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Man at the centre of technology. A philosophical investigation of anthropological knowledge in man-machine-interfaces

Der Mensch im Zentrum der Technik. Eine philosophische Untersuchung des anthropologischen Wissens in Mensch-Maschine-Schnittstellen

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ABSTRACT

The paper aims to examine the construction, circulation, and transformation of knowledge about man (anthropological knowledge) in human-technology interaction in the 20th century. The analysis focuses on the prerequisites of the industrial working world and its implicit knowledge about human beings. However, the basis and starting point of technical adaptation is usually ignored: The concepts of "man" and the anthropological knowledge gained experimentally from a anthropocentric designed interface. Based on the concept of an intuitive interface design this problem will be investigated. The questions posed by this article as well as the objectives associated with them open up an interdisciplinary framework between philosophy of technology, philosophical anthropology and history of science given that they not only focus – by means of historical reconstruction – on historical changes in technological developments. They also address the issue of generation and transformation of anthropological knowledge in the definitions and interactions of "man" and "technology".

KEYWORDS

Man-machine-interaction, philosophy of technology; digitalization; interface; anthropocentrism; usability

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ZUSAMMENFASSUNG

Ziel des Beitrags ist es, die Konstruktion, Zirkulation und Transformation von Wissen über den Menschen (anthropologisches Wissen) in der Mensch-Technik-Interaktion im 20. Jahrhundert herauszuarbeiten. Im Mittelpunkt der Analyse stehen die Voraussetzungen der industriellen Arbeitswelt und ihr implizites Wissen über den Menschen. Die Grundlage und der Ausgangspunkt der technischen Anpassung ist dabei überaus zentral für die Analyse: Die Konzepte des "Menschen" und das anthropologische Wissen, das experimentell aus einer anthropozentrisch gestalteten Schnittstelle gewonnen wird. Basierend auf dem Konzept eines intuitiven Interface-Designs soll dieses Problem untersucht werden. Die in diesem Beitrag aufgeworfenen Fragen sowie die damit verbundenen Zielsetzungen eröffnen einen interdisziplinären Rahmen zwischen Technikphilosophie, philosophischer Anthropologie und Wissenschaftsgeschichte, da sie nicht nur - mittels historischer Rekonstruktion - den historischen Wandel technologischer Entwicklungen in den Blick nehmen. Sie befassen sich auch mit der Frage der Generierung und Transformation anthropologischen Wissens in den Definitionen und Wechselwirkungen von "Mensch" und "Technik".

STICHWORT

Mensch-Maschine-Interaktion; Technikphilosophie; Digitalisierung; Schnittstelle; Anthropozentrismus; Benutzerfreundlichkeit

1 THE PROBLEM OF ANTHROPOCENTRIC TECHNOLOGY

In today's digital society, not only people but also seemingly autonomous "things" are increasingly prevailing. These human-technology interactions also form a part of social life. The Enquete Commission on "Internet and Digital Society," set up in Germany in 2010, has highlighted that the changes brought about by digitization are "profound and irreversible." "They are comparable in their effects to the upheavals of industrialization in the 19th century or the invention of the printing press in the 15th century." (DEUTSCHER BUNDESTAG, 2013, p. 41) One might think, therefore, that in the age of the internet of things, online clouds, big data, learning machines, or totally networked smart factories, humans no longer significantly contribute to the production of industrial goods. It seems promising to concentrate on conducting research on technological aspects such as smart devices or big data processing. (BAUERNHANSL et al. 2014) Yet, the generation and storage of knowledge concern technical structures – not people. The human being is, as a human factor, seen here as an element of error for production. (HEßLER 2015) This argument overlooks the basic assumption: the technology-centered view is only a consequence that owes its functionality to anthropological knowledge at the center. Surprisingly enough, the current technology research of *artificial intelligence* or *machine learning* argues from an exceedingly human-centered vantage point. This double discourse must be taken into account as it is an effective way to understand modern technological development and its persuasiveness and effectiveness. In contrast to technological dystopias, which are still haunting the features sections of newspapers by conjuring alienation as well as the loss of jobs and personal autonomy (FREY, OSBORNE 2013; PFEIFFER et al. 2019;

2018), modern research focuses, both empirically and discursively, on anthropological knowledge. (Cf. HEßLER, 2018; MILLER, HEATHER 2012, 2018; BOLTANSKI, CHIAPELLO 2007; MOULIER-BOUTANG, 2012; BRIKEN et al. 2017; FLORIDA 2002)

This is an important observation, because with these anthropocentric arguments, an implicit, collectively shared understanding of "man" (often analyzed as a philosophical, holistic, psycho-physical concept) finds its way into technological research, which must be examined historically and systematically. The political and ideological discourses, some of which are completely different, make use of traditional notions of man in their arguments, and they have become highly influential. Undoubtedly, with regard to the new digital working worlds of networking, there is a "radicality with which economy and society are digitally transformed." (KAGERMANN, 2016, p. 5) However, the question here must be: Where and when did this anthropocentric ideas come from and how do actors react to this adaption of technology to "man" and what knowledge of the human do they take up and generate?

The intended reconstruction of anthropological knowledge implies that, especially in the 20th century, different notions of "man" were established which determine man physically and mentally, quantitatively and qualitatively, so that complex, sometimes contradictory definitions of "man" emerge (e.g. man as intervener or observer of technology, man as problem solver or error element, man as ‚opponent' or ‚partner' of the machine). (Cf. HEßLER, 2019) These different concepts of "man" can be understood as epistemic assumptions. They are usually the basis for many technical constructions and argumentations. Images of man can be organicistic, mechanistic, holistic or else. They form the implicit, mostly unreflected basis for different technical models of man (f. e. anthropometric, cybernetic).

The digital knowledge of the 21st century is explicitly based on these complex concepts of "man" since it not only collects data (big data) and shapes human interactions (with algorithms) but also has an affective effect on man (technical affinity through smartphones, affective computing, humanoid robots).

The questions posed by this article as well as the objectives associated with them open up an interdisciplinary framework between philosophy of technology, philosophical anthropology and history of science given that they not only focus – by means of historical reconstruction – on historical changes in technological developments. They also address the issue of generation and transformation of anthropological knowledge in the definitions and interactions of "man" and "technology":

- How and in which historical knowledge tradition did the heterogeneous, at times incoherent, yet powerful anthropocentric arguments emerge?
- How were not only anthropological research, but also technical systems founded on the ways of thinking that underlay them?
- Which ideas and concepts were used to attempt to integrate humans into these technical systems, and which anthropological and epistemic preconditions had to be met for doing so?

- If "man" was to be the yardstick for every technological development and had to measure construction and efficiency against himself, how could (philosophical, public, and functional) acceptance be achieved in dealing with technology?

These overarching questions lead in my article to three different thematic complexes with regard to the expected objectives:

1. The aim is to identify, analyze and reconstruct concepts of "man" in the engineering and the humanities, as well as to reconstruct how the various disciplines exchanged and translated their knowledge of "man". For these often only implicit notions of "man" determine and shape technical developments for the world of work and life and are therefore of great relevance for understanding our digital world.

2. The article consists in pursuing a historical perspective and thus expanding current anthropological approaches by making them connectable to interdisciplinary knowledge research. The article therefor focus historically on the interwar period. Already in this conceptualizing phase of man-machine-adaptation, humanistic arguments and human images were constructed that have remained influential in various disciplines to this day despite having transformed themselves in the course of the 20th century.

3. This historical development of heterogeneous anthropological knowledge is to be investigated in order to systematically classify and critically reflect on the technological image of "man". Philosophy therefore frames the different areas. In the following philosophy provides the systematic questions and methodologies to connect and critically illuminate the areas.

A good philosophy must take the devices, the material and the specific interface seriously. A philosophy of the technical interface is particularly important here. Because the interface connects man and machine but also separates both. Only through the designed interface can the entities "human" and "machine" assume their definition. (HOOKWAY, 2014) Therefore, in the following, the human-machine adaptation is examined in more detail based on the german concept of "Sinnfälligkeit". In various steps, concrete relationships between man and machine and man and technical environment worked out. The question will always revolve around a certain anthropological knowledge.

2 THE FALLING INTO SENSE OF TECHNICAL OBJECTS

A history or philosophy of machine adaptation, which could be called affordance or usability engineering exists hitherto only in its initial stages; but it is highly relevant to the interesting transformation of human-machine relationships, especially because it could investigate not only the changing attributions of these two entities (human/machine) but also their interaction (in theory and in practice). (Cf. LIGGIERI, 2017; CAMPBELL, 1989; KILLEN, 2007, ASH, 1998; GORDON, MCCORMICK, 2013; GEUTER, 1992; STADLER, 2017; TURNER, 2005) The present analysis is dedicated to just this machine adaptation with regard to the 'human factor' and is particularly

interested in the interfaces – and inferences – between the knowledge base of anthropology, the humanities and the engineering sciences. What is at issue here will be the charting of an argument that co-determines human-machine interaction in the technological discourse right up to the present: namely, the human is a special and problematizing factor to whose psychophysical peculiarities technology should be adapted. With the emergence and significance of the german concept of "*Sinnfälligkeit*" or 'falling into sense' in the 1920s, a programme is thereby to attract attention which goes beyond the energetic imperative and in which a meeting of different discursive elements – philosophical, economic, psychological, bio-scientific and technical-scientific – takes place.

German engineering science as well as practical psychology – chiefly the branch called psychotechnics – wanted, in a rhetorical demarcation against the schematized image of 'Taylorism', to deal with the human more as living 'factor' as well as problem. (KAUFMAN, 2008; KANIGEL, 1997) In distinction to Frederick W. Taylor's scientific management which wanted to adapt the human as an almost mechanical component to work and to the machine, in psycho-technics the human was characterized as difficult to quantify and rationalize, with which claim the protagonists of this field connect with the demand for an adaptation of the machine to intuitive, simple and thus 'human friendly' operating. The idea behind this adaptation was that in its work the human being, as a complex biological entity, needs a disturbance-free and orderly milieu so as to be able to work productively and efficiently. This optimal, economic movement or operation should thereby always be 'natural' and thus intuitive and energy saving (GIESE, 1927, p. 600). The efficacious term for this was "*Sinnfälligkeit*" which was discovered by engineers rather than by psychologists or philosophers. "*Sinnfälligkeit*" thus means a literal "falling into sense [*In-den-Sinn-Fallen*]", a common-sense obviousness, of the right correlation. This 'falling' should happen unconsciously and disburden, to speak with the psycho-technicians, reflective consciousness. One acts appropriately but does not have to think about it. In the following, the historical term, which has been used in different forms, as well as the underlying programme as the intuitive adaptation of machines to the psycho-physical peculiarities of the human will be developed.

For a long time in the history of technology, the focus was particularly on the origination of a technical-scientific 'modern' image of the human that Rabinbach had characterized as the "human motor" and was recognized in a variety of areas – from Taylorism/Fordism up to cultural implementations. (RABINBACH, 1990) On the one hand the programme of "*Sinnfälligkeit*" shows that the narrative of the "human motor" in the 1920s could also take on other forms than that of a reductionist, energetic analogization between the human and the machine. Since while the human as the energetic motor was indeed partly further discussed in rhetorical proclamations, practically engineers were more aware of dexterity, craftsmanship, perception and adaptation to the senses. With reference to Andreas Killen it can be said that the sciences of work, in bidding farewell to the human-motor paradigm, conceived themselves as the "science of the workplace" as well as of the autonomous subject.

(KILLEN, 2006, p. 195-200) Thereby the engineering scientific question concerning technical artefacts that were constructed according to an adaptation that 'fell into sense' and that referred back to the 'human being' formed the important duplicate to this working-scientific perspective. Thus the motor metaphor would no longer do justice to a tram driver or a pilot in their complex interaction with the operating technical elements. Since the concept of "*Sinnfälligkeit*" goes beyond the energetic imperative ("Waste no energy, utilize it"), the analysis want to look at what happens when the "human motor" is *living* (and therewith: sensing, skilled, instinctive and susceptible to disturbance).

On the other hand, with "*Sinnfälligkeit*", which includes "order" just as much as "perception", it is shown that the often described ending of psycho-technical movements at the beginning of the 1930s in no way holds of "*Sinnfälligkeit*". On the contrary, the heterogenous region of psycho-technical 'falling into sense' or *Sinnfälligkeit*, in its investigations into lightening, advertising as well as the working milieu, offered the new technical requirements for dexterity, perception and order of the 1930s and 1940s because it shifted a determinate conception of signal-receiving human beings into the foreground. Thus "*Sinnfälligkeit*" was not a construct that was later discontinued but rather it established itself in scientific discourse such that up to today in determinate frameworks. This concept is called now "ergonomics" or respectively "affordance" in the engineering sciences. With the conceptualisation of "Sinnfälligkeit" in the interwar period man-machine adaptation become reality and effective.

In the new concept of "*Sinnfälligkeit*" the human is no longer presented as a pure machine that can be adjusted but rather it must be coordinated with regard to the work equipment and the workplace. Through the fact that in the discourse on "*Sinnfälligkeit*" the machine corresponds to the human, the 'living' (together with parameters such as performance, dexterity, intuition or attention) moved into focus as the norm for a user friendly or operator accessible design (usability). This was a surprisingly new paradigm at that time. If human beings and the technical working milieu were to be allowed to be efficiently interact in the factories, psychologists must consider variations and fluctuations that are difficult to calculate and, on their part, to react to these in a manner that 'falls into sense [*sinnfällig*]'. However, the wholly practical problem of efficiency, already well-known from Taylorism, became at the same time (1920s) the normative argument which moved the human freely to the centre, based loosely according to the Homo-Mensura proposition. In the psycho-technicians' self-proclaimed distinction to Taylorism and its supposedly mechanical objectification of the human (which was an philosophical problem at this time, too), this argument for a design that 'falls into sense' accordingly aims at integrating the natural psycho-physics of the human and adapting equipment to it, so as to allow – as will be explained – an almost instinctive interaction with machines (but which always aims at efficiency). This thus raises the question of how this "*Sinnfälligkeit*" can be situated as the interface between "human motor", the energy paradigm and the information

paradigm of modern technical artefacts.[2] On the one hand, it should be considered with regard to the praxis of a physiological as well as psychical disburdening (with concrete examples of work equipment and the work place) and on the other with regard to a determinate anthropology of human-machine interaction in the discourse of "*Sinnfälligkeit*". What practices, equipment and conceptions were used to construct machines for human beings as independent users who are susceptible to disturbances and what was the image of the human that stands behind such assumptions? How did this concept shape our current interaction with machines?

3 THE ANTHROPOCENTRIC CALIBRATION OF HUMAN AND MATERIAL

Based on technical and psychological developments in den 1920s the human and its 'nature' becomes more and more the measure of things. Space and equipment must be directed according to it. The human and its statutes will now no longer be ignored and no longer simply embedded in mechanical analogies but became the special point of access for the investigation that adopts the 'human measure'. This human measure is not to be thought of as purely autonomous for also in this seemingly anthropo-centric calibration, the human was "a part of the material process […]." (GIESE, 1927, p. 587)

The human being was thus regarded in this material psychological shaping of work as a "matter" that must be taken into consideration to a particular degree as "operational factor" amongst others for "optimal results" (GIESE, 1927, p. VI), since in its dynamic interaction with the environment, calculations and effects were more difficult to measure. The main problem lied and still lies in modern man-machine-interaction in establishing an order with the extra-ordinary 'human factor'. Looking more closely at the shaping of technical equipment and environment according to '*Sinnfälligkeit*', a close connection between psychology, physiology as well as holistic philosophy is shown in the depiction and thus the differentiated treatment of a human 'psycho-physics'. It was, however, also programmatically projected as a living 'more'. This idea of a "biology of work" formed the foundation for investigation of *Sinnfälligkeit* which had the task of knowing the human. (GIESE, 1928a, p. 152; GIESE, 1932, p. 80) As already indicated, for many psychologists and philosophers in the 1920s, however, the biological was never purely rational, mechanical or constant but dynamic and partly. Due to individual fatigue, dexterity, capacity for absorption and reaction, there thus could not be the one right operation for the human being, but always only one that is more or less flexibly adapted to it. In the following the philosophical focus should not be merely on the anatomical, physiological or "industrial hygienic" aspects but decidedly on a "psycho-technics of the work apparatus" and thus on the concrete technical side which must be adjusted to the

[2] The information paradigm (including cybernetics) is focused more on cognitive capabilities and describes the human being as a signal receiving operator. Thereby information is more important than energy, perception/ attentiveness was more important than corporeal fatigue and cognition more important than motor activity.

'living being'. (FABIAN, 1930, p. 620)

4 THE WORK EQUIPMENT

A philosophy of the interface must consider the man-machine relations in their concrete, specific, changing connections, couplings, overlaps, but also with regard to drawing boundaries. In the human-machine relation, the design of the possibilities of intervention and thus the anthropocentric interfaces must be examined above all. "Man" interacts and works concretely with other (technical) entities but is also processed and defined by them. The mediation of the processual constituent entities does not take place in an abstract, purely theoretical space, but in different situations in dealing with tangible technology in our living environment.

So the work equipment with their cranks, levers, handles and light as well as sound in the room were adapted to the human movements, positions and also sensory peculiarities. Georg Schlesinger, the chief designer at the *Loewe*-Company, already recognized from the practical point of view that these machines, which are not completely automatic, require special attention from psychologists as well as from designers of machine tools. Because of the fact that they are operated by human beings and thus are "constantly adapted to incessantly changing conditions" (SCHLESINGER, 1932, p. 20), the operator was no longer the same general 'average human being' for whom the machine had to be adjusted only once. Instead of this the producer must, according to the credo, always had to take this 'elasticity' and the peculiarity of the operator into consideration. (SCHLESINGER, 1932, p. 20) In Schlesinger's construction of machines, the natural movement position of the human thus in a certain sense suggested the arrangement of the workplace and the calibration of the apparatus. What was at issue in this, as in all technical constructions, was predominantly a practically appropriate "*operability* of the machine tools". (SCHLESINGER, p. 37, emphasis by the author) The living being had to serve as the norm for technical design. A striking example of this handling of work tools that is far from all mechanical constructions is given by the production engineer and head of the Berlin tram system test facility, Karl August Tramm, in 1921, when he – wholly in the sense of Martin Heidegger's "readiness-to-hand" [Zuhandenheit] – mentioned a "naturally" formed hammer handle that a boiler maker used for 21 years. (HEIDEGGER, 1927, p. 69) In this case, the hammer handle, according to Tramm, had been adapted in a "natural" way to the human hand. This is very similar to the modern definition of an user friendly "natural" interface. (ASPLING, 2015; BLAKE, 2009; WIGDOR, WIXON, 2011)

With this 'adapted' position of the handle it is clear that the dynamic (movement) and the reaction were gauged for the human working position. 'Unnatural' courses of movement and handle positions held as inefficient. The human-machine/workplace system was not allowed to foster these movements, but rather had to prevent them by adapting.

5 THE "FALLING INTO SENSE" OF MOVEMENT

This image of the human in a holistic psycho-physics required optimal, economic movement or operation that should always be 'natural', that is, intuitive and energy-saving. The main goal, on the one hand, here too was to lessen the loss of "mental energy" (and fatigue in itself). (LIPMANN, 1932, p. 182) On the other hand, however, the psychologists and engineers were able to make use of this 'falling into sense' in advertising and operational elements, because through constructions not only bodily but also mental performance (and with this mistakes, accidents and loss of time) were reduced and intuitive dexterity could be increased. The man-machine adaption of 'Falling into sense' thus related to different forms like traditional associations, habits, physiological disburdening of movement or instinctive movement.[3]

What now needs to be examined in more detail are these different kinds of human-technical mediation with regard psychological disburdening (reaction, attentiveness) that was of course always co-implied by the material-psychological calibration of equipment and the environment. This meditation proceeded not only from an instinctive use of technology but equally from a very specific anthropo-centric, holistic technical design. The fundamental idea that appears in discursive and practical dealings is: the technology should and can support "reactive moments" by suitable design. (GIESE, 1927, p. 601) An example of this would be a motorist who should break and avoid simultaneously. The operation of the equipment (steering wheel, clutch, hand break, foot break) proves to be more complex than initially thought because in acting the 'falling into sense' is efficacious. With the left hand, the motorist must turn the steering wheel, with the right hand draw up the hand break, press the clutch with the left foot and step on the breaks with the right foot. (GIESE, 1927, p. 601-602)[4] What makes the driving manoeuvre itself less problematic, because it runs its course intuitively, reveals its difficulty when one of these operational elements does not function such an 'obvious' fashion. The driver cannot so simply let themselves 'fall into the sense', hence they fall out – an accident occurs. The "falling into sense of movement", that is made efficacious here was reflected imperatively in the "hand rule" that underlaid and still underlies most technical designs: "shifting and turning to the right leads right, moving in (opens) or increases. Shifting or respectively turning to the left leads left, moving out (closes) or diminishes." (GIESE, 1927, p. 603)[5]

Complementary to haptic adaptation to machines, visual identifications of work material such as red as a warning colour or flashing as a sign of danger were in the engineering-psychological context of the 1920s examples of an "obviousness" and "mnemonic aid" for the "simple" worker. (GANZENHUBER, 1931, p. 251) In his

[3] On the differentiation of "*Sinnfälligkeit*" see Giese 1927, p. 601.
[4] These 'intuitive' handles had to be practiced to a certain extent, on this see Tramm 1919, p. 20–21.
[5] The fact that in these areas problems can occur, can be only indicated here. (GIESE, 1927, p. 603) It is be to considered from an operational-economical perspective that if the objects are already intuitively presented personal can be found more easily who require less training if the objects are already intuitively presented by this optimized arrangement.

Psychotechnical Journal the psychologist Hans Rupp spoke in this sense with the terminology of the philosopher Johann Friedrich Herbart's of the "narrowness of consciousness" which, on the one hand, was characterized by a restrictedness of the human receptive capacity and on the other was characterized by a dependence of the order and structure within which signals and impressions reach the human being. (RUPP, 1929, p. 18, 19) The goal thus lay in delivering signal, symbol and significance in a "meaningful context". (LIPMANN, 1932, p. 177) A metaphor or a sentence would therefore have been completely ineffective. As against this, a narrow non-reflective over-lapping of signs and meaningful content was striven for. Identifications had to convey their meaningful content "briefly, clearly and unambiguously" such that the "essentials" could be quickly separated from "additional matters". (GANZENHUBER, 1931, p. 251)

In most of the demands for *Sinnfälligkeit* not only the body and its movements but thinking too should be disburdened and not 'stand in the way' of the worker. The focus thus broadened from a physical (saving of force, muscular tiredness) to a mental disburdening (attentiveness, reaction) and opened up a field for the conveniently operating human-machine surface in which what is at issue is the reception of signals, as in the more complex technical computer in our days. Activity should be an intuitive reflex and thereby less liable to error: "An identification", Ganzenhuber thus concludes, "is only then correct when in addition to falling into sense, the psycho-technical functions are so divided that they are harmoniously interrelated, and none of the individual functions prevails, especially not memory". (GANZENHUBER, 1931, p. 251) Consequently what matters is the quick, efficient and secure reception of signals (later: information) that should then lead to error-free action.

In spite of the schematic remarks on "*Sinnfälligkeit*" it should be clear that what anthropocentric calibration concerns is not a tactile recognition of objects but perception, attentive impulse, activity and dexterous reactive movements. (FABIAN, 1930, p. 649-650; MOEDE, 1920, p. 138) This is a new negotiation of human-machine interaction and relation, which is still relevant today. It was here that central interaction concepts were developed that have since determined technical designs: The activities carried out should take place "conveniently", "fatigue-free" and "correctly" through the intuitive machine operating. (GIESE, 1927, p. 608; TRAMM, 1921, p. 36) "Conveniently" was thus often synonymous with "usable".

6 THE HUMAN BEING AS *LIVING* WHOLE AND AS (PROBLEMATIC) FACTOR

After the important detailed explanations of the constructions and programmes of *Sinnfälligkeit*, which already imply a certain image of the human, this anthropology is to be accurately more formulated and reflected upon in a final step. As was shown, in contrast to Taylor's time studies and the studies of movement later carried out by his student Frank B. Gilbreth's, for the man-machine-adaptation there could not be a "one best way" of movement and operating. For the psychologists and engineers but

also for the philosophers of that time who dealt with the problem of *Sinnfälligkeit*, the human being was thus not a machine that was to be universally adjusted but had to be individually coordinated with reference to research data, the work site and the equipment. The mistake, Giese said critically, was that Gilbreth and others thought "the human as a machine for which a single kind of lever [could] be the optimum." (GIESE, 1928b, p. 59) Giese and Fabian wanted to change this false conception of the human by "controlled observation of the living human being […] in the form of the object psychotechnics" and by the "replacement of a technical-material mechanical conception of the human by psychological typology". (GIESE, 1928b, p. 59) Following this new "typology", it was so complicated as to be impossible to determine the 'living' generally when such individual parameters as performance, movement, dexterity or attentiveness were concerned. In this sense, performance, movement, skill or willingness to work were not only different from human being to human being but could also vary within a person (dependent on the form on the day). If the human being and the work surroundings were to be matched and allowed to interact in an (operational) system, the technical design must heed such variations and weaknesses and react to these in the manner of *Sinnfälligkeit*.

It seems remarkable that in these genuinely anti-Tayloristic, anti-Gilbrethian and therefore anti-mechanistic arguments, quite similar automatisms of an unconscious reaction can be found as already in Gilbreth, when the latter writes: "[i]t is the automaticity that permits high output without the monotony of superattention on unimportant repetitive decisions." (GILBRETH, GILBRETH, 1920, p. 150) However, the central point about this similarity between automatism and *Sinnfälligkeit* is that each was based on a different model of the human which is still in effective in technology debates today. In Gilbreth, therefore, it is not a question (at least argumentatively) of a 'human-friendly' adaptation but rather the analogization of the human and machine whereby the human being should become an automaton through labour-economical automatisms. (KAUFMAN, 2008, p. 69; 317) On the other hand, in the holistic, anthropocentric *Sinnfälligkeit* the 'whole' human being should be perceived and the machine should be adapted to its 'living' psychophysical peculiarities and liability to disturbances.

It can thus be said often made and partly polemic demarcation to Taylorism (as collective concept for technization, objectification, rationalization) in psycho-technical circles was in no way concerned goals or interventions in themselves (such as the formation of the workplace, fatigue prophylaxis, increasing efficiency) but rather the 'human' research object, which was interpreted differently in both attributions.

As stated, the access to the human was in no way obsolete in psycho-technical approach but acted more deeply and in a more differentiated fashion through extensive analyses of work movements, measurements of reactions and such like, whereby the anthropocentric rhetoric evoked interdisciplinary connectivity in the 1920s. Following the aforementioned Hans Rupp, rationalization should not intervene "uselessly" with the "natural" movements but adapt to them because the nature of the human and its affects would always break through again anyway. (RUPP, 1928, p. 167)

Where Taylorism and Fordism were directed towards *de-naturalizing* the worker's movements in the name of effectiveness, the psychotechnics advocated (in a putatively humanistic way) supporting the "naturally given" psycho-physics of the human and adapting the equipment to it, consequently *naturalization*. Where the workplace (the assembly line) at Ford remained constant and only the worker changed, for *Sinnfälligkeit* the surroundings must also be modified.[6] You can think of modern ideas of internet of things or smart homes. This 'new' access to the human, which was so emphatically propagated by many researchers, seemed throughout the 1920s very capable of being connected with in different fields and manifested itself terminologically in *Sinnfälligkeit*. As the present analysis shows, the human being became, in spite of humanistic proclamations, a 'reflex machine' in praxis who – freed from thinking – only *reacts* but should no longer *reflect*.

7 HUMAN-MACHINE INTERACTION AS A CONCRETE PHILOSOPHICAL TASK OF OUR TIME

When one looks at the explanations as well as at the question initially introduced concerning acceptance through adaptation in the 1920s with the advent of *Sinnfälligkeit*, the view of human-machine interaction seems to change although different paradigms (familiarity, simple operation, universal user, accident prevention) have remained constant since then to this day. (SMITH, 2015; KUUTTI, BANNON, 2014; MINDELL, 2008) Where the human being in studies of time and movement of 1920s Taylorism represented an error factor, "Sinnfälligkeit" as a new concept of interface-relation saw in it psychological, physiological and epistemic possibilities as well as limitations. These possibilities and limitations also reappear in the modern view, for example that of the German Federal Ministry of Education and Research BMBF. Its 2015 research program—with the telling title "Bringing Technology to the Human"— clearly focuses on a human-machine interaction that is not exactly subtly positioned as anthropocentric. The program focuses on a "hand in hand" relationship between the human being and technology (BMBF 2015, p. 5), in which a "responsible" technology (BMBF 2015, p. 6) not only serves human beings and thus moves them to the "center point" (BMBF 2015, p. 7) but shall also increase "acceptance" as well as "trust" by design. (BMBF 2015, p. 6) These motives were, as shown, already argumentatively as well as technically laid out in "Sinnfälligkeit" and have been differentiated through information-processing machines. However, the anthropocentric maxim of a 'cooperation' based on partnership between the human being and the machine as well as a human-centered operation has remained the same. (GRUNDIN, 2016)

According to the credo of "Sinnfälligkeit" as well as of modern usability engineering, what is combined in the human factor is, on the one hand, the fear of unpredictable and surprising irrationality in the form of performance fluctuations and,

[6] See for this humanization Campbell (1989), p. 158-178.

on the other, an opportunity for the ethical aspects of work (humanization): so it is human as a factor and as an actor. (BANNON, 1991) On this interpretation, the human being is indeed in a certain sense subordinate to the machine, on the other hand the machine must be ethically 'adjusted' to: the argument goes from taylorism to tailorability. It was apparent in the present analysis that a natural-scientific exactitude cannot be simply transferred to the human being and its statutes. In the descriptions then and today, the living being seems too complex, too chaotic, too incalculable for a simple mathematization. (BERTELSEN et al. 2018) It was thus clear to many of the researchers that the problem factor 'human being' required a new treatment of its own. The opportunity was that of seeing the human being as a human actor and no longer as a slavish muscle 'machine' (factor). The task was and is still to adapt the machine such that it 'falls into sense' for the living human being. In this sense, not only the machine was changed in the argumentative and constructive process of "Sinnfälligkeit", but also the human being. However, it was not merely a humanistic aspect that was associated with this but rather a more economic one: in the 'human friendly' and 'user accessible' machine, it was not unconditionally better for the human being, but its work was more efficient, more disturbance free and thus more productive when its interaction with the machine 'fell into sense'. The fact that these economically dominated, as well as disciplining, accesses to the human being are also still present in the modern forms of an ergonomic usability engineering and interface design, should at least be noticed—better yet, understood—before one speaks unreflectingly and prematurely of a 'humanization of work' or of 'human-friendly' design. The "Sinnfälligkeit" (in modern terms: usability) of the interface, however, contributes to the machine being no longer regarded as something other, unknown and non-human.

Technology therefore adopt a different approach from the two classic narratives of dystopia or utopia. Today the problem no longer lies in the fear of apocalypse, alienation or technological intimidation. On the contrary: modern technology has become anthropocentric, or user friendly. We have become attached to our mobile devices. They ensnare us physically and mentally, and flatter our ego. They even complement us in a certain way.

Traditional attempts to describe technology – as a method to utilise or exploit knowledge from natural sciences, or as the composition of a device – no longer therefore quite chime with the way we use technology today. Despite all the human downfall scenarios and perennial pessimism about the pitfalls of technology, the use of technology is no longer a problem in daily life. We feel comfortable using our mobile phones, smart TVs and laptops; we scroll, tap, press or stroke them. We have an ever-closer relationship with technology – quite often an emotional one. Modern technology shapes us through socio-cultural, private and public contexts, and to a large extent through its user-friendly design as well. Our interaction with technology works precisely because we cannot take a neutral stance towards it.

But how did we actually get to the point where we now have a "touchy-feely" attitude towards an existence that is actually intensely alien to humans? As shown on

the article in the twentieth century, technology was humanised both from an epistemological and practical perspective, or to put it another way, it was integrated into human society. This blurred the boundaries and reduced the distance between man and machine: technology became practically invisible to us.

The technical possibilities have a normative effective on people, as demonstrated by the smartphone, for example. Constant availability, route planning using Google Maps, or our digital self-image on countless social media appear to connect us seamlessly with reality. But all these applications require the small, unobtrusive end device that fits our hand so easily. This is where the outside world becomes our "shared world".

New machines, technical milieus and digital working environments undoubtedly change the image of man and machine in both a discursive and practical context. The tram driver of the 1920s or the pilot of the 1960s worked with very different technical systems from today's totally networked user.

But the human condition has an equally powerful influence on technical realisation. One question I find particularly interesting here is how, and why, man-machine interactions are conceived and constructed based on a model of interhuman relations and anthropological/humanist notions. The various players in Machine Learning or Affective Computing try to shape technology according to human criteria so as to make them seem less alien and facilitate interaction with them. The major fear that humans could become "mechanised" is allayed by the reassuring fact that technology eventually becomes naturalised. Maximising user-friendliness is thus synonymous with minimising anxiety.

The new technologies are rhetorically anthropologised, linearised and finalised. Interestingly, in the modern discourse on technical sciences, it is no longer dystopian post-, trans-, or anti-humanistic images that are invoked, but rather classical humanist-anthropological ones. An anthropocentric interface design like Siri or Alexis is successful because it fosters acceptance, trust and efficiency in human-machine interaction. Michel Foucault rightly demands that the sciences should waken from their "anthropological sleep" and stop "speaking of man, of his domination and of his liberation". But the same anthropological sleep has become rhetorically and practically significant in man-machine design. (FOUCAULT, 2004, p. 371)

Anthropology, humanism and anthropocentrism are efficient from both a commercial and design-technology perspective. The design is geared entirely to the user, in other words the living, thinking and breathing person. This anthropological signature of the technical dimension is necessary for us to be able to manage, use and live with the technology. The problem of anthropocentric technology could therefore lie precisely in the fact that there is no longer any problem using it. Technical applications therefore convey a naturalness that needs to be scrutinised and analysed regarding their structure, arguments and practices. Debates are bound to continue about the technical substitution or optimisation of humans, which either play man and machine against each other, or try to merge the two. But that's why a concrete reflection on the technical and anthropological issues is all the more important

(FARAJ, AZAD, 2012): otherwise the subtle problem of technology as an intuitive application in our lives will be obscured too quickly by abstract pros and cons.

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