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Can We Think Computation in Images or Numbers?

Critical Remarks on Vilém Flusser's

Philosophy of Digital Technologies

1. Intelligent machines, criticism and techno-imagination

Vilém Flusser's vision of the universe of computation comes close to Friedrich Kittler's view on computer technology and its impact on culture, on knowledge, perception and imagination. As Flusser states in *Towards a Philosophy of Photography*, all apparatuses are "calculating machines" (2000: 31). They "simulate thinking in the sense of a combinatory game using number-like symbols; at the same time, they mechanize this thinking in such a way that, in future, human beings will become less and less competent to deal with it and have to rely more and more on apparatuses. Apparatuses are scientific black boxes that carry out this type of thinking better than human beings because they are better at playing (more quickly and with fewer errors) with numberlike symbols." (2000: 32)

While Flusser and Kittler agree on the main point of the argument, computers carrying out calculations more effective than human beings, Flusser's formulation "simulate thinking" seems to refer to thinking as a capacity of man, the mind or spirit ("Geist"¹), transferred to computers – an idea Kittler dismisses. As opposed to Flusser's idea of simulating human thinking by machines, Kittler indicates that "thinking" is rather a metaphor for technical operations, which can be performed by computers or by calculating human beings². In effect, the arguments converge: thinking in numbers can be mechanized and evolves in computing beyond calculations performed by human beings. "The spirit becomes an object of technical manipulation and can thus be simulated. All functions of the mind, starting with perception ending with decision making ('artificial intelligence') can be objectified, which means transferred from human beings to objects." (Flusser 1998: 18/19, my translation)³. As a consequence of this "transfer" or rather, from the kittlerian viewpoint, technical deconstruction of "thinking", philosophical reflection – thinking this thinking – has to be part

¹ The title volume „Die Austreibung des Geistes aus den Geisteswissenschaften“ from 1980, edited by Kittler, has become a slogan of German media theory or „Medienwissenschaft“ (Media Studies); Kittler elaborates his approach in *Discourse Networks 1800/1900* (1990) and *Grammophone, Film, Typewriter* (1999) – today canonic texts of German media theory.

² Human beings can in this sense be called "calculating machines", as in Alan Turing's definition: "A man provided with paper, pencil, and rubber, and subject to strict discipline, is in effect a universal machine." (Turing 1948/1968: 5).

³ Translated from German: "Der Geist wird zum Objekt technischer Manipulation und daher simulierbar. Alle ‚mentalen‘ Funktionen, angefangen von der Wahrnehmung bis zur Entscheidung („künstliche Intelligenz“) werden von jetzt an objektivierbar, und das heißt vom Menschen auf andere Objekte übertragbar."

of the technology as well. Reflection can be considered a function of computation: feedback loops or machine learning can thus replace the philosophical notion of thinking and philosophy itself. Flusser however does not abandon philosophy, which is obvious not only in *Towards a Philosophy of Photography*, where Flusser specifies this new philosophy as *criticism* (Flusser 2000: 33) which allows to „win out against the camera’s program“ (ibid.: 48) . A task difficult to perform, if we tie thinking (as well as perception, decision making etc.) to technical operations and more precisely to computer technology. Thinking and reflection are in this case a function of the apparatus – “Thinking itself proves to be a knot in a calculated network” (Flusser 1998: 21, my translation)⁴. There is no room for critique, which would not be part of the program, but an *intervention* into the program, criticizing the program as such, the way in which it shapes our perception, experience, knowledge.

It seems that Flusser tries to escape this „closed circuit“ of mechanized thinking by the “visual poetry” (Flusser 1995b: 271, my translation) of technical images, generated by computers. Philosophy is replaced by a new „techno-imagination“ (Flusser 2000: 88; Flusser, 1998b: 15) that allows to reflect the non-sensual, imperceptible processes of computation. As Flusser emphasizes in an interview with Florian Rötzer in 1991: “We have a new kind of images. We have images that visualize forms of thinking. There are numerically generated images which, let’s say, make platonic forms visible on the monitor. This opens a new area of a non-discursive philosophy, a philosophy that works with images.” (Flusser 1996b: 228, my translation)⁵. This is a noteworthy turn in Flusser’s narrative⁶ that explores the connections of image, writing and number: first of all he links critical reflection to writing – texts explain images, “unroll” images, placing their elements into a line (Flusser 2002: 37), producing stories and history, causal relations and science. “Only one who writes lines can think logically, calculate, criticize, pursue knowledge, philosophize [...]. Before that, one turned in circles.” (Flusser 2011: 7). “Numerically generated images“ however “do not signify history or facts but algorithms. They are images of pure zero-dimensional thinking.”

(Flusser 1996b: 174, my translation)⁷ Flusser himself addresses this paradox of two-dimensional images representing zero-dimensional thinking: these images are not really surfaces, but constellations of particles „appearing like surfaces.“ “It doesn’t matter if it is produced by artificial intelligence or still by human programmers – the calculations generating these images – their ‘program’

⁴ Translated from German: “Dabei zeigt sich das Denken selbst als eine Verknotung eines kalkulatorischen Netzes.“

⁵ Translated from German: “Wir haben neuartige Bilder. Wir besitzen Bilder, die die Formen des Denkens ansichtig werden lassen. Es gibt numerisch generierte Bilder, die, sagen wir einmal, platonische Formen auf dem Monitor anschaulich machen. Hier öffnet sich das Gebiet einer nicht mehr diskursiven, sondern mit Bildern arbeitenden Philosophie.“

⁶ Flusser links his concept of history – “Geschichte” – with telling stories (“Geschichten”), both effects of thinking in lines.

⁷ Translated from German: „bedeuten nicht Geschichte oder Sachverhalt, sondern sie bedeuten Algorithmen, Es sind Bilder des reinen nulldimensionalen Denkens.“

– is a probability calculation.” (Flusser 1995a: 58) ⁸ Computation is based on a mathematical ‘imagination’, which deals with numbers, not pictures. Thus Flusser’s (hi)story doesn’t seem to provide an explanation for the new “techno-imagination” transgressing the program of calculating machines – a kafkaesque apparatus, as criticized in *Towards a Philosophy of Photography*: “Functionaries control a game over which they have no competence.” (Flusser 2000: 28)

Flusser is clearly not as consistent as Kittler who stresses a non-hermeneutic to technology. Computers from this perspective do not realize platonic ideas – accessible by intuition in logical thinking – but rather proves ideas to be an effect of a technique of manipulating symbols. A logical a priori is replaced by a technological one: technology determines what is thinkable, imaginable. We have to think in numbers in order to understand computation – and not just try to imagine what computers do. If, however, we only think in numbers, we remain functionaries of the apparatus: there is no outside, nothing non digital (or “digitalisable”), nothing that cannot be calculated.

2. The alphanumerical code

We shall have a closer look at Flusser’s history of abstraction, focusing on the “calculable basis of our thinking” (Flusser 2011: 15), the “calculating, formal consciousness” (Flusser 2002: 128), which plays such an important part in the constitution of the universe of computation, but seems to fade into the background in the universe of technical images.

In the essay “The emigration of numbers out of the alphanumerical code” [Die Auswanderung der Zahlen aus dem alphanumerischen Code] from 1991 (published 1996) Flusser characterizes thinking in Descartes’ sense as „clear and distinct perception“, corresponding with the structure of arithmetics: „The numerical series is ‚clear‘, that means, each number is univocal, definite, and it is ‚distinct‘, because every number is distinguished from its precursor and successor by an interval. And nature (in Descartes’ sense) is understood as a gapless set of points [...]” (Flusser 1996a: 10, my translation)⁹ Writing then has a similar structure, following Flusser’s description as mentioned above: writing “enrolls” images assembling elements in lines. Writing and number are closely intertwined as symbolic systems, both based on graphic notation. Along the line of Flusser’s history, from early Modern Age on it becomes apparent that numbers serve scientific knowledge better

⁸ Translated from German: „Ob er nun automatisch von künstlichen Intelligenzen oder vorläufig noch von menschlichen Programmierern vorgenommen wird, der Kalkül, dem diese Bilder entstammen – ihr ‚Programm‘ – ist eine Wahrscheinlichkeitsrechnung.“

⁹ Translated from German: “Denn die Zahlenreihe ist ‚klar‘, das heißt, jede Zahl ist eindeutig, und sie ist ‚deutlich‘, da jede Zahl von ihrer Vorgängerin und ihrer Nachfolgerin durch ein Intervall unterschieden ist. Und die Natur (im Sinne Descartes’) wurde als eine lückenlose Menge von Punkten, als ‚konkret‘ (*concrevere* = Zusammenwachsen) verstanden.“

than , “nature cannot be described, but calculated” (ibid.: 9). This “calculatory reason” (ibid.: 12) is at its peak, when it seems possible to calculate all there is, when man seems to become all-knowing and almighty. Flusser’s vision of the universe of computation clearly follows this evolution of mathematical thinking: “Thanks to differential equations everything in the world that can be conceived of can be formulated and formalized. Formal mathematical thinking can recognize everything and offers models that allow to produce everything [...]” (Flusser 1997: 206)¹⁰ Advanced mathematics goes beyond the understanding of nature – it doesn’t seek the correspondence with *res extensae*, with any thing. Implemented in computers, mathematics grants us the freedom to create new worlds, independent from reality: „In these projected worlds, everything conceivable mathematically can be done – even what is impossible in our environment like four dimensional bodies or Mandelbrot sets.” (ibid.: 211)¹¹ Flusser’s history of abstraction is directed towards this zero-dimensional universe: a universe of freedom – or “a totalitarian tendency to the quantification of all qualities” (Flusser 1996a: 11). Reality can be manipulated – if it is reduced to that which can be calculated. Numbers, calculations are not *one* “model” structuring the world, shaping thinking in a certain way – different than writing or images – they are the real or the “the transcendental-technical, the condition for the empirical as such” (Hansen 2006: 9).

Flusser’s first book from 1963 *Lingua e realidade* proves how much he was influenced by the philosophy of language before World War II which finds a bridge between language and mathematics in mathematical logic. “The structure of the universe can be identified with language“ (Flusser 1963/2005: 41, my translation¹²): , states Flusser in the introduction to his book; „knowledge, reality and truth are aspects of language“ (ibid.). This structure of language, logic, then can be reflected by a mathematical ,metalanguage‘. This metalanguage becomes more and more formal and structural, and suppresses more and more meaning. “The highest level, ,the level of algebra, would be purely formal, it would imply all languages and mean *nothing*.” (ibid.: 148) At this point Flusser anticipates his later reflection of the universe of computation as a completely abstract and empty universe, arguing that in the sense of this formal logic, “the electronic brains will be free, too” – in the sense of a “mechanic freedom of the re-combination of defined and given elements” (ibid.: 139)

The *tension* in the alphanumeric code, accentuated by Sigrid Weigel in her Flusser lecture “Die „innere Spannung im alphanumerischen Code“ (Flusser)” [“The ‘innertension in the alphanumeric

¹⁰ Translated from German: "Tatsächlich kann mittels Differentialgleichungen alles Erdenkliche auf der Welt formuliert und formalisiert werden. Das formale mathematische Denken kann alles erkennen und es bietet Modelle, nach denen sich alles herstellen lässt".

¹¹ Translated from German: „In diesen projizierten Welten ist alles, was mathematisch denkbar ist, auch tatsächlich machbar – selbst das, was in der Umwelt ,unmöglich‘ ist wie vierdimensionale Körper oder Mandelbrotmännchen.“

¹² Translated from the Czech version of *Lingua e realidade*, translated by Karel Palek, with reference to the pages in the Portuguese original published by Annablume (2007).

code' (Flusser)"] (Weigel 2006), shows a way across the linear evolution of abstraction towards an empty mathematical universe, focusing the tension between the referential use of the alphabet as an instrument to express meaning conveyed by language and the "operative" use of graphic symbols¹³ like letters or numbers and other signs like quotation marks: » or ? are symbols, that signify the gesture of writing, notes Flusser in his essay "Praise of Superficiality" (Lob der Oberflächlichkeit). This question draws attention not to language, but writing – as a specific (cultural) technique. This manner of reflection on the different and related ways of thinking in writing and in numbers may be considered a starting point of Flusser's media-philosophical approach – not following a technical logic, but criticizing it.

3. Computation and technical images

Flusser's linear history of abstraction starts with human beings embedded in their surroundings, continues with them grasping objects, then abstracting scenes, representing them in images, writing explaining images to the last step of abstraction leading to the completely abstract, empty, zero-dimensional universe of computation. As we have seen, the last step is a matter of first and foremost numerical thinking, connected to writing. This connection seems crucial for the future of critical reflection beyond the universe of texts – beyond a discursive philosophy. However, trying to reflect the new consciousness, Flusser turns not to calculations, but technical images – as images of concepts, visualizations of scientific texts (not computations). To come back to Flusser's narrative: In prehistoric images human beings do not grasp objects any more (e.g. bulls), but "manipulate surfaces to represent objects (e.g. bulls)" (Flusser 2011: 12). Technical images then "signify texts, not the world out there. The imagination that produces them involves the ability to transcode concepts from texts into images; when we observe them, we see concepts - encoded in a new way of the world out there." (Flusser 2000: 15) Technical images do not depict objects or scenes but "visualize" – in the computed universe "particles are assembled into visible images. This emerging universe, this dimensionless imagined universe of technical images, is meant to render our circumstances conceivable, representable, and comprehensible." Abstract algorithms are thus made palpable or vivid. However, as Flusser stresses in *Towards a Philosophy of Photography*, technical images also work in a magical way¹⁴, a "magic of the second order" (Flusser 2000: 17): they seem to depict the world as it is or even to serve as "windows" to look through to see the real world – concealing

¹³ Discussed by Sybille Krämer (2005: 23-60) and others.

¹⁴ The prehistoric magical world is a "world of the eternal return of the same, in which everything lends meaning to everything else and anything can be meant by anything else." Flusser 2011: 13.

that they are surfaces with a symbolic content. Looking at technical images not seeing them as images is a regression to a prehistoric consciousness – combined with the historical model of “true” (scientific) depiction – but how do we perceive images on the “entirely different level of consciousness” (Flusser 2011: 13) of the universe of computation?

In the famous last scenes in the 1999 film *THE MATRIX*, where Neo, the hero, having understood that the phenomenal world he considered real is in fact a computer simulation, realizes that he can act *inside the code*, not only within the images (of the “real” world, projected by the machines directly into the brain of human beings). Neo is in *THE MATRIX* part of the code, but not completely determined by the program – a tricky constellation extended in the sequels.



THE MATRIX (L. & L. Wachowski, 1999)

Neo intervenes in the *code* and not only the reality he sees (in which he is used to act in a certain way, according to certain rules – gravity etc.). The image thus shows the *unimaginable*: in order to understand the code, reach the level of consciousness adequate to the code, Neo has to stop to think in images. If we would consider this image from the Matrix a reflection of technical images¹⁵, we can do so with and against Flusser’s concept: the code is here of course just depicted – as “green rain”. Technically, it doesn’t make sense to visualize the code: we can easily have a look at the

¹⁵ We would have to have a closer look at the digital special effects, too, transforming the film into a “computational” image.

source code of a website, but we cannot see how the code is *executed*, we cannot perceive the processing of data which are crucial for computation¹⁶. The code is clearly alphanumeric, not linked to visual thinking – definitely not to traditional or prehistoric images.

Following Flusser in his critique of technical images we have to radically question the representational model implied in the “imaginative consciousness” “infected with conceptual thinking” (Flusser 2011: 13) – leaving behind the focus on the image and visualization as a representation of ideas. Only if we understand visualization as “operative”, the surface really becomes significant: looking at images (and apparatuses) *constituting* what there is, what can be identified, conceptualized, calculated, like the telescope¹⁷, scientific visualizations of the DNA etc.¹⁸ – not *representing, depicting* algorithms inside the computer, calculations and computations, which do not need to be visualized at all. And of course we mustn’t forget all the “operative” images used in surgery, construction, astronomy, warfare etc. – images analyzed by the computer as a set of data, not looked upon as images by anybody. While in Flusser’s time, due to graphic interfaces, the new universe may have seemed to be a visual universe, in today’s more and more pervasive models of augmented reality and smart things, computations are no longer dealt with only in images: 3D interfaces controlled by gestures, the movement of bodies in space and non-conscious measuring of temperature etc. have very palpable, concrete effects, but do not require a symbolic interaction of the visual nor the alphanumeric type¹⁹.

Images of course still play an important role in culture and have in the last 20 years again and again become the starting point of exploring thinking beyond discourse and speaking with Flusser, the linear discourse. The link between image and number though tends to push the specifics of numerical thinking into the background, preferring the vivid and seemingly obvious image.

The “Next Rembrandt”²⁰, a picture generated by a computer based on the analysis of Rembrandt’s paintings, might be described using Flusser’s idea of a technical image as an image of

¹⁶ With bigger apparatuses we can still *hear* (and sometimes feel) that they are “working”, but this concerns the more mechanical parts of the machine – themselves getting more and more silent.

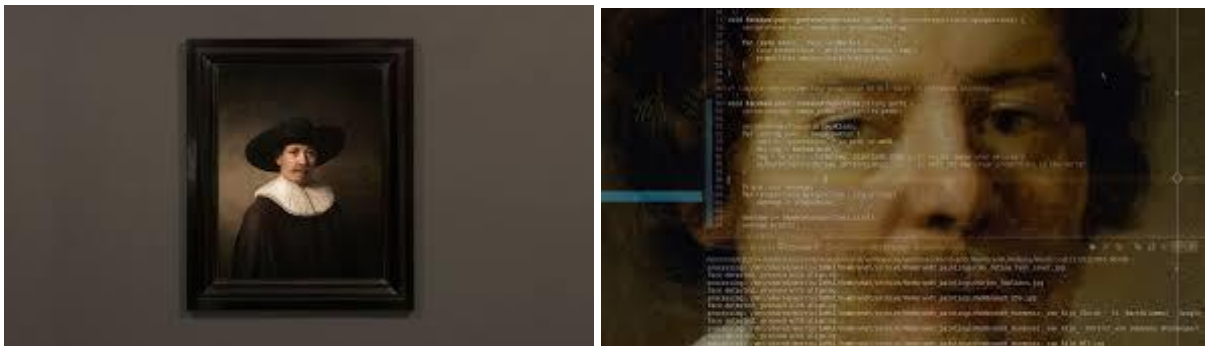
¹⁷ Referring to the famous article by Joseph Vogl “Medien-Werden. Galileis Fernrohr”, published in: *Mediale Historiographien*, 1 (2001), p. 115--123

¹⁸ Hans-Jörg Rheinberger is one pioneer of this kind of a historic epistemology in the field of biology and beyond (Rheinberger 1997). Recent theoretic and visual examples are presented in the exhibition + *ultra. gestaltung schafft wissen* of the Cluster of Excellence Image, Knowledge, Gestaltung in the Martin-Gropius-Bau Berlin, 30.9. 2016 – 8.1.2017.

¹⁹ Flusser’s notion of a gesture offers a theoretical model that might be used to reflect these interfaces, as Barbara Büscher has pointed out in her essay “Medial Gestures. On the ‘decipherability’ of techno-images (Vilém Flusser) and their production”, in: *MAP #7* (2016), <http://www.perfomap.de/map7/media-performance-on-gestures> [accessed 7.11. 2016]

²⁰ The project has involved data scientists, developers, engineers and art historians from organisations including Microsoft, Delft University of Technology, the Mauritshuis in The Hague and the Rembrandt House Museum in Amsterdam. It was developed by the advertising agency J Walter Thompson in Amsterdam for its client, ING Bank.

concepts, scientific theories: the “painting”²¹ is based on the analysis of the compositions, motifs, colors, materials, painting techniques etc., informed by knowledge from art history. These are used to create algorithms that can identify patterns and re-combine the distinctive features of Rembrandt’s paintings – creating a painting that is not just a copy, but a new picture that looks like a Rembrandt. The interesting part of the project is however not so much the concrete (printed) painting, but the scientific analysis connected to the creation of an algorithm, the mathematical and computational ‘imagination’ – the program and the printing runs automatically. The creativity here is not linked to the visual thinking of a painter, thinking *in* painting, creating an image as a performance, tied to a bodily presence, perception, skill, and material conditions. The “new Rembrandt” can be reproduced like a photograph, ‘his’ algorithm used for other purposes etc. Looking at the new Rembrandt we can thus exercise a different approach to technical images, a different level of consciousness, not looking at it like at an old Rembrandt painting in Den Haag, but the theoretical and technical analysis (and production) of a Rembrandt “style”.



“The next Rembrandt”, <https://www.nextrembrandt.com/>

4. Thinking in numbers, images, writing

In contrast to Flusser’s idea of the universe of computation as a universe of technical images I would like to stress the non-representational character of computation. Computers deal with symbols on a completely different level than images and texts and it makes no sense to interpret this processing, storing, transmitting as we do interpret images or texts. Computers work and function (in a different way than images or texts). Interpreting images does not help to understand what

²¹ The picture was in fact printed in a special procedure, creating the painting in 13 layers of paint-based ink. See <http://www.digitaltrends.com/cool-tech/the-new-rembrandt/> and <https://www.nextrembrandt.com.> [accessed 9.11. 2016]

computers *do*. Computer interfaces do not represent what is happening in the computer, they exist merely to provide access to the functionalities of the computer.

Kittler's emphasis on a non-hermeneutical approach to computer technology on one hand avoids the fall back to an imaginative and historical thinking as described by Flusser. Flusser on the other hand tries to avoid the obscurity of the computational universe, so to speak, the non-human, non-sensual, dimensionless, abstract universe governed by calculating machines. His history however is oriented towards this universe, as far as he follows the concept of thinking informed by mathematical logic. If mathematics allows to elaborate logic abstracted from language, and computation allows to implement mathematics, computation replaces thinking – *this* kind of thinking. *Logical-mathematical thinking* can be performed by (mathematical) machines much more effective than human minds. On the verge of the universe of computation however we also get the chance to reflect this kind of thinking – as a thinking dependent on media, like the imaginative thinking and thinking in writing. The crisis connected to the end of the universe of texts and the „leap“ facing the universe of calculation-computation in Flusser's history and story of abstraction, I suggest, is the key to a critical reflection (or reflection as critique) of computation – which cannot be accomplished merely by analyzing technical images.

Drawing on Heidegger's critique of the techno-scientific worldview²⁴: understanding the scientific concepts behind technical images and creating new realities re-combining these concepts (transforming scientific theories into algorithm) is an appropriate next step in the history of logical abstraction – and corresponds with the worldview Heidegger deconstructs: the free manipulation of everything according to scientific concepts, implemented in technology.

In Heidegger's view, science and technology collapse into technoscience: we only discover in reality what we have *produced* as real. In science, to understand means, in fact, to manipulate. Scientific knowledge does not formulate real questions but determines what can be found out at all. Which means: We understand only what we can compute, what can be 'recognized' (as a technical term in informatics), or digitalized.

Heidegger did not anticipate what intelligent machines could do and “learn” in the future, but his analysis of the danger of reducing knowledge, understanding to “calculatory reason” seems today even more relevant. Flusser's vision of the universe of computation, apparently inspired by cybernetics, perfectly illustrates this danger: the universe is completely abstract, it follows mathematical rules that are completely formal, refer to nothing. This universe of logic corresponds with the structure of reality (it proves right), because reality can be calculated – a closed circuit. Given

²⁴ For a more detailed analysis of the parallels and tensions between Flusser's and Heidegger's question of technology see Krtilova 2015.

reality can never be completely grasped in numbers, because things slip through the intervals between the numbers, in Flusser's terms – unless reality is *made* calculable, manipulated, produced by calculating machines. In the universe of computation there might be different realities, but they are all computed.

In terms of THE MATRIX: If he was a mere “knot in the calculated net”, Neo could not understand the Matrix *as* the Matrix. His intervention would be just a part of the program. Heidegger's answer to the end and the task of *thinking* (the two meanings of the German word “Aufgabe”) as an intervention is to radically change it – not following scientific-technological knowledge. Not thinking inside the program, calculating, but seeing it *as* a program. Flusser, we could argue, undermines his own ‘matrix’ of mathematical logic in this sense, understanding text and image, instruments and scientific theories as ‘mediations’:

“Both text and image are ‘mediations’. For a long time, this was not easy to see because the orthographic rules (above all logic and mathematics) produce far more effective actions than the magic that had come before. And we have only recently begun to realize that we don't discover these rules in the environment [...]; rather they come from our own scientific texts. In this way, we lose faith in the laws of syntax. We recognize in them rules of play that could also be other than they are [...]” (Flusser 2011: 9/10). This step of abstraction allows to think techniques, practices, artifacts or symbolic systems as *media*.

A “medial” reflection then is a different one than the “metalanguage” of mathematics. It is reflection in the sense of optics, referring to Heidegger's notion of “reflection”, opposing Husserl's method of reflection (Heidegger 1997: 226), not reducing reflection to the metaphor of a mirror, but stressing the refraction of light. In this sense, media practices and techniques allow a “*side glance*”²⁵, as Dieter Mersch suggests (Mersch 2008: 309) on the “logic”, the rules of the discourse, and, in a broader sense, the “models” of different universes. A reflection Flusser in fact *performs* – transgressing logic and holding on to writing, instead of numbers.

In this sense, computing has to be understood as a mediation, *one* way how to deal with the world, bearing in mind “the rules of play could also be other than they are”.

²⁵ Mersch characterizes this “method” (which escapes the scientific definitions of a method) referring to Heidegger's philosophy of language: “All talk that finds itself “on the way” to language has already “marked” this in talking, that is, has *modified* it. The philosophy of language therefore cannot discover language directly (as philosophy of media cannot discover media themselves), but only traces of such modifications, and one has to constantly move and displace language in order to tease out different, surprising and unexpected channellings, just as is the case with the mediality of media.” Mersch 2008: 307; quoted from the English version “Tertium datur. Introduction to a Negative Media Theory”, published in *Matrizes*, Vol. 7, No. 1 (2013), p. 211/212. Retrieved November 20th 2016 from: <http://www.revistas.usp.br/matrizes/article/view/56654>.

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