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Psychology in Times of Smart Systems—Beyond Cyborgs and Intra-action

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Puns, Metaphors, and Allusions

In postmodern theorizing, the cyborg metaphor stands for the displacement of boundaries between humans and the 'nonorganic' and 'artificial' materiality. By advocating a symmetry of these matters, the cyborg is something more than a symbol. It is an attempt to taper the epistemic problem that also "the boundary between science fiction and social reality [would be] an optical illusion" (Haraway, 1985, p. 191). For Donna Haraway, the feminist luminary of postmodernism, the metaphor of the cyborg thus condenses (or "diffracts" as she later puts it)[1] the instability

[1]"Diffraction does not produce 'the same' displaced, as reflection and refraction do. Diffraction is a mapping of interference, not of replication, reflection, or reproduction. A diffraction pattern does not map where differences appear, but rather maps where the *effects* of differences appear" (Haraway, 1992, p. 300).

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K. C. O'Doherty et al. (eds.), *Psychological Studies of Science and Technology*, Palgrave Studies in the Theory and History of Psychology,
https://doi.org/10.1007/978-3-030-25308-0_14

in all current forms of life as "a struggle over life and death" (ibid.). Allusions to the 'to-be-or-not-to-be' question indicate the scope of intervention.

In more rational words, Haraway wants scientists to recognize themselves not only as observers, as neutral witnesses, so to speak, but simultaneously as actors related to the world and responsible for it. Her way of speaking literally is not just a cryptic pun or a wink (e.g.: "Unlike the hopes of Frankenstein's monster, the cyborg does not expect its father to save it", Haraway, 1985, p. 192). It is deliberately tongue-in-cheek, playing with the subject matter. Allusions to the Hamlet-drama, like the ambiguous comment that "there was always the specter of the ghost in the machine" (Haraway, 1985, p. 193), indicate that Haraway tries to create "a condensed image of both imagination and material reality", and to find "pleasure in the confusion of boundaries and for responsibility in their construction" (Haraway, 1985, p. 191). She uses this pleasure to tackle the 'normal', 'clean' ways of reporting, perceiving, and investigating empirically. To reflect an object of study theoretically should thus become a question of responsibility and self-entanglement.

While recognizing and keeping up this aim, this kind of critical thinking shall be put to a test. By simultaneously clarifying its theorems and methods, the underlying methodology is applied to today's contradictions in the field of *learning* into which more and more technologies are inscribed. The feminist techno-scientific critique cannot be reduced to the work of Haraway, therefore more recent continuations by Karen Barad are also considered.

Tackling the Realist Epistemic Belief

In her continuations of this feminist approach, Karen Barad elaborates further on Haraway's idea to see boundaries as ultimately "lived relations of domination" (Haraway 1985, p. 194). To do so, Barad (2007, p. 42) accentuates "semiotic and deconstructivist positions". She also takes sides with praxeology, in that "knowing does not come from standing at a distance and representing but rather from *a direct engagement with the world*" (p. 49). Like Haraway's cyborg metaphor,

Barad thus emphasizes the transformative forces that come from *within* socio-technological relations rather than from outside. She coins this 'within' "intra-action". She draws attention to the cyborg-like penetration of humans and artificial entities where matters "intra-act" and ontological distinctions become iridescent. Her argument regarding this "intra-action" is developed as follows.

Barad takes the historical development of scientific disciplines, including laboratory research, as given. She argues that laboratory research works with "a rigid apparatus with fixed parts" and thus creates a certain meaning for the "notion of 'position'" (Barad, 2003, p. 814). For this reason, she concludes that "any measurement of 'position' using this apparatus cannot be attributed to some abstract, independently existing 'object', but rather is a property of the *phenomenon*" as a whole. This implies changes in the notion of a phenomenon. Barad assumes a "causal relationship between the apparatus of bodily production and the phenomena produced" (Barad, 2003, p. 814). This relationship would be "one of 'agential intra-action'" (Barad, 2003, p. 814). Intra-action expands the notion of a phenomenon to be inherent to the apparatus (as a technologically controlled and designed practice), because it is both the carrier of causality (experimental reactions) and of the particular appearance (experimental results). There is no 'outside' where the observer could stand and thus not a neutral-witness-position to occupy. Concomitantly, Barad makes a certain epistemic belief a subject of discussion: The realist belief which implies, among others, that the epistemic subject exists independently from the object and, vice versa, that the object 'out there' is recognizable by the subject, because the disturbing insight from quantum physics, the Heisenberg uncertainty principle,[2] displays "material exclusion of 'position' and 'momentum' arrangements" or, in more common language, questions the

[2]Heisenberg reflected on the inexactness of measurements in physics. The disturbance of an electron by a photon would be necessary for measuring the electron's movement, but at the same time the photon adds energy to the system the electron is part of. Therefore, an observation without changing the object to be observed would be impossible. This is what is meant by 'the Heisenberg uncertainty principle'. Simultaneously, it reflects the impossibility of measuring precisely both the position of the electron and its movement.

"epistemological inseparability of 'observer' and 'observed'": in Barad's own words, it problematizes *"the ontological inseparability of agentially intra-acting 'components'"* (Barad, 2003, p. 815).

Barad is not the first to recognize epistemic beliefs as an unconscious influence in the development of science. A predecessor of this thesis is Gaston Bachelard who investigated the realist belief as one of numerous "epistemic obstacles" (Bachelard, 2006). Barad (2011, p. 451) does not deal with epistemic obstacles but is rather interested in "why and how matters of science […] are always already intra-actively entangled with questions of politics and power". This would ultimately lead to the core question: "Who and what gets excluded matters" (Barad, 2011, p. 451).

Thus, Several Questions Emerge

1. In what ways are *intra*-actions different from *inter*-actions and how do they bring new insights to the fore?
2. Is it justified to reinterpret the *epistemological* inseparability of observer and observed as an *ontological* rather than an apparatus-related inseparability?
3. In what ways is playing with an assumed symmetry of matter, especially of technological and human matter reasonable, and how does it lead to a radical critique with regard to societal life and action?
4. In what ways can we articulate issues of responsibility and exclusion in a more adequate and more substantial way?
5. How cogent is the feminist techno-scientific critique to solve the epistemological issues addressed?

With these questions, I put Barad's attempt to develop a new epistemic foundation at a distance. I am doubtful about the assumed immanence of societal problems of exclusion and domination within the epistemological problems raised in quantum physics. At first sight, Barad's argument seems to invoke a radical critique of empirical research. However, this argument stirs uneasiness about the usefulness of seeing the field of quantum physics (similar to Haraway's cyborg) not merely as a metaphor or an analogy for a thought-provoking epistemic problematic, but

as immediately political. In addition, Barad's critique of the immanent epistemic position is presented as a general issue concerning *all* scientific research, whilst her argumentation refers to the realist belief of empiricism and positivism (which sees the representations and the entities to be represented as distinct and independent, Barad, 2003, p. 804). Thus, she ignores other paradigms, for example the dialectical one beginning with Marx's theses on Feuerbach. This is strange because both Barad and Haraway stand on the shoulders of Marxian thought. In what follows, I scrutinize whether Barad's entire argument is ultimately a short circuit, because it neglects the societal mediations that maybe justify why the findings of quantum physics reveal something about power relations in material societal life (cf. Langemeyer, 2017b).

To explain my doubts further: Like Haraway, Barad aims at understanding the workings of power. I agree with both, and especially with Barad, that we must pay attention to the unity of knowing and intervening (*Einheit von Erkennen und Verändern*). This becomes clear when she highlights that "the nature of power" lies in "the fullness of its materiality" (Barad, 2003, p. 810), in particular, in the "apparatuses [which, I.L.] are dynamic (re)configurings of the world, specific agential practices/intra-actions/performances through which specific exclusionary boundaries are enacted" (Barad, 2003, p. 816). To strengthen this argument, Barad reinterprets processes of signification by which phenomena become noumena: According to her, "meaning" would not be "ideational but rather specific material (re)configurings of the world" (Barad, 2003, pp. 818–819). However, this means that language as a practice recedes into the background and becomes a subordinate dimension of allegedly nonsymbolic material or, more specifically, technological (re) configurations of the world. This seems to exaggerate the theoretical intervention compared to Marx's plea to see the object of research as subjective practice to which significations belong. His first thesis on Feuerbach (Marx, 1947) accentuates subjectivity as concrete-sensual activity, knowing that subjective practice is not devoid of cognitive activity (not pure manual labor, so to speak) nor is cognition a simple effect of material practice. Otherwise, one should remember, puns, metaphors and allusions would be impossible.

Concerning the inseparability of observer and observed on the one hand, and the question of power as organized through an apparatus on the other, Barad draws on two arguments that somehow merge into one. The apparatus with its "intra-actions" and its epistemic power relations becomes the superior subject. Thus, she construes an immanence relation.

My way of questioning Barad's concept of materiality is motivated against the background of a critical appreciation of arguments presented by Louis Althusser, and later Michel Foucault, in structuralist French philosophy. In the early 1960s, when Althusser was interested in Bertolt Brecht's theater, he rejected the traditional notion of consciousness as something purely ideational and began to outline an analysis of power along the material practices of the 'apparatus' (cf. French also: *dispositif*), a concept he borrowed from Gaston Bachelard (Althusser, 1962, 2014). In more recent publications, Barad continues to work on the same issues as Althusser, such as the difference between homogeneous and historical time (Althusser, 2006). It is therefore astonishing not to find any reference to his work in this context (cf. Barad, 2017), while reference to Foucault's argument for structural immanence is made (Barad, 2007, p. 229; cf. pp. 199–204). Both Althusserian and Foucaultian analyses of power relations raised awareness of the lack of neutrality or impartiality of the scientific observer and the consequent missing distance for reflection. While this insight can be read as a general request for more critical reflection on power relations in science, in order to gain or regain relatively more distance from the apparatus, with Barad, this possibility recedes into the background. She neglects to discuss the ways in which societal subjects can enhance and expand the necessary conditions for themselves in order to regain a form of distance as practical and cognitive independence (including political independence)—shortfalls that she probably inherits from Althusser and Foucault.

Against these shortfalls, I draw on the work of Vygotsky, who is clearer about the necessity to develop scientificated societal relations as cognitive and practical empowerments.

Rediscovering Vygotsky

Through Vygotsky's psychological approach, it is possible to discover that the problems addressed in the previous sections are not entirely new and have already been subject to considerable theoretical developments (for similar theoretical developments with Bertolt Brecht and Kurt Lewin, cf. Langemeyer, 2017b). Beyond realism, beyond inert ontological entities and self-reliant subjects and objects, Vygotsky has demonstrated the productivity of dialectical theorizing. The main features can be outlined as follows:

> Methodologically, a phenomenon should be studied in its most developed form by reconstructing how it emerges through previous forms (historico-genetic perspective), which is why the phenomenon should also be investigated in the process of its change (perspective on dynamics, mediations and transformations); the phenomenon of a developed form is then conceived of as a whole instead of isolated parts or elements, and the method applied needs to preserve the inner relations between the parts of a whole (holistic perspective); thus, the complexity of the objects of investigation is not reduced and the representations of these objects (theorems, concepts, or models) do not tend to feed false abstractions (structuralist, integral, or organic perspective); but since no method provides a guarantee for truth, it is necessary to reflect the process of theorizing and to determine the (historical) limits of scientific concepts, insights and generalizations (self-critical perspective) (cf. Langemeyer & Roth, 2006, p. 27).

This description is not meant to fixate the essence of dialectics; quite the contrary, it should help to recognize that dialectical thinking works by dissolving reified or reifying modes of thinking and transforming them into intellectual engagements with a changing world. These engagements are envisioned with emancipatory practice.

To explain the advantage of Vygotskian thought more concretely in relation to psychology: Vygotsky assumed that the human ontogenesis encompasses two lines of development which constantly interact so that neither one can be investigated immediately and isolated from the other. One would refer to the biological aspects of development,

the other to the sociocultural aspects. Causal relationships could therefore not be referred to unidirectional impacts from one line onto the other. Thus, the permanent interaction of two lines of development means that the child growing up does not undergo a metamorphosis from a natural or biological to a societal being: it is always already both. Against this backdrop, a concrete observation of 'biological' and 'societal development' was rejected by Vygotsky. It therefore became possible only to refer to 'nature' or 'society' in an analytical and historical way. Similarly to the sociobiological development, Vygotsky also assumed interactions between the individual and the collective level in human development, which is why he clearly rejected methodological individualism (where everything emerges from the individual level and must be studied from the allegedly simple individual forms to the complex societal forms), and structural determinism (where individuals are merely an effect of societal structures). In contradistinction, Vygotsky defined as a law of psychic development, that "every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level" (Vygotsky, 1978, p. 57). This contributed to his methodological insight that studying the genesis of higher psychic functions can be accomplished properly only by investigating them "first as a collective form of behavior, as an inter-psychological function" and then "as an intra-psychological function, as a certain way of behaving" (Vygotsky, 1997, p. 95). Furthermore, the analysis by Vygotsky proceeds with reconstructions as to how the interiorized forms of action, as psychic means, contribute to forming more advanced psychic functions. The child's change in experiencing (and behavior) when he/she learns to think with scientific concepts rather than spontaneous or everyday concepts is a good example (Vygotsky, 1987).

Vygotsky therefore saw a problem in epistemic beliefs, virulent now as then, that empirical investigations of isolated phenomena would suffice, and that concepts, without peril and ambiguity, would serve to capture their truth. Against these beliefs, his understanding was that effective psychological research would require theoretical reflection and therefore a methodology of an "indirect" way, which implies that observation in the traditional sense of the realist position is impossible, and

that the mediation that theories organize should be methodologically controlled. It is for this reason that, drawing on Marx, he argued:

> After all, if concepts, as tools, were set aside for particular facts of experience in advance, all science would be superfluous; then a thousand administrator-registrators or statistician-counters could note down the universe on cards, graphs, columns. Scientific knowledge differs from the registration of a fact in that it selects the concept needed, i.e., it analyzes both fact and concept. (Vygotsky, 1997, p. 251)

Vygotsky's approach thus became recognized as a new and original epistemology of psychology (cf. Friedrich, 2012). Like Haraway later, he worked with the insight that the researcher's subjectivity is always already a product of human activity and its societal contexts. This similarity is not a surprise, as already mentioned: both Haraway and Vygotsky were building on Marx's first thesis on Feuerbach. This clarifies their commonalities with regard to the epistemic argument that the researcher's subjectivity does not 'witness modestly' objectivity (cf. Haraway & Goodeve, 2018), but that it is always already entangled with the same matter as psychological research: the origins and the modes of conscious behavior. But differently from immanence philosophy, Vygotsky saw scientific consciousness raised only along with critical work on concepts, i.e., with the struggle for cognitive independence to deliberately investigate things anew from another perspective, and not to reify the products of a critical engagement with practice (Vygotsky, 1997, p. 251).

Cultural-historical development as a subject matter (how people produce their lives, how they find meaning in it etc.) is—similarly to psychological development—not seen as something immediately observable and requires dialectical theorizing. It is mainly for this insight that Vygotsky must be seen as a Marxian scholar (cf. Ratner & Silva, 2017; Sève, 2018; Stetsenko, 2016, p. 183). The history of scientific concepts and ways of doing science do not exist independently from other practices in societal life, which implies that they do not exist independently from biological and other material processes either (Schraube, 2009). To avoid false ontological divisions, separations and

dissections which distort the subject matter into unrecognizable parts, Vygotsky elaborated on holistic methodological considerations to find adequate "units of analysis" which "[make] it possible to see the relationship between the individual's needs or inclinations and his thinking" or "the relationship that links his thoughts to the dynamics of behavior, to the concrete activity of the personality" (Vygotsky, 1987, pp. 50–51).

Against the naïve expectation of a positivistic realism, Vygotsky's approach conveyed that truth would not be immediately available through techniques (or scientific methods) of observation and so accessible merely by fixations of the research object. He forged the wisdom for a dialectical methodology that "it is only in movement that a body shows what it is" (Vygotsky, 1978, p. 65). But unlike Barad, Vygotsky suggested taking the dialectical interaction between the special sciences and the general as essential:

> […] we can give no absolute definition of the concept of a general science […,] it can only be defined relative to the special science. From the latter it is distinguished not by its object, nor by the method, goal, or result of the investigation. But for a number of special sciences which study related realms of reality from a single viewpoint it accomplishes the same work and by the same method and with the same goal as each of these sciences accomplish for their own material. (Vygotsky, 1997, p. 249)

The perspective of the "special science" thus captures what feminist philosophers like Haraway find in 'situated' knowledge and subjectivity: It includes a concrete researcher subject and a concrete research object, located in concrete practice and in a particular arrangement of scientific investigation. Its result is concrete (not abstract) experience, fueled (more or less) by the materiality of societal contradictions and conflicts. But since reflection uses generalized meaning, and generalizations can be trapped in illusions or blurred imaginations, general science comes into play. "General science" is any self-critical philosophical engagement with the particular discipline in which researchers develop their thoughts and insights. As Vygotsky clarifies, this way of doing science as general science is still dependent on the same objects, methods, and

experiences. However, it does not assume that researchers' consciousness remains an immanent effect of material relations:

> We have seen that no science confines itself to the simple accumulation of material, but rather that it subjects this material to diverse and prolonged processing, that it groups and generalizes the material, creates a theory and hypotheses which help to get a wider perspective on reality than the one which follows from the various uncoordinated facts. […] When the material is carried to the highest degree of generalization possible in that science, further generalization is possible only beyond the boundaries of the given science and by comparing it with the material of a number of adjacent sciences. This is what the general science does. (Vygotsky, 1997, p. 249)

The relative distance from research objects that scientific research needs is thus neither given nor can it be assumed to be stable like an ontological fact. Distance from the object of study is achieved by moving between special and general sciences and by reflecting the different experiences each science enables. Turning to general science is not an end in itself, but is necessary when false abstractions take the lead.

Returning to the five questions, some answers may be given now:

The assumption that intra-actions bring more or better insights than interactions is only striking when we know the apparatus which frames intra-actions. We need to make the apparatus (like the particular laboratory research design or, more generally, the political regime in which we live) an object of study in order to understand how it produces intra-actions from within. Researchers must expand their questioning and scrutiny from the original concrete object of study to concrete research practice, its materiality, its representations, and its power relations. With Vygotsky, they need to shift the unit of analysis from the single positivistic objects of study to the apparatus of experiments, observations etc. I assume that Barad and Haraway agree largely with this conclusion.

However, I object to Barad's program that without deeper knowledge of the apparatus, intra-actions are not differently intelligible than interactions. That means that the problem of locating the object of research at a distance to observe it is only postponed: Research would

have to start with the apparatus. But then the problem is to grasp the complex apparatus. Its scientific observation is not easier than the investigation of the phenomenon it produces. The alternative I suggest as a Vygotskian scholar is to strengthen the self-critical relation of the researcher toward her/his own concepts and the generalizations used. To give an example:

Barad construes responsibility in relation to concrete materiality when she speaks about "material reconfigurations of spacetimemattering" (Barad, 2017, p. 63). These reconfigurations are seen as caused by radioactivity after nuclear bombs had destroyed Hiroshima and Nagasaki, for instance, and had contaminated the soil. To underline its agential role as a causer of diseases, radioactivity appears grammatically as a subject-like human entity while the human societal actors fall out of sight. This interpretation becomes excessive when radioactivity also seems to do the epistemic work of reworking notions and calculations (Barad, 2017, p. 63). In line with this rhetoric, Barad considers objects of study in physics as responsible for colonialist worldviews and endeavors:

> The void occupied a central place in Newton's natural philosophy. […] The void, in classical physics, is *that which literally doesn't matter*. It is merely that which frames what is absolute. While the so-called voyages of discovery, bringing data (including astronomical and tidal changes) culled from European journeys to non-European sites aided Newton in his efforts to develop a natural philosophy that united heaven and earth, Newtonian physics helped consolidate and give scientific credence to colonialist endeavors to make claims on lands that were said to be de-void of persons in possession of culture and reason. (Barad, 2017, p. 77)

While I do not question the primary concern of Barad's critique (the need for awareness of injustice and responsibility), I see her argumentation here lacking a dialectical turn—it is stuck in a rather unhistorical reflection of materiality: Are the objects of physics (like radioactivity, matter, the void etc.) really imposing their ways of 'mattering' onto the understanding of philosophers so that their interpretations could serve the imperialist regimes of Europe as a legitimization for compulsory

acquisition of land, or: Isn't it more convincing to say that Newton's philosophy and physics is implicitly influenced by colonialism, his own time and context, when he theorized the relation between matter and void?

With regard to the remaining three questions concerning the layout of a radical critique, detailed answers are not yet clear. As mentioned above, I am doubtful that the assumed equivalence or symmetry of human subjects and nonhuman objects would revolutionize the point of departure for a radical critique, hence the question of responsibility tends to be leveled out. Symmetry is not an adequate notion of the human–world relation to clarify that human beings depend in their development and well-being on the care of others, on participating in societal practices, foresight, security and freedom, whilst the world 'out there', especially the diversity of species, could probably exist more easily if they were unaffected by humankind. It is not physics, but *societal* practices (including sciences) that reconfigure matter and thus the conditions of individual lives, which means that a number of mediating instances need to be taken into account. Although playing with the assumed symmetry is supposed to reveal, among others, problems of colonialism and injustice as they occur in situ, the effect on critical thought might be altogether rather contrary to this. Therefore, these problems shall be subject to discussion in the next sections.

Human or Artificial Intelligence?

Similarly to Vygotsky, Barad's feminist techno-scientific approach tries to open up "deeper understanding of the ontological dimensions of scientific practice" (Barad, 2007, p. 42). In what follows, I put these approaches to a test: In what ways do they improve practices of doing science when one starts questioning whether, for example, human "intelligence" is essentially human, or no longer exclusive to human brains? For Haraway and Barad, the crucial point of supporting their view of cyborgs as well as intra-actions of an apparatus as the central matters of theorizing, or not, is whether this contributes to a better articulation of the question of responsibility in social practice and of

coming to a better understanding of what that means in terms of social justice.

Undeniably, the ontological misunderstanding of the exclusiveness of human skills is boosted nowadays not only by puns: When companies sell their products as 'intelligent' systems, as 'smart' tools, and the like, they create meaning that blurs the ontological distinction between technology and human intelligence. From a psychological point of view, the fundamental question is however, whether concepts like cognition, awareness, perception, action, motivation, and judgement are therefore still unproblematic or should be rethought, since cognitive capacities are no longer considered as belonging solely to the individual psyche but exceeds it through technological devices or organization systems.

Unlike Haraway and Barad, I suggest interpreting these changes not as an ontological shift, but as a historically new quality of societal life. This implies seeing the challenge for psychology not merely in the transgression of boundaries between human bodies and 'nonorganic' and 'artificial' matter (I would include this as part of the entirety of cultural human development), but rather in understanding the particular cultural (or collective) development of the psychic functions in the light of a technologically driven *societal* process of the *scientification of capacities to act*.

Scientification is understood as a rather precarious process of non-simultaneous and nonlinear cultural human development. One aspect of this development is the world-changing character of scientific inventions such as computers and the internet. More and more dimensions of societal life are dependent on these scientifically invented technologies. The everyday culture (the communication with others, reading, and writing, self-reflection) has changed tremendously. Furthermore, changes in labor and learning concretize the constraints and challenges that individuals face in our lives. Regarding demands of qualification, the scientification process is not necessarily clear or unambiguous: There is no automatism that means the individual worker becomes a scientist just because technologies are produced scientifically. However, given digitalization, the main aspects of the development of labor lie in the intellectualization and scientification of work: i.e., relevant intervention

into digitalized processes is only possible via the apt use of computers and scientific methods (Langemeyer, 2017a).

To develop a deeper understanding of this matter of "smart technology", it is firstly shown that the perspective of "agential realism" which Barad proposes lacks some relevant presuppositions. The presuppositions become relevant with regard to new forms and constellations of technological power, such as autopilots and completely automated systems that make more and more decisions concerning peoples' lives. With regard to this automation, responsibility comes into play through intellectualized working capacities. These require not only the acquisition of scientific stores of knowledge but the competences to imagine and anticipate the problems and risks that can be triggered or unleashed within the societal use of IT systems and their connections to other systems and contexts.

'Smart' houses, offices, production plants, clinics, and even entire cities are in the making, and some are already tested in reality. In this context, the technologies of 'deep learning' and 'organic computing' have obtained the capacity to transform themselves independently while processing data or while they interact with the environment. These technologies are seen, for instance, as powerful inventions in accomplishing the transition from nuclear and fossil powers to the so-called sustainable energies. Another domain is the calculation of risks. Politics concerned with climate change or biopolitics, insurance companies, financial institutions, stock exchange, personnel recruitment departments, etc., have become interested in modeling, simulating and forecasting by means of computational analytics. If their results are fed into further automatic processes, the contribution of human intellectuality to this no longer seems important or necessary. However, an increasingly self-referential technological apparatus means that political will for interventions or shifts cannot be formed and critically developed in a timely manner. If software takes care of processing people's annual tax declarations, and if this software 'learns' through processing the data fed into its system, then certain exceptions to rules will not be found against the background of considerations of societal responsibilities and ethics, but only in relation to the data and the patterns extracted from it. Reasoning related to *responsibility* would still require the involvement of human

reflection, i.e., to evaluate people's needs and futures in the light of the actual decisions. However, human involvement in processing data is increasingly systemically excluded, and an intervention into conclusions automatically 'drawn' by the software would firstly demand a reconstruction of the applied calculations. This can imply a delay of insight and decisions with severe consequences. This situation likely reminds us of having a ghost in the machine (cf. Knorr Cetina, 2007).

The semantic dimension of this societal change can be interpreted as follows. On the one hand, the economic and political vision behind this digitalization is, as it were, traditional or old-fashioned: Human subjectivity is seen as outdated and not fail-safe, whilst advanced technologies bring human capacities, physically and intellectually, to perfection. On the other, what is experienced as a break is that not only manual skills and physical powers, but also perceiving, calculating, reasoning and—last but not least—learning, are considered as imperfect activities which are amendable through the most advanced technologies. It is ultimately the entirety of human subjective behavior that is reinterpreted as accessible by technological efforts and strategies, not only to replace it, but also to track and granulate it into individual-related data (Kucklick, 2014) in order to optimize it or, at least, to influence it. Objectives and criteria are set by companies, which acquire expertise from psychology and arts to sell their commercialized way of life. In contradistinction, the striving to develop personality and autonomy in their institutionalized forms as human rights therefore seems to be (or is deliberately construed as) a remnant of an outdated romantic vision of life.

Is the Subject Matter of Psychology Transgressing to Technological Devices or Systems?

These developments of 'smart' technologies and cyber systems are not trivial to psychological theorizing, as the following issues may discern: Approaches of general psychology often presuppose that the acting subject (let's assume: sober-minded and without defects) is responsible

for the consequences of her/his actions. At least, they accept the societal conditions which ascribe responsibility to human actors. The conditions under which their actions take place are usually acknowledged theoretically as possibly 'restraining', 'intervening', or 'convening'. The "attribution theory" for instance, distinguishes between "internal" and "external" reasons for either success or failure in actions that the individual attaches to him-/herself (Heider, 1958). Yet, what are "actions" conducted in a digital environment of cyber systems? And what about the "soft" power of algorithms and their "intra-actions", which could be seen in their self-referential transformations according to the data fed into them. If these material transformations are completely run by digital information, hard- and software, or if the system's interface provides users with suggestions, forecasts, judgements, and even with decisions, is the subject then still the center, or at least an instance of, responsibility? This is, on the one hand, a juridical issue (Are programmers or the owner to blame if an automated-driven car hurts someone?) and, on the other, elementary to psychological concepts such as "self-efficacy" or "self-coherence" and "personality development". Psychological approaches convey that experience with actions and personal responsibility contribute to forming a "self" with values and norms and certain ambitions in life. They also assume that well-being depends on experiencing oneself as the 'cause' or at least as the main driver of the respective actions (cf. Brandtstätter & Otto, 2009; Kuhl & Kaschel, 2004; Urhahne, 2008). In philosophy, George Canguilhem (2002, p. 68) relates the notion of health to someone's way of experiencing responsibility:

> I am well to the extent that I feel able to take responsibility for my actions, to bring things into existence and to create between them relations which would not come without me.

Similarly, Rahel Jaeggi argues for the experience that people overcome a "relation of relationlessness", thereby interpreting the opposite state with the concept of "alienation" (*Entfremdung*) in an anti-essentialist manner (2005). Yet, regarding the concrete technological uses of algorithms and cyber systems, the ratio between being the responsible agent

or rather the string puppet is blurred. This problem is also cogent for learning.

Learning is often psychologically defined as a change in both behavior and cognition. But if algorithms start to make decisions, e.g., about someone's trajectory or progress with learning challenges: Is it then still the same cognitive and motivational process if learners stop bothering about interesting learning content ('What stirs my passions?') and aims ('What do others want me to do, and what is it that I want to do?'), about lessons learnt, goal-adequate issues, materials, and adequate forms of learning? Some might argue that learners who are using learning analytics are not necessarily prevented from taking responsibility for their learning progress. However, the inclination to avoid responsibility and effort while looking for a benefit from these technologies is already visible: People who use search engines usually have no insight into how their search request is processed. They might know that search engines automatically create user profiles to personalize the order of results. Yet, without being fully aware of the automated selection done by the search engine and its logics of prioritizing, the individual user consumes the information given—and with it, accept the priorities set. This is not trivial, as people implicitly infer from such synesthetic impressions what is of higher importance, or rather what is irrelevant. If social media makes suggestions about 'friends' or 'colleagues' to keep contact with, these decisions receive their clues not only from experiencing oneself in a certain situation but quite distinctly from algorithms.

This problem does not consist only in consumers' unreflected practice, but in the opacity of this technology itself: Not even programmers have a clear and complete understanding of the self-transforming algorithms they invented. In addition, if some information is given, the problem is not only that false or unreliable information needs 'good' information to reveal the error, the illusion or the lie: Often, digital information is not critically compared with *experience* as it can be *made* by humans. Thus the entire background of experiencing is alienated. The more that algorithms produce a societal reality that becomes the reference for interpretations and interpretative horizons, the more they undermine our self-critical engagements with concrete subjective

practice. The distinction between objectified data and the subjective activity of experiencing is nowadays confused.

Digitalization implies a deep transformation of spaces in everyday life that seem to 'speak' immediately and innocently to us. Most clearly, this tendency can be experienced with technological devices equipped with bots or avatars, voice control, and audio interfaces so that one can interact with them in a pseudo-social form. Digital technology is designed to make sense of our activities and our life in general. This 'sense' is *made*, not merely in an interpretative manner as meaning, but also in a practical one as a mass of people are drawn into this 'machine' and (have to) supply more and more personal information to social media, for example, in order to receive benefits such as attention by 'friends' or followers, or storage space. Digital life has become a touchable and calculable form of life, often more attractive than its analogous correspondent. It reaches out to become *the main* way of being social. As the backbone of a new mode of automated production, digital technologies not only control other technologies but nowadays satisfy a number of needs for participation, belonging, and recognition.

By extending the possibilities of consuming 'sense' and by creating spaces of 'meaningful' activity, these technologies simultaneously minimize and distort the subjective activity of experiencing her-/himself. In the 1950s, when broadcasting and TV invaded the private sphere, Günther Anders criticized the new possibility of consuming pictures of other regions as well as information about situations and events elsewhere as a loss of the necessity to go a certain way; for this "way-less" experience would be a "pseudo-familiarization" of the world (Anders, 1956, p. 117; cf. Schraube, 2009).

As if it was an acting subject, digital technology also seems to have emancipated itself from being merely a tool, an instrument, or a means to an end other than itself. It intrudes into the fabric of everyday life, kraken-like, looks for more and more applications to practice, and thus makes itself an indispensable part of human activities and societal ways of existence. It is not exclusion from, but rather inclusion in this process which appears as a problem. The apparatus reaches a new extension.

Consequently, this process obviously has many parallels with the problem of the "presumed inherent separability of observer and

observed, knower and known" (see above). However, in what ways is the diffraction of the categories of subject–object useful in this current development? Returning to Lev S. Vygotsky, it can be shown that the epistemological problem cannot be resolved without dialectical theorizing, and becomes quite problematic with overstressing structural immanence, as can be found with Barad, and partly with Haraway.

The Cyborg Metaphor Revisited—Or: The Manner of Doing Science

Looking back at Haraway's influential book of 1997, *Modest witness@ second millennium. FemaleMan meets OncoMouse: Feminism and Technoscience* (reprinted: Haraway & Goodeve, 2018), feminist philosophy celebrated a societal and paradigmatic shift which was perceived in the mirror of new technologies. Besides an ironic play of confusion, Haraway's essay revolved around questions of matter and science as it emerges in its 'situated' making. It was clarified that 'situated knowledge' should no longer be ignored and depreciated, so that scientific research gets a more sophisticated understanding of human action (cf. Suchman, 1987).

The postmodern critique as it was laid out by Haraway dared to break with the researcher's subjectivity invoked to 'witness' objectivity. This was seen as an abstraction disguising the concrete societal relations and practices of excluding subjectivities that were considered to be unsuitable for science (Haraway, 1985, p. 32). Therefore, Haraway's plea was to overcome women's exclusion from the production of new technologies and, similarly, to include all other persons concerned in the material development of their conditions of life.

However, although Haraway's critique was presented as a radical one, it is striking that the shortfalls of 'situated' knowledge as reflected (and not abstracted) concrete subjective experience did not attract the attention of postmodern and deconstructivist thinkers in similar ways. Barad's turn to structuralist immanence can be interpreted as a continuation within this move. As highlighted in the previous section however,

digitalized environments demand scientific engagement with people's particular situatedness.

Looking at Barad's research program, it becomes obvious that there is a methodological reflection that is missing—with far-reaching consequences. Barad stresses the "intra-activity of the world" in an all-encompassing way, i.e., as a fundamental form by which "*matter comes to matter* through the iterative intra-activity of the world" (Barad, 2007, p. 152). But from the standpoint of an "iterative intra-activity of the world", the discourse in which we have learnt to articulate subjective reasons and responsibilities in relation to our actions and in relation to others is transformed into a discourse of rather impersonal processes. This disarticulates our particular engagements with societal practices *we are part of* and through which *we* produce and consume, for example, radioactivity, digitalization, etc. In a nutshell, methodologically, I suggest that this historical work of generations on our ways of knowing and experiencing ourselves cannot simply be revealed as an illusion or as an error, and thus, can be dismissed. The relation between the responsible 'agential' parts and their entire societal practice is not immediately available and criticizable against the backdrop of 'situated' ways of being and consciousness. However, if matter constantly intra-acts, often irrespective of human will, the individual faces uncertainty above all, and can merely hope that the ethically 'right' solution, or at least, the 'correct' socio-critical intervention in relation to the world will be ready to hand. Without developing human capacities to bring matter (both as societal and natural conditions) under control, we would endorse a fatalism with regard to the apparatus we are in.

Scientification as a Politicized Capacity to Act

There is no epistemic rupture today with the thesis that the activities of thinking, knowing and recognition, including in a scientific manner, are time and field dependent (cf. Langemeyer, 2017b, p. 19). However, as the previous section shows, the mere acknowledgment of 'situated knowledge' and its rather global revaluation through a symmetry of

matters is not a solution to the problem of scientists' and, more generally, humankind's responsibilities.

Against these shortcomings, the concept of "scientification" shall be strengthened. With Vygotsky, this approach agrees that the cognition of an individual cannot be scientific only in relation to itself. To establish a relation to certain *scientific concepts, methods* and *research results* in relation to capacities to act means participating in a certain domain of the historical practice of scientific thinking and knowledge production.

This is also true for the economic sectors where the production of technologies builds on scientific knowledge. Particularly, digitalization brings about a new level of scientification because it enables a close connection between the technological regulation of numerous processes and their mathematical operationalization. This means that, without science, the new digital 'universe' of information and automatic information processing would be disjointed, incoherent and as such useless. Digital data would be unusable for automated control if it did not 'incorporate' science.

However, scientification and technologization also increase the distance between the world of objects and the working subjects, so that their relationship becomes more indirect, more theoretical and thus opaque. The problems which IT workers, for instance, deal with are opaque and complex (e.g., software systems), and become intelligible only with activities to analyze, interpret, reveal, expand, experiment, test, and reinterpret the object of work (Langemeyer, 2017a).

Within research activities like these, workers may however be thrown back on believing and relying blindly on opaque technologies, on their 'interpretations', 'testing', 'calculations', and 'solutions' produced elsewhere. The capitalist relations of production create particular problems of distorted cooperation and transparency. A common phenomenon is therefore that particular work activities have become science-like activities: In this mode, subjects who are (or should be) *striving* for comprehension and agency in relation to unresolved problems are dependent on societal institutions that provide expertise (and sometimes pseudo-expertise) in testing, elaborating, and reconfiguring the matter which is to be brought under control (cf. Langemeyer, 2015, 2019a, b). These science-like activities are conducted individually and sometimes

collectively. In either case, their potential mainly unfolds by overcoming the limits of distorted comprehension, which implies igniting the interaction between special and general science.

Science-like activities can therefore be interpreted as a transitory form of practice of a collective. This collective becomes more powerful through its engagements in overcoming the deficits of science-like activities. It strives for scientification by critically testing and theorizing in depth why capacities to think are incomplete or imperfect to see the broader picture of interrelations (ibid.). This transition from science-like to scientificated practices includes reconfiguration, communication, debate, and further investigation to ensure correct, precise and appropriate thinking and reasoning.

Politically, economically and scientifically, the precarious scientification process is therefore essential and needs societal conditions for independence. Its precariousness is thus entangled with many societal relations of time and space, which might be simultaneously economic, political, cultural, etc. And in these challenging entanglements, critical perspectives are to be generated—each time anew. The need for critique emerges as situated in practice, but the presuppositions and the capacities for thinking and acting in a critical manner depend on long-term cultural development.

Concluding Remark

The question can be raised whether this approach is, intentionally or unintentionally, inclined to rationalist and scientistic positions since it accepts continuing with subject and object as poles in the epistemic process, and with referring responsible and conscious activity to humans only. This criticism would be misleading. I assume that there is no guarantee of exceeding the numerous science-like activities through scientification. Within science-like activities, the different positions of researcher subjects are not unproblematic. They are concrete societal conditions under which the objects of study are identified, interpreted, and construed. I agreed with Haraway and Barad that moving to more comprehensive forms of knowledge must be an engagement

with the world, a way of taking on responsibility for it, but to become more scientific this must be combined with self-critical engagements. The sources for developing these engagements further are social, and from there, become individual. They are social and thus material, yet we should not resign ourselves to structural immanence. Raising consciousness is subjective activity and not intra-activity. The scientification approach therefore emphasizes that, also in scientific practice, individuals must take a stance and then take on the responsibility for this in relation to concrete others and future generations. This is what distinguishes their scientific engagement (as sociohistorical human practice) from matter like radioactivity or digital data. Ultimately, it is this responsibility which seems to be diverted by "agential realism"—an awkward peripeteia, especially with regard to current technological developments.

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