlarging freedom (Vygotsky)

You remember Vygotsky's idea of freedom by reflexivity: The use of signs or meaning as mediational means makes us independent from the immediate determination of objects, so free will and free decision become possible. With the help of media history we can reformulate this idea as a process of uncoupling from the constraints of an old medium and coupling with those of a new one resulting in a historical process of increased reflexivity and commitment after all.

With regard to digital technology this argument refers to "smart artifacts" or "smart environments". Because of their inherent digital technology they are perceived as "knowledge based" today. It's nothing but their knowledge based capability what makes them 'smart' enough to function as independent systems. Modern systems theorists propose to understand the becoming established of digital technology in rather every product and even in human labor itself as "knowledge foundation" and speak about "organized knowledge labor". This is a totally new production force whose results are "intelligent" products and "intelligent organizations", the latter being characterized by a self increasing recursiveness of usage and generation of knowledge, that is: they learn. Seemingly addressing activity theory in particular Willke writes: "Many people though still find it hard to envisage, what organizational knowledge could be anyway, that means knowledge, not being stored in the heads of humans but within the modes of operating of a social system" (Willke, 1998, p. 166).

Willke discovers forms of organizational or institutionalized knowledge in individually independent anonymous rule systems, which determine the operating mode of social systems like e.g. standard procedures, guidelines, codifying schemes, work process descriptions, prescription knowledge for defined situations, routines, traditions, codified project knowledge —in short, all characteristic features of the specific culture of an organization, including universities and schools. This does not mean the knowledge foundation of organizations emerging independently of persons at all, but solely of *specific* persons. It rather works like a "collective mind", and depends on whether it is based on self-referential mechanisms, which control the organizational emergence of knowledge and its processing — what is exactly distinguishing the communication systems of internet. Considering things like that assumes however, that psychology and activity theory as well cut

off their traditionally assignment and ascription of knowledge to the individual consciousness only.

Important is: All this marks a process of increasing free space for societal potentials of decision, creation and steering, and of a simultaneously increasing commitment to use them. Because of the growing digital mediation there is not only less dependency from old media but a growing force to consciously regulating our man-nature-relationship.

2. Transition of leading media as a special object of investigation

Comparing the various media transformations in history, we can notice that the transitions do not run off arbitrarily but proceed as a media historical law (McLuhan) in a series of steps or stages which can be described as dependency, counter dependency and autonomy. Although models like that are already well known from group dynamics or group therapeutically psychoanalysis, they become useful to explain the transition processes between communication systems of different leading media.[16]

At the *first* stage, every new medium adapts all traditional tasks from the older medium.[17] The aim is to find better solutions for the old problems than the ones offered by the former medium. Gutenberg e.g. did not intent to start a medium revolution but simply prettify the copies of the bible, to make it better, faster, cheaper. Exactly that's the principle of this first stage. And it is effective to the electrification and digitalization of all those processes of perceiving, counting, presenting and language storing, which are already highly socially standardized. It is true to machines executing logical operations by symbols we know from book culture like letters and numerals. The same for electronic versions of books and catalogues in CD-ROM, for all those word processing programs and even for all the software applications modeling professionalized and institutionalized actions of traditional social activities.

Therefore, all electronically stored information, which can be changed without problems in typographic products, still belongs to the typographic era. From this point of view we may say we are just starting the transition from dependency to counter dependency.

Talking about the *second* stage therefore means to speculate —widely— about the future. But if we look at the main principles of counter dependency: with the focus on the neglected areas, the weak points and shortcomings of the typographic medium and communication systems, we are able to notice interesting new aspects already emerging.

Book culture neglects e.g. (*ibid*., p. 260):

- Groups, teams, lateral world systems, world society and world public.
- Affect and intuition. Interactive networks, feedback processes or project organization, above all in terms of societal professionalization.
- Chaos and redundancy.

[16] I am highly obliged to the writings of M. Giesecke, especially to his book 2002.

[17] We may of course find differences in between this stage: 1. phase: an euphoric overrating and a conservative peniaphobia or fear of loosing values, lifestyles or customs; 2. phase: emerging new communication systems and a increasing decay of existing ones; 3. phase: socializing of the medium on the one hand and socializing of people and habits on the other hand.

- Functional ad hoc decisions.
- Control of agreeableness to environment and mankind.
- Dichotomies of gender, generations, cultures, classes.

Typographic communication neglects (*ibid*., p. 261):

> Other senses than vision.
> Body experience.
> Nonverbal expression.
> Affective and circular information processing.
> Immediate face to face communication.
> Synesthetic cooperation of different senses.
> Social self reflection.
> Cooperative knowledge production.
> Interactive group work.
> Self organizing information processing.
> Decentralized networking with immediate feedback.

To summarize: In the ongoing second stage of counter dependency the weak points of the old and the outcomes of the new medium evolve for public discussion. There is a growing interest for alternative solutions of still unanswered problems, and above all for interactive, circular and virtual modeling of social processes and man-nature-relations completely beyond linguistic information, visual perception, rational thinking, linguistic storage or form of presentation. Nobody knows the code of the new media yet. Only because of their counter dependency from those still most critical points to us, they will come to perform the third stage.

The *third* stage of autonomy lies even further ahead. We can only say that autonomy means a liberation of old dependencies proceeding social and cultural systems, their totally new and unknown information processing, and their free ad hoc selection of different –old or new, existing or emerging– media.

> As long as we just replace one technology by an other one –e.g. heavy industry by information technology– we follow the beaten tracks of modern progress: from coal stove to gas furnace and to voice controlled microwave, from Aeolian harps to flutes, to shellac discs and to CD-ROM, always looking for better solutions for old problems by new technologies. But really new thinking only will commence when we completely stop thinking that our visions could be realized by the pure exchange of technology or the mechanization of individual human achievements. We do not need dream machines any more. Our world is full of them, and we suffer by nightmares when brooding about their disposal (ibid., p. 297).

3. Learning and learning institutions in times of transition

I don't want to talk about those new types of learning like we all know from the extended internet discussion on e.g. e-learning, blended, informal, social, self regulated learning, contracts of learning, learning portfolios and so on and so forth. I will instead reflect on new forms of learning like e.g. learning machines, learning organizations, learning institutions, and learning social and cultural systems.

Although it would be interesting to talk about intelligent members of stupid organizations like universities I want to focus on the learning process of a certain social system dealing with digital technology and its societal introduction in particular, that is on the European Union's Commission for the improval of digital technology. There is seemingly no other social system in history which watched and controlled itself more thoroughly –on the basis of self created methods, expert systems, or political and financial means of facilitating the transition process which all had been mirrored and stored and can therefore be investigated easily. In doing so we may have a look on a social system reflecting its own learning process in a series of 6 developing visions which are of high methodological interest for the analysis of other learning organizations as well– like e.g. universities. These visions are:

• *Techno vision*. The idea is to facilitate the information society by fostering the information technology itself. So during 1994 and 2002 they decided to invest 18. 900 million dollars. It was sheer belief in technological determinism what made the experts so optimistic.

A modern project is

> … the One Laptop per Child (OLPC) project which started out with big dreams. Founded by Nicholas Negroponte of MIT's media lab, it promised a hundred dollar laptop that would be sold directly to Ministries of Education in huge lots. The laptop, they promised, was the new pencil. It was going to revolutionize education in the developing world. It didn't. […] It's not going to change the world, or even affect it all that much. One Laptop per Child got everyone thinking about the education in the developing world. It spawned the commercial laptops that are now out competing it. But that's all. The dream is over (Alanna Shaikh's blog, 9. September 2009).

• *Market vision*. While this belief came to nothing the commissioners in charge then shifted to the primacy of economy as Bangemann, the former head of the commission of the European Community, put it: "Our report urges the European union to put its faith into the market mechanisms as the motive power to carry us into the Information Age." Despite of the liberalization and deregulation of the telecommunication sector the economical turn up, the positive impact on labor market, and above all the expected acceptance of new media with the majority of the population held off.

• *Human* or *user vision*. So the experts changed once more. The point of this new vision was: "The development of the information society will effectively depend on its societal acceptance." The new goals: better instruction of people in using the new media in general, and in handling of ambivalences, paradoxes and contradictions in particular; earlier inclusion of people into the development of programs and infrastructures as well as into the processes of political decision; conceptualizing society as a learning society to organizing lifelong learning for everybody.

• *Network vision.* The principle is: New overall concepts for all areas in economy, politics, judiciaries, culture, education, health system and so on. To all those areas the new media incorporate totally new systems of possible forms of growth and development. Up to then it had been emphasized either that information, communica-

tion and social knowledge production appeared as an additional subsystem, or that information gets a new production force besides capital and labor. But there is no pure addition possible because it changes the overall system when new part systems appear in the network. But if we accept the functional equivalence of all subsystems, this will result in far reaching consequences for socio-political decisions. The new principle is: dialogue instead of pure representation. It is not enough to provide new electric cables and electronic access only. Equal to machines the technical networks have to be cultivated, that is, they have to be made part of the cultural system as a whole. In this sense the experts of the EU stress the fact that direct face to face communication is of highly increasing importance to information society what makes us reassess and revalue new services like facebook or twitter.

• *Mankind vision*. Its main principles are to finally overcome the limits of sheer sociotechnical visions in favor of the survival of mankind; preservation of the diversity of species; the management and protection of resources by sustainability as a principle. To quote one of the expert, F. J. Rademacher:

> If we consider mankind like a living creature and the structure of mankind as a body, then we witness at the moment an enormous step of evolution of mankind, recognizing this body in forming its nervous system so to speak. This process is going to change dramatically the way people organize themselves and will be of full impact not least on all political processes and central control mechanisms of our society (Giesecke, 2002, p. 363).

The quest for balance becomes a central category not only for investigation but for political discourses as well. Because any mechanization interrupts the dynamic equilibrium of a system, it has to be legitimized. But this is no more possible by referring to the techno vision. This vision is to legitimize itself.

• Culture vision. That is a cultural system of its own that learns with respect the needs and feedbacks of every other subsystem, including environment and nature, an ecological system to which dialogical learning is the mode of existence. This is clearly the vision of the third stage: autonomy. But it could and should be an orientation mark, a leading idea, a kind of overall value, or the most general sense horizon of the becoming world society to which digital technology can be the decisive medium. We learned from activity in particular that the cultural heredity transmission of acquired attributes is specifically human. The cultural vision tells us to not burden the following generations with our restricted achievements. We give them a broader freedom of action instead when our own actions stay reversible and the technologies applied by us support the reversibility and not fix it. In doing so we even make the unborn part of our culture.

My personal conclusion: Although all these visions function with ambivalence, paradox, contradictions, and backslides they can be ascertained as an ongoing trend of development. One of the chief causes of our problems with digital technology is the one-sided orientation for decades on sociology and psychology modeling communication concepts. Up to now there is a comprehensive theory missing –perhaps except activity theory– which would be able to model the coactions of man, society, market, technology and nature. But to tap its full potential, activity theory is to upgrade its methodology and to integrate at least the concepts of medium and systems.

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