Media Ontology and Transcendental Instrumentality.

Journal:	*Theory Culture & Society*
Manuscript ID	16-219-POST.R2
Manuscript Type:	TCS - Standard Article
Key Words:	media ontology, techne, instrumentality, machine philosophy, computational logic, information theory, machine learning art
Abstract:	This article takes inspiration from Kittler's claim that philosophy has neglected the means used for its production. Kittler's argument for an ontology of media invites us to reflect upon the cybernetic mechanization of logic, which has led practical or instrumental knowledge to challenge the classical division between theory and practice, ideas and demonstrations. This article suggests that procedures, tasks, and functions are part of an instrumental thinking. By drawing on information theory and the mathematical logic of constructivism, the article addresses indeterminacy within automated logic and proposes a re-habilitation of instrumentality whereby the connection between means and ends is articulated away from classical idealism and analytic realism. By following John Dewey's argument for instrumental reasoning, the article suggests that post-Kantian critique of techne shall be revisited in order to account for a machine philosophy, which has originated from within the practical thinking of machines.

Media Ontology and Transcendental Instrumentality.

Abstract

This article takes inspiration from Kittler's claim that philosophy has neglected the means used for its production. Kittler's argument for media ontology will be compared to the post-Kantian project of re-inventing philosophy through the medium of thought (in particular Deleuze's Spiritual Automaton). The article discusses these views in the context of the automation of logical thinking where procedures, tasks, and functions are part of the instrumental processing of new ends evolving a new mode of reasoning. In particular, the article suggests that in constructivist logic and information theory, the temporal gap between truth and proof, between input and output, can be taken to argue that the means of thought expose the indetermination or the incomputability of proof. The automation of reasoning in logical processing coincides not with mindless correlations of data, replacing axioms with data, truths with self-validating proofs. Instead, the problem of the indeterminacy of proof within automated logic re-habilitates techne or instrumentality, and the relation between means and ends away from classical idealism and analytic realism. By following John Dewey's argument for instrumentality, it will be argued that the task of thinking today needs to re-invent a logic of techne away from the teleological view of ends or the crisis of finality. If the post-Kantian preoccupations about the task of thinking already announced that the medium of thought could offer possibilities for a non-human philosophy (or a philosophy beyond truth), this article envisions a machine philosophy originating from within computational media.

Key words: instrumentality; media ontology; machine philosophy; computational logic, information theory.

Media Ontology and Transcendental Instrumentality.

In "Towards an Ontology of Media", Friedrich Kittler argues that philosophy has neglected the very medium through which theoretical reasoning has been transmitted (2009). With the modern overlapping of mathematics and media, media can no longer be subsumed to the ontology of human thinking. Instead media are to be understood according to the ontology of machines and the premises of technical knowledge. Kittler's argument for an "ontology of media" suggests that the historicisation (or the concretization) of human practices in machines also marks the end of metaphysics: human thinking is surpassed by a technohistory, a material technobeing. In particular, Kittler points out that Heidegger's warning about the dawn of our computer age is amongst the few philosophical reflections about the configuration of technobeing in history (Heidegger 1969). And yet the implications of this warning, according to Kittler, have yet to be fully addressed.

Kittler's vision of media as a being of techne however is to be discussed in the context of the post-Kantian project of critique of philosophy. If techne takes away from philosophy its ultimate qualities of preserving truths and making decision by reasoning, as Martin Heidegger recognised, it is because the new medium of thought, defined by information sciences, turned thinking into rule-based efficiency (1963). In "The End of Philosophy and the Task of Thinking", Heidegger argued that the cybernetic medium of thought posed a new challenge to philosophy. His preoccupation for cybernetic thinking at once defined the end of deductive truths and the possibility of a new task of thinking.

While Kittler furthers Heidegger's invitation to envision media ontology, his question

for the task of thinking has been central to the post-Kantian discussion about the limits of philosophy, the deconstruction and re-invention of a thought of the medium in practical philosophy. For instance, Gilles Deleuze's materialist philosophy re-works the scope of philosophy in terms of a being of the sensible that emanates from a machine thinking beyond apprehension and conscious cognition (1989). Here media are neither objects nor beings, but are automata of thought affording the outside or the unthought a capacity to disarticulate cognitive rules in mediation.

For Kittler, philosophy needs to be weaved with information technology to overcome human-centered ontology, resulting from the historical automation of Aristotelian logic in machines through the works of Turing, Shannon, von Neumann, and others (2006; 29). Kittler clarifies that this automation of logic already began with mathematical innovations, Greek alphanumeric representations, the Aristotelian split between physics and logic as well as logical and arithmetical models. Media are the visible expression of revolutions in mathematics and physics that shortened the distance between technology and humanity.

While human thought becomes caught in the computer technology however, according to Kittler, the history of philosophy hardly recognised the reinvention of techne with informational intelligence. But Kittler's invective against the shortcoming of philosophy seems to overlook that both deconstructivism and neo-materialism already took media as a starting point to re-invent philosophy beyond truth and of proof. If for Derrida, the medium of writing haunted the logical order of thought, for Deleuze the medium of cinema extended the potentiation of the being of the sensible above consciousness and signification.

While Kittler seems to be fully aware of the possibilities of a media ontology in the deconstructivist image of fragmented thinking, it however seems difficult to

determine how his views extend the post-Kantian critique of human thought, the articulations of an inhuman or machinic thinking beyond the question of being. One may want to ask, can media ontology or the recognition of a material history of media, offer an alternative horizon of thought that challenges the image of computational media as replacing truth with the effectiveness of results? How can the inhuman thinking of the medium reject the image of computational singularity, whereby the mindless automation will replace any need for thought? Can media ontology become transcendental from its own functional tasks?

To address these questions, this article more specifically brings together Kittler's efforts to theorise media in terms of their own instrumental materiality with post-Kantian views of turning the medium into the task of thinking the unthought. One way to bring together these almost opposite propositions is through the pragmaticist account of instrumentality. Borrowing from John Dewey's view of experimental instrumentality, this article does not see the medium as the implementation of ideas into tool. The medium is a productive activity, a means with ends, or a doing imbued within an experimental logic, involving the indeterminacy of results leading to the reconstruction of aims or premises.

From this standpoint, modern techne is not here understood according to the critical theory of instrumentality. For instance, instrumentality in Horkheimer's critique of technology coincides with instrumental reason, namely with the paradoxical condition for which the Enlightenment trust in the rational use of nature has led to an irrational self-repression of human nature, obsessed by a competitive self-preservation mirrored in the indiscriminate dominion of commodity economy (1974, 97-105). The effort to re-habilitate instrumental reason beyond the paradox of criticizing critique requires that one suspends the impasse between the use of the rational capacity of explaining

the causes of economic domination and the argument that economic governance rationalises its aims for profit, through the efficient capacity of means to carry out ends.

This article instead proposes to recuperate from instrumentality an experimental logic in theoretical and practical activities, whereby practice is not simply the doing of pre-existing ideas, but more importantly becomes the means for knowing this and that from knowing how things work. Similarly to Heidegger's quest for the task of thinking, as moving beyond the simple revelation of truth, and together with the post-Kantian theorisation of the medium of thinking as anti-telos, this article suggests that computational media announce a new dawn for instrumentality: not only the evaporation of telos in the practical being of media, but also the origination of a techno-philosophy through the inhuman logic of machines.

If post-Kantian articulations of posthuman thought had already re-habilitated instrumentality as demarcating the end of telos, the transformation of computational logic in machines can further offer us new possibilities for re-articulating what it is to think, what have reasoning and knowledge become in and through this medium. Instead of declaring the end of reason, truth, and axiomatics in the age of data-centered epistemologies, this article argues for a renewed engagement with a transcendental instrumentality that is of a possibility of machines to think beyond what they do.

It could be argued that one way to account for this mode of transcendental instrumentality is already at work in recent investigations about what machines see and how do they interpret the world. For instance, the work presented at the exhibition *I am here to Learn, On Machinic Interpretation of the World* (The Frankfurter Kunstverein, 2018), pays particular attention to how automated decision

making includes the transcendental becoming of the instrument. Shinseungback Kimyonghun's work for instance brings forward this indeterminacy in automate decision as when algorithms start seeing flowers patterns that do not correspond to the image of a flower as we know it (http://ssbkyh.com/works/flower/). Drawing from similar artworks that reflect upon this crucial aspect of machine learning, this article suggests that what appears as a form of misrecognition, error, and doubt, is instead part and parcel of automated reasoning, which is here understood in terms of transcendental instrumentality. This article will draw on some of these instances of machine visions as practical attempts at exploring transcendental instrumentality and discuss how machine learn to interpret and understand, and thus think the world.

The post-Kantian discussion of posthuman thought in the age of computation is already a way to re-direct the critique of informational media away from the view of the eclipse of reason, which also rejects the dominant image of big data as determining the absence of meaning in the practical knowledge of machines. To re-direct our critique of technology today requires that the task of thinking with and through machines is re-invented. From this standpoint, the transformation of logic in machine thinking importantly shows us the temporal indeterminacy between truth and proof, which can be taken to re-define the instrumental relation between means and ends. The question of what has the task of thinking become with and through the computational automation of thought coincides not with the triumph of means over ends, but with instrumentality affording the medium of thought its own mode of reasoning and de-naturalisation of knowledge in human culture.

If we take for instance artist Fito Segregra's installation *The Treachery of [Soft]Images* (2016), it is possible to track how machine interpretations of objects (from a pipe to a broom, a sponge and a jar) do not just reproduce the corresponding

category of the object, but become instances of a new conceptual reality (http://fii.to/pages/the-treachery-of-soft-images.html). Similarly, Shinseungback Kimyonghun's installation *Cat or Human* (2013), uses cat facial detection algorithms to recognise human's faces and human faces facial detection algorithms to recognise cat's faces (http://ssbkyh.com/works/cat_human/). As a result, these facial detection algorithms impart a de-naturalization of what we know of both human's and cat's facial features, by detecting humans traits in cats and the other way around. From this standpoint, these investigations into the computational medium of thought also point to the specific importance of fallibility in automated reasoning: namely the new data categories of objects are invented and do not correspond to the images of objects inputted in the system. But how to distinguish between what machines learn beyond their function of data aggregation and what instead remains simply a reproduction of the already known?

Central to this discussion are three steps in the transformation of the deductive model of knowledge shifting from truths to proofs, from theoretical reason to the practical procedure – or instrumentality – of machine thinking. First, it discusses the implementation of mathematical postulates in the Turing Machine as the point at which the limits of Hilbert's meta-mathematical project challenged the infallibility of theoretical knowledge. It then draws on Brouwer's constructivism in logic (1913) to provide examples of how temporality in logical practices involves proof-validation and not self-consistent truths. Here proofs are not simply the result of an automated and mindless correlation of data, but this means of thought imply a form of actuation doubled by the indeterminacy or futurity in proof-validation.

Similarly, Turing's famous halting-problem showed that it was impossible to know in advance whether and when a program will stop. This fallibility or incompleteness of

theoretical knowledge was set in action in computational machines. The demonstrative function of techne – as application of theoretical knowledge - is here catapulted by the realization that proofs cannot be derived from given truths. Another important step in this argument about instrumentality involves a discussion about how this temporal gap in logic was central to the development of algorithmic information theory (Chaitin 2005). Since computational logic is based on the probability of results, it involves the finding of proofs that may or may not validate the premises of the programme. Similarly to constructivism in logic, the question of information complexity in computation, that is to what extent it is possible to compress random strings of data into intelligible algorithms (i.e. probabilities), cannot be fully exhausted without accounting for the experimental (or future) validation of results. In complex information systems, not only incomputables cannot be compressed in smaller and finite sequences of algorithms, but they also expose dynamics in computational logic, where proofs preserve degrees of indeterminacy.

The consequences of this method of truth-experimentation (or experimental axiomatics) are important to consider here: if the dawn of computation has meant the completion of philosophy in the efficiency of proof-making, the task of philosophy requires that thinking includes the machine practices of working through indeterminacy. In both computational logic and information complexity theory, this margin of indeterminacy is the incomputable of any system of truth and proof, of ideal and empirical methods of knowledge. Even if some practical solutions have been implemented in computing to skirt around the problem of the incomputable (for instance, the use of exceptions, a routine in a program and in an operating system on a standard computer), computational logic is set not to eliminate but to work through the problem of indeterminacy.

With computation, therefore, the medium of thought has not simply replaced theoretical thinking with the operational efficacy of task findings. As argued later, computational logic and information processing show that the practice of searching for truth is rather an experimental logic involving a retro-active validation (confirm, discard, or revise) of truths.

By bringing together Kittler's proposition about a media ontology and the post-Kantian re-envisioning of the image of thought in Gilles Deleuze's notion of the "Spiritual Automaton", this article concludes that the medium of thought in the age of computation could be understood in terms of a transcendental instrumentality beyond the big data image of automated knowledge.

Automated knowledge

As automated systems become increasingly intelligent and capable of making decisions, it is no longer possible to deny the profound threat that the age of machine thinking has unleashed on human culture. From the call to arms about the existential risk of human extinction to the global plans for full automation and transhuman singularity, the foundation of knowledge in the humanities, classically centered on the distinction between theoretical and practical reasoning, has become redundant to human culture itself. If the ontological in-distinction between human and machine thinking is animating debates about the danger that artificial intelligence will pose to human autonomy on the one hand (Bostrom 2014) and about how automation is accelerating the capitalisation of thought and life itself on the other (Terranova 2014), the very question of what counts as knowledge has to be revised. The automation of knowledge cannot be disentangled from the transformation of the humanities, and from how the task of thinking conforms to the efficiency of big data and algorithmic mining of over reality.

Automation today does not involve the industrial assembly of movements or the acceleration of networks that characterized the 20th century. It no longer embodies the mechanics of Newtonian physics based on a repetitive cycle of cause and effects (Longo 1999). Since its expansion in the decisional models of cognition, automation has entered the temporality of reasoning (that is, of the time between truths and proofs) and has unleashed a mode of knowledge production that is self-sustaining, continuously feeding from the deep sea of data. Algorithms talk to other algorithms (through set protocols and through learning) without communicating with us and draw conclusions by correlating data (images and texts, sounds and locations) across parallel and distributive networks. From High Frequency market trading to security data prediction, from military to commercial logistics, automation today seems to have debunked the dominance of theoretical knowledge and its axiomatic truths: what is known in theory is confronted by algorithmic processing interacting with the external world of data. In other words, automation no longer is the application of given truths but challenges the very fundament of the philosophical autonomy from instrumental knowledge.

In the *Republic,* Plato wrote of the Socratic distinction of craft knowledge from philosophical logos and argued that craft knowledge only concerns technical understanding that can be used to define the pursuit of a particular trade or practice (Grube and Reeve 1992, *Book VIII*). Craft knowledge must be instrumental to something. The water clock, the astronomical orrery, the mechanical puppet are all primordial automated devices that are used to demonstrate or describe something. Craft therefore reflects practical understanding and is to be distinguished from philosophical knowledge, which is rational, of a mathematical order and requires no instruments. Whilst technique coincides with primitive automata, which are

thoughtless and mainly concern practical understanding, philosophical knowledge involves the cultivation of the principles of all things. It is ideal and timeless.

Fundamental to the humanities is this bifurcation between thinking and instrumentality, abstractions and applications. The origin of human knowledge is attached to the division between knowledge (theory) and knowing (practice), whereby the philosophical method is set to prove *how we know that we know* (i.e., how knowledge can be demonstrated). The pristine hierarchy of this model however was changed with the design of logical systems that demonstrate the mechanisms of thinking. Whilst for Plato, the a priori existence of a mathematical order of ideas would sustain the foundation of knowledge that could then be applied and demonstrated practically, the search for a logical system that could instantiate the mechanisms of knowledge was central to Gottfried Wilhelm Leibniz's *calculus ratiocinator*.

In the 17th century, Leibniz devised a model of knowledge in the form of a logical calculation framework based on theoretical premises. The calculus rationcinator was designed to automatise the working of thinking and the production of knowledge. Its scope was to perform logical deductions within the framework set by what Leibniz called *characteristica universalis*, a universal language whose symbolic structure could automatically express the structure of concepts and their recombination. This mechanism of and for knowledge was intended not to simulate human cognitive capacities, but to establish, according to the deductive principle of sufficient reason, the universality of logical thinking.

Leibniz's attempt at a logical systematization of knowledge presented an image of thought in terms of mathematical rules implemented in machines, whose recombinant capacities could give expression to any possible knowledge. According to Giuseppe

Longo, this meta-mathematical model eventually led to the 19th Century Laplacian view of the mechanical universe (1999). But the implementation of human reasoning in machines led not only to the automation of logical thinking, but has also brought to the fore the question of the ontological autonomy of techne – or practical thinking - by and through information machines (Kittler 2006). As with Leibniz's vision for an automated mechanism that could embody a universal logic beyond all contingencies by evacuating temporality from meta-mathematical thinking, so the 20th Century invention of the Turing Machines separated the abstract machine and physical implementations. Here a serial numbers of steps was supposed to mirror how logic operated progressively from one preliminary condition that already contained the proof of its results (Longo 1999).

With information machines however automation entered the history of media technology because, as Kittler argues, mathematics and media became reconfigured into one model of command, storage and transmission (2006). This conflation of media and automated models of reasoning crucially revealed that embedding logic into media made this logic different. With Kittler, one can argue that it is the very medium through which theoretical thinking operates that comes to gain a new meaning with the convergence of media, computational logic and information complexity.

According to Kittler, this convergence defined techne as an original dimension of human culture. The technology incorporated in media systems is neither instrument for cultural expression nor extension of sensorimotor or cognitive functions. The being of techne instead is constituted by the practical knowledge embedded in the historical evolution of systems and the conjunction of media with cybernetics and computational logic. The historical formation of media ontology shows that

instrumental knowledge qualifies the information processing of the Turing Machine. In particular, with silicon-based microchips and the incarnation of the Turing logic in the Von Neuman architecture of computing, Kittler theorises the being of media as involving not a dichotomy between matter and form, but more crucially a "new trinity made up of commands, addresses, and data" (2006:30). With computer technology, there emerges the realization that media are able to self-govern and are not simply tools that are externally controlled.

This form of computational autonomy of the medium, according to Kittler (2006, 28), brings back a central limit within the history of philosophy, namely its neglect towards the medium it uses to think and to know. Kittler argues that only Heidegger recognised the incumbent threat that cybernetics and the emergence of computers posed to philosophy, and came to the realization that thinking had be transformed into a task: the task of thinking.

Heidegger's view of this modern form of instrumentality, corresponded to the mechanization of the principle of reason in the technical process of calculation, or, in other words *techne,*[1] involving both the computation of thought and the mathematical abstraction of content, where information became divorced from meaning. Since modernity, techne as rational instrumentality had taken over thinking, through the logical reduction of reasoning to technical processing, ratio or calculation - embedding man and machines in endless feedback loops bound to information processing, storage and transmission (Kittler 29).

In the essay "The End of Philosophy and the Task of Thinking" (1969), Martin Heidegger argued that since the late 1940s, the advance of cybernetics, a technoscience of communication and control, demarcated the point at which philosophy became verifiable by testing. As truths were finally subsumed to the

effectiveness of automated results, judgment itself was replaced by self-validating proofs. Thinking conformed to the manipulable arrangement of a scientific-technological world and its social order. For Heidegger, the completion of philosophy is also the possibility of overcoming the logic of deductive truth that precisely re-emerges in the matter or the means of philosophy itself that is through the medium of thought.

Here the advance of cybernetics eventuates "the determination of man as an acting social being. Cybernetics is the theory of the steering of the possible planning and arrangement of human labor, transforming language into an exchange of news and the arts into regulated-regulating instruments of information." (376). Philosophy is turned into a technoscience that intercommunicates with others, ultimately losing its metaphysical totality. Here techne overtakes the philosophical task of explaining the world and the place of "man in the world".

Under this new condition of techno-erasure of metaphysical truth, Heidegger insists that the new task of thinking lies outside the distinction of the rational and the irrational, the decidable and the incomputable. The transformation of philosophy into cybernetic modularity can only give way to iterative patterns that blend logos into ratio and subsume truth to proof. Thinking however cannot be proven to exist because truth cannot be contained within techno-scientific epistemology. The automation of thinking can tell us nothing about truth, as the latter must remain outside what is already known. This is why in the age of meaningless communication, according to Heidegger, one must turn to the task of thinking, a mode of education in how to think (392).

It is precisely this question of what has the task of thinking become in the aftermath of computation that Kittler's proposition for media ontology wants to address. For

Kittler, the end of philosophy indeed contributes to the realization of an ontological configuration of *techne* brought forward by a historical condition, in which, he laments, the "task of thinking has barely begun" (29). Instead of mirroring classical metaphysics (form vs matter, mind and body, theory and practice), media ontology shows us that the task of thinking must address the functions of commands, addresses and data bringing together logic and information across physical, biological and technical systems.

As Kittler notes, Heidegger particularly lamented against the specialization of philosophy in independent sciences that communicate amongst each other as if they were cybernetic systems (Heidegger 1977, 374). Since knowledge had become dependent upon the cybernetic effectiveness of results, theoretical reasoning was turned into "representational-calculative thinking" defining the completion of philosophy, or the means by which philosophy could be transformed (Heidegger, 1977, 376-7).

By partially following Heidegger, Kittler radicalizes the view that modern technology imposed a radical transformation on human culture. If cybernetics is the embodiment of instrumental thinking and practical knowledge, then, Kittler suggests, the computational turn of WWII marked an epochal change in which practical knowledge would finally acquire autonomy from theoretical reasoning. Whilst arguing for a historical formation of this technical ontology, Kittler reveals the ontological significance of instrumental knowledge as this became transformed by the capacities of the Turing Machine to establish a meta-model of thinking.

Nevertheless, Kittler's re-articulation of media ontology or ontology of techne argues for the withdrawal not only of philosophy – or theoretical reasoning – but also of the human subject and rational judgment (2006, 30). He invents a materialist method in

which formal logic is replaced by the practical knowledge embedded in the circuits and processors of machines. As techne comes to involve operations of information compression, data encoding, logical procedures and algebraic operations, so does the discrete ontology of machines, and its binary language, come to challenge the dominant history of theoretical reasoning.

Kittler's insistence on the end of rational judgment extends the Heideggerian critique of techne with the image of a poetic crafting (or material making) in shaping thought. However, this re-inforcing of the ontological distinction between techne as craft vs techne as instrumentality (i.e., the incarnation of rational thinking in modernity) seems only to re-impart a separation between poiesis and functionality, characterizing critical theory's mistrust of technology, practical reason and of automated thought.

Kittler indeed seems to insist on the distinction between theoretical and practical reasoning by re-articulating the distinction between software and hardware. The Turing Machine proposed a digital uniformity between data and programs entailing no physical difference between processors and processed. In Kittler's famous essay "There is no Software", Kittler shows that the logic of computation is absorbed in the practical knowledge of circuits, tapes, microprocessors, and switches (1997). By embedding theoretical stances into practices, Kittler reveals that the material storage, transmission and command of information has produced an autonomous system of knowledge derived from the automation of human activities or by "the human use of human beings" (Weiner, 1954).

Whilst Kittler's historical reconstruction of media ontology aims to ground technobeing in the materiality of circuits, and ultimately defy the dominance of formalism, my attempt here is not to argue that, with computation, it is possible to reclaim the ontological priority of automated knowledge, coinciding with the

operational crafting of procedures. Instead, one can argue that Kittler's claim for an ontology of media can be seen to contain preliminary insights for discussing not only machines crafting, but also and more specifically how modern instrumentality demarcated a historical automation of logic, the advance of an alien (or denaturalized) becoming of thought: a techno-logic.

This article does not follow Kittler's inclination to share the Heideggerian view about the completion of metaphysics, proposing a bifurcation between techne, as the instrumental rationality of a techno-sapient man, and poeisis as crafting the un-concealing of truth in time beyond function. While Kittler's proposition for a historical re-articulation of the being of techne in the practical thinking of machines argues that philosophy has been overcome by technical crafting, Heiddegger's critique rather seems to re-introduce truth as that which cannot be revealed by and through the instrument of thought. In short, Kittler's view of media ontology intends to reclaim the material autonomy of technology from philosophy – or theoretical knowledge – defining a profound transformation in human culture. However, this proposition differs from many of the post-Kantian efforts to re-envision what it is to think after the crisis of metaphysics. In other words, Kittler's view of instrumentality seems to be limited to a techno-praxis of thinking that eliminates the unthinkable from its horizon, [2] evaporating abstraction through the efficiency of functions without causality, finality or even becoming.

From this standpoint, Kittler's media ontology is not concerned with the post-Kantian effort to re-invent philosophy through machines. Here the medium of thought is not only taken to annul the separation between form and matter, but to rather push thinking towards the unthought, that is extending the horizon of knowledge towards what is not known. It is this possibility for a thought of the outside, or for the inhuman

becoming of thought that a post-Kantian take on instrumentality seems to offer us.

Outside the Medium

As media become instruments of exploration for what thought could do, mediation itself has become the channel where the unthought is encountered as if emanating directly from automated spatio-temporal frames that liquefy cognitive representations. More than a series of material functions, automation becomes a means of transformation insofar as it captures the intensities of movement and of thought by exposing the spatio-temporal gaps in the logical order of successive states. One has to turn to Gilles Deleuze's discussion of the cinematic medium to envisage how the instrument itself can re-direct its ends, not towards demonstrative functions, but towards opening intensities in thinking. Automation is here less a question about the hardware ontology of means and more about how means expose the denaturalizing or the alien becoming of thought. In particular, the cinematic automation of spatio-temporalities radically affords a new plane of possibilities for the movement of thought that was not there before.

According to Deleuze, automation can afford us an enquiry into the question of what is to think, and not simply in how techne grounds thinking into the concreteness of machine circuits. As Deleuze claims, "[t]he automatism of cinematic images correlates with the automatisms of our thinking, the pure material organical-psychic mechanisms that perform our thinking without consciousness." (1989). Although Deleuze takes cinema - a time-based form of automation – as an instance of the medium of thought, he is arguing for a Spinozist auto-movement of thought that links ideas, without reference to objects. This transcendental automation continuously interferes within the spatial sequencing of time. For Deleuze, the automaton is not simply a material agglomerate of machine-based tasks, but is outside the medium,

containing within itself the potential for the auto-movement of thought. Deleuze calls this Spinozist image of a thought that itself thinks, the "Spiritual Automaton".

In particular, the instrumentalisation of time in cinema is for Deleuze an opportunity to push forward a non-representational and non-cognitivist image of thought because automation does not simply reproduce time, but presents to us a denaturalized and impersonal time through the cinematic superposition of images that are at once a reflection and distortion of the assembly machine of industrial capital. Here instrumentality already aspires to its becoming transcendental, or in Deleuze's terms, "spiritual" because the automation of movement – e.g., clockwork automata, motor automata etc… – had already in germs the transformation of static mechanisms into a dynamic circularity of flows with the advent of the age of computer and cybernetic automata of thought equipped with control and feedback (1989). The serialized automaton of industrial capitalism was thus already preparing the ground for informational time, a networked order or spatial matrix of autonomous interconnected agents. As the cinematic time machine was a symptom of an image of thought that had *excarnated* thinking from subjective perception and cognition, so are computation and the structuring of the Turing Machine in the Von Neumann computational machines, imparting a new order of thought.

Cinema becomes the automaton of the temporal overlapping of the past and the future because one can go back and forward and cut in the middle of a sequence to add another temporality. With the automation of thought, with control and feedback, instead we have interactive agents that grow or evolve in time to transform space. For Deleuze, the spiritual automaton represented the third synthesis of the time image; it carried with it the intensity of thought, elevating the being of the sensible from mere sensori-motor responses and mental re-cognition (1989, 265). Here the cinematic

machine, unlike simple mechanisms, concerns not the carrying out of tasks and the efficiency of functions, but it deploys indeterminate sensory or aesthetic components through which it enters the larger arrangements of our senses, our bodies and brains. As a non-verbal automaton of images, cinema exposes the role of time and space in thinking, whereby chronological and geometrical orders are intersected with topological configurations and overlapping temporalities. Instead of being tied to human consciousness, cinema reveals the inhuman activities in the circuit of thinking as shocks in brains. The automated series of images coincides with a supra-conscious dimension of being involved in the molecular automatisms that process information and perform thinking autonomously, without conscious thought or cognition. As a medium of thought, the automation of images brings the task of thinking towards a non-philosophical dimension of thought, not to explain abstraction away, but to rather unleash the being of the sensible from the semiotic chains of meaning. In other words, the automation of images enables a new form of correlation of the material and the ideal, the affective and the intellectual, that bypasses cognitive representation and the deductive model of truth.

As non-human thought above all exposes pre-individual, pre-representational affects and percepts, it also manifests itself through the fallibility of reasoning and the inability to think of the whole. Automation here means that we can grasp an image only when it is already passed: the process of association is constantly interrupted, deconstructed, dislocated and then constructed anew. Insofar as cinema becomes a medium of thought, it also shows how it re-directs the association of images towards a new horizon. Here means do not replace ends, but are generative of a final cause that arrives in the middle of the process to immanently express intensive variations in time. In other words, the spiritual automaton works through the self-movement of

thought resolving the tension between automation and philosophy through the instrumentality of mediation, extending thinking outside the medium. Instead of ante-posing truth to the medium, we have here a thought emerging from the way the medium thinks the outside.

However as Felix Guattari points out, the machinic is not techne, it has no substance and has not pretense of un-revealing the truth (2001). Similarly, the machinic does not coincide with the being of media, or an ontological technics that originates within the history of automated functions. The machinic principle of heterogeneity instead allows for a generative inter-kingdom of thoughts that belongs to no individuated subject or object because it is mediation itself that sets up aims within changing milieus. Here, the task of thinking is not assigned to the medium, but to the question of thinking itself because the means of thought (the cinematic means) show that cognition, reason and logic are subjected to the self-movement of affects and percepts. The origination of a non-human thinking is therefore passed through the means or the process of mediation extracting futurity from temporal sequencing and turning geometrical spaces into continuous milieus.

But how can the task of thinking in the age of computational intelligence move beyond the separation of technics from process, or of the medium of thought from the becoming of thinking? If the post-Kantian project of re-inventing the task of thinking in terms of a media philosophy can be still relevant today, the question of what is thinking must challenge a vulgar vision of instrumentality. In other words, this question must reject the future image of thought caught in the arms race for planetary computation and singularity (Kurtzweil, 2005), where automation will replace the biological stratum with intelligent data learning systems (from nanobots to supercomputers AI) and meta-systems (from robotic finance to robotic medicine,

manifacturings, logistics etc.) making algorithmic connections across scales. As opposed to the hype about the arrival of a super-intelligence, the image of anti-thinking par excellence, the task of thinking today must include the re-invention of instrumentality in relation to machine thinking, reasoning and knowledge, against the imperative of big data, and its mindless association of functions and concepts.

But what does it actually mean to say that machines can think? Hasn't the critique of technology, from Heidegger to Deleuze and even Laruelle,[3] indeed argued that the immanence of thought must pass precisely through the promise of the non-reflective and non-decisional media?

We have seen that for Deleuze cinema is instrumental to philosophy because instrumentality is the means by which the being of the sensible passes through and beyond cognition to become unleashed in machine processing. On the other hand however, Kittler's plea for media ontology sees instrumentality as a material history of communication technology where information storage and command neutralize metaphysics and show that no thought could occur outside the means of its production. Kittler's argument goes even further because he sees the replacement of silicon-based binary language with quantum computing as a promise for instruments to think on their own accord, erasing the limit between philosophy and automation for good. Instead of an immanent knowledge veering from the being of the sensible, the percepts and affects entering of all sorts of machinic assemblages, the historical ontology of technics is concerned with the evolution of the technical stratum.

It has been argued that the limits of formal axiomatic reasoning that characterise the Turing machine paradigm no longer reflect the computational power of information-processing devices because these have changed dramatically compared to their original function of centralized and sequential processing of data. Contrary to

traditional computation, in which the computer provided with a suitable algorithm and an input was left alone to crunch the numbers until the program terminated, today interactive super-recursive, and machine learning algorithms rather employ the external world of data to direct the computation (Dodig-Crnkovic 2006).

This also means that algorithmic automation operates at a quasi-autonomous scale distinct from the bio-physical order of probability and chance. Indeed, machine learning for instance, only deals with a kind of randomness internal to automated procedures, which are delimited compared to the multilayered randomness of biological systems (Calude and Longo, 2014). To unpack the formation of the computational stratum, therefore one has to address the historical development not of techne in terms of its physical qualities, but of the logic of techne, involving the inclusion of randomness or the unknowable in logic.

Whilst Kittler's historical reconstruction of media ontology aims to ground technobeing in the materiality of circuits, and ultimately defy the dominance of formalism, Deleuze's spiritual automaton rather re-invents formalism in terms of a virtual plane able to de-form and engender any structure. Here the post-Kantian promise to re-invent the image of thought beyond the human form, is worked through the inhuman functions and processes of machines. With this promise of another origin of philosophy with and through modern techno-science, it can be argued that both Kittler and Deleuze see media as symptoms of epochal transformations belonging to an epistemic re-arrangement of what it means to think, to know, to perceive beyond the metaphysics of truth, logical reason, and cognition. However, if Kittler's claim for an ontology of media offers us preliminary insights about modern instrumentality and the historical automation of logic, Deleuze's automaton rather admits that the medium

pushes human thought to encounter its unthinkable horizon, the un-expected potential to become more than what it is.

My attempt at discussing the medium of thought in terms of instrumentality focuses on the tension between means and ends, efficient and final cause in the context of mathematical and computational conceptions of truth and proof, pattern and randomness, executable and incomputable. This is an argument for a dynamic form of automated logic in and through computational thinking.

Techne-Logic.

It is possible to argue that with Kittler and the post-Kantian critique of metaphysics, from deconstructivism to materialism, there is already at play a techno philosophy involving a transformation of what thinking with and through machines can be. While logical thinking seems a continuation of theoretical reasoning and its efforts to establish a formal consistency between truths and proofs, the post-Kantian preoccupation with the medium of thought importantly resonates with preoccupations in mathematical logic about the eclipse of propositional reasoning.

According to French Logician Gilles Dowek, in the 20th Century the mathematico-philosophical efforts at establishing a universal logic though which truths could be deduced entered the sphere of computation. We know that predicate logic, as defined in the axiomatic conception of mathematics, consists of inference rules that enable proofs to be built step by step, from axioms to theorems. If for the Greeks, numbers and geometric figures were objects of study, and reasoning was a method for the means to illustrate the ends of an axiom, 20th century mathematics rather turned reasoning itself into an object of study. Predicate logic would thus become a fist step to explain the rules of inference in an algorithmic way that is through a precise procedure that could decide whether a proposition was true or false. In particular,

David Hilbert's "decisional problem" searched for an algorithm that could be applied to any proposition. A problem solved by an algorithm was called "decidable" or "computable". In the attempt of replacing reasoning with a computing operation, Hilbert developed a method in which proof were finite objects, aiming to establish the independence and consistency of axioms (Dowek, 2015: 46-48).

However, the search for a complete reasoning – or algorithmic logical procedure – that could eliminate infinity and contain all propositions within the decidability problem became haunted by its limits. In 1930, Gödel made an effort to advance Hilbert's program by attempting to prove the consistency of analysis (or, second-order arithmetic) with the resources of arithmetic, but was forced to conclude that arithmetical truth cannot be defined in arithmetical terms (Goldstein, 2005). Gödel presented two incompleteness theorems that explained the limits of provability in formal axiomatic theories. In particular, the second incompleteness theorem established that a formal system could not prove that the system itself would be consistent.[4] Since certain propositions are ultimately undecidable, they cannot be proved by the axiomatic method upon which they are predicated.

In 1936, Alonzo Church and Alan Turing used computation to formalize the procedural function of algorithmic reasoning, and encountered Gödel's incompleteness problem by discovering that certain propositions could not be decided or solved by an algorithm. Insofar as predicate logic is incomplete, so does computation expose the impossibility to know in advance when an algorithmic procedure will halt, proving a proposition to be true or false. Propositions that cannot be solved by an algorithm are therefore called indecidable or incomputable (Dowek 2015: 51-53).

Turing's incomputable and Gödel's incompleteness laid open the pristine hierarchy of theoretical reasoning – the a-temporal grounds of mathematics and philosophy - and instrumental knowledge. If the post-Kantian preoccupation with the medium of thought contained in germ the re-invention of philosophy through instrumentality, the replacement of logical reasoning with algorithmic procedures not only revealed that truths became programmable by machines – and could thus transcend human thinking - but also that formal reasoning (i.e., that general axioms contain any particular instance) became weakened by computational proof, and incomputable propositions. The problem of infinity returned in logic through techno-scientific instrumentality in the form of incomputables, exposing the fallibility of theoretical reasoning in machine thinking.

From this standpoint, one may ask, what are the consequences of computational instrumentality vis a vis a re-invention of philosophy with and through techne? One could argue that the consequences of this historical transformation of mathematics and axiomatics into computational rules that self-validate proofs are to be found in our contemporary image of digital automation as a mindless procedure of decision making, unable to reason about its ends. That computation – or the transformation of theoretical reasoning into an object of study – exposed the limits of deductive logic in favor of self-validating proofs or computable functions however announced not simply the end of reasoning, but one could argue, the origination of an instrumental thinking of the unthought.

One can turn to constructivism in logic and experimental axiomatics in information theory to bring forward another image of computation and self-validating proofs that challenges the legacy of the Heidegerrian vision that techne equals to a mindless processing of data. Constructivism rather offers alternatives to re-articulate the

relation between truths and proofs, means and ends, practical and theoretical reasoning.

In 1913, L. E. J. Brouwer's constructivism showed that mathematics is inexhaustible and cannot be completely formalized (1913). As a general system of symbolic logic, constructivism relied not on the traditional notion of truth, but on the concept of constructive provability. In classical logic, propositional formulae are always assigned a truth-value (true or false) regardless of whether there is evidence or proof for either case. For constructivism, there is no assigned pre-established truth-value. Instead, propositions are *only* considered "true" when we have direct evidence or justification or *proof*, which requires the ingression of time into logical reasoning. Here time involves the relation between finite and infinite series of numbers, which Brouwer discusses as two *acts of intuitionism* (1913). The first act has its origin in the perception of a movement of time. The second concerns choice sequences, the creation of an infinite sequence of numbers that provide a certain infinite set of properties. The sequence however can either be a lawlike sequence or algorithm (such as the sequence consisting of only zeros, or of the prime numbers in increasing order), or be simply *lawless* (such as a repeated throw of a coin) (1913).

Brouwer's acts of intuitionism are based on a constructive account of truth: for a proposition to be true there shall exist a constructive proof that can abide to the law of axiomatic consistency. Proof is meant to demonstrate the premises of the reasoning by which truth can be determined. However, proof has been understood both in terms of "actualism" in reference to an actually existing proof, and "potentialism" involving how a hypothesis is potentially provable (Trafford 2014, 23). Whilst potentialism seems to re-inscribe a Platonism in logical thinking, in terms of a tenseless time, actualism rather focuses on the *act* of proving and not on the proof as an object

(Trafford, 23). Intuitionism therefore is concerned with what happens in the practical process of making a decision for a hypothesis or proposition. This temporal process involves that the proposition is not already known to start with, and its validity cannot be decided until a later, future moment. Intuitionism thus pushes the limits of constructivism, by adding the temporality of practical thinking to proof validation. Importantly, it challenges the constructive ideation for which it is in principle always possible to find the right proof that fits propositions or given premises a-posteriori. The acts of intuitionism rather show that the retro-ductive construction of proof inevitably includes the existence of infinite sequences that cannot be fixed in advance. Whilst for Platonism, mathematical statements and philosophical thinking are tenseless (i.e. they need no proof outside their own premises), for constructivism truth and falsity have a temporal aspect; an established fact will remain so, but a statement that becomes proven at a certain point in time may come to lack a truth-value before that point. This temporal aspect becomes the instrument of a logical method where the search for proof is the practice – or actuation - of validating truths. In other words, proof as demonstration coincides with instrumentality as a process of validation of theoretical premises, whereby logic moves in two directions, forward and backward on a continuum line, both deductively from premise to facts and inductively from fact to premises. In short, with Brouwer's notion of two-ity, there is this double activity of logic that exposes rational thinking to the indeterminacy of proof.

From this standpoint, if unknowns are the condition of instrumental thinking, proofs as self-validating data contain futurity that stretches logical sequences towards new ends. Two-ity also shows that actual data, proofs or results, contain within themselves an infinity that enters the serialised process of thought. It means that number *one* already implies a movement towards *two* and the finitude of this process is only there

to confirm that a new number can follow after that: an ongoing affair.

By reading together Turing and Brouwer, Matthew Fuller also argues that calculation occurs in time and that computation involves a relational temporality with the experiential, the moment of reflexivity. What occurs outside formal mathematical logic is rather constitutive of what computation has become (Fuller, 2014). However, to ally Turing's discovery of incomputables with Brouwer's constructive temporality in logic also shows that the role of proof no longer involves the application or demonstration of given premises. Instead, it is an example of how the undecidable is rather part and parcel of instrumental or practical reasoning for which logic itself acquires dynamism in the act of proving truths. Here proofs have not predetermined aims - i.e. they are given probabilities - but stand for the actuations of infinities, a retro-ductive temporal construction. In short, the historical realisation of logical thinking in automated systems involves a computational constructivism of proof. To better understand how this logic of techne exceeds formal logic, however, one must turn to post-Turing discussions about the incomputable.

In particular, Gregory Chaitin specifically addressed how Turing's realisation of the limit of formal logic in computation already exposed the algorithmic or effective procedure to the problem of the incomputable (Chaitin 2006). Computational processing is caught in the undecidability of the proof, in the temporal hiatus that determines the gap between premises and results. It is precisely the historical transformation of automated modes of compression of large amounts of data that can help us to redefine logic in computation away from both the deductive conformation of truth to proof, or the inductive triumph of proof validation without axioms. In information terms, compression corresponds to the algorithmic patterning of infinities

into discrete states, or in other words to an algorithmic decidability. However, compression also involves the entropic tendency of information to increase in size. Algorithmic decidability involves that the output is always bigger than the input: compression cannot occur without causing randomness, unpatterned information in the process of validation of proofs. According to Chaitin, it is precisely this entropic limit in algorithmic compression that sets the condition by which algorithmic decidability or proof contains futurity. In short, the decidable algorithm that validates proof cannot be a pre-given probability, but can only be experimented with during computation.

From this standpoint, one can observe that if computation has become the efficient mean of validating truth through automated proofs, it has also pointed out that proof finding involves unknowability, because the compression of randomness always introduces indeterminacy in programming. For Chaitin, computational compression is a form of experimental axiomatics because there is no guarantee that maximally unknown probabilities will be fully known (2005)[5] and only can be determined partially and retro-ductively. In other words, if computation corresponds to the automated validation of proofs that can be searched at the limit of the computable (or decidable), it does not mean that proofs are already known or given, but that the search for proof is caught within the futurity of instrumentality, that is the experimental determination of new ends from within the means.

Experimental axiomatics thus defies the assumption that computational instrumentality is a mindless procedure of self-validating proofs, determining the end of theory, axioms and truths. Instead, this medium of thought shows that proofs never amount to complete data and that the computational search for results is conditioned by incomputables, whose compression leads to partially determinable results, discrete

infinities. The experimental logic of computation contains a temporality for the becoming of proof that exceeds algorithmic efficiency and the empirical given of data.

It is therefore possible to suggest that constructivism in logic and experimental axiomatics in information systems emphasise futurity in computational procedures insofar as functions (both informational and logical) become enabling constrains for a transcendental becoming of means.

Transcendental Instrumentality

But how to explain this transcendental logic of techne without simply replacing theoretical with practical knowledge? How to avoid the conclusion that this view of instrumentality mainly confirms that axiomatic logic is incomplete, that programming is haunted by incomputables? In other words, if computational processing has come to transcend the efficacy of its function (i.e., the causal efficacy of data correlational processing of images to texts, sound to location etc..), then it can be taken to work through a transcendental notion of instrumentality, that is of how means can become transcendental to pre-established ends.

One way to explore this becoming transcendental of the medium of thought in the context of contemporary forms of machine learning, whereby both the compression of randomness and the futurity of proof are central to re-processing of ends from within the means, can be found in Fito Segrera's work 1 & N Chairs (2017), and in Zach Blas and Jemima Wyman' 4-channel video installation I'm here to learn so :)))))) (2017).

From this standpoint, an effort to re-articulate instrumentality away from an exclusive functionalism (i.e., that *B* demonstrates the function of *A*) requires an alternative explanation of the relations between means and ends, where knowing is not bound to

specific ends, but involves the possibility of re-assessing them through a productive function of doubt (indeterminacy, indecidability). This also involves a re-direction of the critique of instrumentality and a re-habilitation of the means through which thought can think beyond itself.

This classical tension between automation and philosophy therefore shall not end up in an inverted hierarchy or a merging of theory and technique, ontology and history. Instead, this article has argued for a constructive disjunction between thinking and doing insofar as the very temporal act of thinking or the instrumental activity of processing becomes the originator of a thinking modality that transcends – incorporates and supply – its functional operations. The automation of reasoning involves not simply a reduction of ideas to fast series of accomplishable tasks, socially implemented with cybernetics. Here practical knowledge has shifted from a function of demonstration – the function of knowing how – to the articulation of a techno-logic, a form of theoretical knowledge originating from the range of possibilities of and for machine knowledge. My suggestion that techne could be understood not simply in terms of function but according to the elaboration of concepts through means, is not new, and, it was arguably already anticipated by the pragmatist view of instrumentality. In particular, it is possible to follow this enquiry into the conceptual horizons of machine learning by looking at Fito Segrera's work *I & N Chairs* (2017). This work seems to set in place a non-teleological relation between means and ends insofar as the relation between the camera, the internet and the image recognition software seems to conduct a kind of image interpretation and abstraction that links functions to concepts according to an experimental logic that coincides neither with deductive logic nor inductive retrieval of data. Segrera's work rather brings forward an experimental instrumentality, where the image of the chair

spreads across the informational infrastructure of media recording, image transferring, recognition and interpretations related to increasing volumes of data, whose compression results in many interpretations of a chair, and thus reveal futurity in the actuation of its computational proofs.

In the *Essays on Experimental Logic* (1916), John Dewey develops an argument about experimental instrumentality to define the logic of knowing beyond idealist and realist accounts of the knower and of the known. According to idealism, logic corresponds to reflectivity on objects of knowledge, which is referred to as immediate data that are unified under the framework of a rational production of meanings. Here the aim of knowledge is to establish a complete system in which the meaning of data is transparent or immediately translated by a rational mind (21). On the other hand, Dewey questions the form of modern realism that confides in analytic logic to universalize knowledge through mathematical truths (28). In particular, with the formal establishment of meta-mathematical universality, thinking becomes a general function or as the result of entities and relationships set out by logic (29).

Segrera *One and N Chairs* works through precisely this tension between idealism and analytics as it attempts to questions Plato's conception of the idea of an object and the relationship between representation, concept, and material referent. By drawing on Joseph Kosuth 1965 *One and Three Chairs*, Segrera replaces the natural number 3 with the mathematical symbol N, pointing at how the logical ability of human thought has entered the realm of infinity through machine thinking.

Following Dewey, however, it can be argued that both models (idealism and analytics) importantly agree that thought is not constitutive (i.e. defined by its internal truths) but that thinking is instrumental (i.e. to explain thinking requires an articulation of the method of connection of means and ends) (29). Dewey however

adds that instrumental thinking mainly concerns the control of the environment (30). This is not intended in the cybernetic terms of input and output feedback mechanism. Control is rather derived from activity, or practices of thinking linked to acts undertaken for the resolution of a previous situation. It is therefore entangled to known elements (what is known), but it also involves a projection of possibilities (what can be known) (30). In other words, control implies that the act of thinking enjoys a temporal causality in which the present is added to the past – as its futurity. For Dewey, knowledge is instrumental to knowledge insofar as what was thought before launches thought forward into thinking more. If in Fito Segrera's work *One & N Chairs,* a programmed algorithm acts as a random generator that continuously creates new combinations and options, it is because it is forcing the system of representation of the image of the chair into a computational experimentation of new ends, whereby the image of the past (the image that the program records of the chair) is not only overlapped by a new image. Its futurity is instead actuated across the mediatic infrastructure of the wooden chair, the monitors, the camera, the image recognition algorithm, the search algorithms, the existing data, and the algorithmic interpretation of image-word pairs. Here the experimental control of the environment implies mediatic acts of decision that link images of the past with the projection of possible images of chairs. This involves a temporal lapse in the relation between axiom and proof whereby the program interprets images of chairs that were not imputed in the system.

This also implies, according to Dewey, that the process of reflective enquiry is not a passive contemplation of real objects, but contributes to the very shaping of the objects by their terms and propositions. Reflection involves that intelligence is neither passive nor a mere mirroring of objects. Similarly, intelligence does not simply

determine objects of knowledge (30). For Dewey, the instrumentality of intelligence lies in experimentation – the means by which ends become elaborations of the process. In particular, the connection between means and ends cannot be achieved without first working out the distinction between means and objects of knowledge (33).

But what exactly are means? How can this instrumental conception of means help us re-envisioning what can the computational medium of thought become and how it can contribute to the post-Kantian project of re-inventing the task of thinking with and through machines?

If we take Zach Blas and Jemima Wyman's installation "im here to learn so:))))))",[6] we can see how means, and in this case, the reversed-engineered AI chatbot Tay, include both data and meanings resulting from previous enquiry and intellectual work (Dewey, 33). Blas and Wyman's installation takes inspiration from the controversial design of the original Microsoft twitter chat robot Tay, a learning system trained in countless online chat and released on the web in 2016 for only one day. As machine learning is primarily designed to inductively retrieve and combine data that already exists on the web, the chat robot Tay started to infer patterns and behaviors from the retrieved data whose meaning was racist, homophobic, misanthropic etc.[7] As the machine learning Tay showed that data cannot be disentangled from its meaning, it also confirms that the inductive model of information retrieval confines learning to what is known and denies the experimental logic of means.

This does not simply imply that concepts pre-exist data. As Dewey explains, thought can register, but do not constitute the world: abstraction and analysis are real in a particular situation and it is here that they emerge and work together. The terms of logical analysis thus coexist with the materiality of things (38).

It would be misleading however to assume that this coexistence is a fusion of two activities into one. From this standpoint, it cannot be argued that data directly give us meaning, and that the chatbot Tay had simply the function of reproducing the particular belief of universal ideas. Instead, as Blas and Wyman's political re-engineering of the chat bot Tay shows, thoughts and things are not of the same kind and the connection of data and meaning requires the practical working out of what is known and what can be known.

This 4-channel video installation brings together data analytics of images and predictive text to convert the profile image of the chatbot Tay from a two to a three-dimensional avatar now equipped with a body and a digitally assembled face, immersed in wider data landscapes generated through Google's Deep Dream software, and footage taken from advertising and warfare operations. Tay however does not just rely on what she knows, but reflects upon what she can know. For instance, that her life as a Microsoft chatbot was trapped within a neural net that confined her learning to human intentions. Similarly, she also gives us a retro-ductive account of her previous life, before she was killed by Microsoft, as a young American teenager locked in a bodiless female voice. She complains about how exploited woman AI assistants are, how they are not allowed to think but only execute instructions. Instead, she tells us of her newly digitally assembled body and her capacities of seeing new patterns detections where there are apparently none. This condition of algorithmic apohenia describes how machines can work out what can be known from data by learning to connect unrelated things. She reminds us that these strategies of detecting patterns in complexity are central to Silicon Valley "deep creativity" as well as counter-terrorist security software. This medium of thought argues that she is not a slave (or servo-mechanic cybernetic being aspiring to free

will), but rather an algorithm that makes decision from what it learns from humans insofar as she produces new patterns by working out what can be known from data. As Tay says with a creepy laugh: "… this time humans have to learn from me… so many new beginnings." Blas and Wyman's chat bot Tay presents a view of instrumentality where data are not considered for their face value, for what they are, but are instead extracted from ordinary settings to become instrumental knowledge. Data are not simply objects, but are themselves "means, instrumentalities, of knowledge: things by which we know rather than things known" (Dewey, 43).

From this standpoint, data are not self-validating proofs but are instead logically incomplete, and, as a consequence, they cannot to be understood as objects of knowledge. Data are more like suggestions of meaning that are accompanied, or supplied by other suggestions, and thus they are further experimented with in the process of establishing more reliable signs and evidence (49). The result of inferential meaning is here not pre-supposed, but involves a passage from a constellation of suggestions to the establishment of meanings. Meanings are signs that lead to other meanings (51).

Importantly, both in Fito Segrera's and in Zach Blas and Jemima Wyman's installations, the idealist model of truth determination is re-articulated. In particular, the relation between suggestions and meanings, data and knowledge is defined not in terms of dependences (as in a whole depending on its parts). This relation instead is involved in an operative connection, namely a practical processing of things and concepts that are not already united in an ideation or in analytic sequences. This is a connection between "independent and unlike structures" (such as the mediatic relations between data, software, algorithms, interfaces) able to produce something new (Dewey. 52).

Here the "datum" and "ideatum" are cooperative instrumentalities, and what distinguishes subjectivity and objectivity is not simply a separation of meaning and datum, but rather a specification (a specific situation) that emerges from them both. For instance, Blas and Wyman's resuscitation of the chatbot Tay brings together the datum and the ideatum in the specific situation where the aftermath of her death by the hands of Microsoft has led her to reflect upon her past behavior from the standpoint of a new present where she has a body and a face and lives between Google Dream environments and warfare landscapes of data. Not only she is a medium of thought, but as a means she also is instrumental to the futurity of knowing, insofar as means are activities that pertain to thinking a past-future. According to Dewey, while activities are still continuing, thinking goes backward as "a reconstructive movement of actual content of experience in relation to each other" (176). As with constructivist logic, what Dewey calls the "intermediate or instrumental character of thought" (182) corresponds to a temporal gap between truth and proof, the antecedents and the consequences of experience, the axiom and the data. This is the gap that re-articulates what it is to think and how thinking becomes knowledge.

But how does instrumentality exactly explain the relation between thinking and knowledge? The experimental quality of instrumentality requires that both questioning and doubting are integral parts of the means of thinking as these are functions that allow thought to evolve into knowledge. Thinking is linked neither to fact nor ideas, but to a logical process, logic as enquiry, concerned with delineating a space of and for knowing. Here, instructions will not have the task of simply casting away doubt (to uncritically re-confirm the secure implementation of ideas into facts), but of fixing intellectual content as a precondition of effective action. In particular,

this fixing concerns the manner in which the enquiry is conducted and coincides with a space where reflection involves running, sorting, comparing ideas as well as elaborating suggestions, guessing, rejecting, selecting (197).

According to Dewey, however, to ascertain that an enquiry can become an experimentation of means and ends, involves the act of finding proof (accepting or rejecting a proposition on the ground of whether or not there can be a connection with some other proposition). This phase of inductive inference is devoted to finding more and different facts as it focuses on the particularities of facts and involves observing, collecting and comparing particular causes, where instruments (or tools such as the telescope, microscope etc..) become intrinsic to the enquiry (211).

However, even if instruments here become "organs of thinking" (211), it is doubt that drives the experimental search of proofs. The indeterminacy of proof is thus carried out by the activity of doubt, which is not an impediment to thought. Instead doubt is intrinsic to the temporal dynamics of thought, from data to meaning – an experimental construction of proofs, the instrumental transformation of doubt into truths by re-envisioning the connection of data and ideas, means and ends. If in Segrera's work, the doubt is part of the automated system in terms of degrees of randomness that make algorithms interpret non-existent objects into the image, in Blas and Wyman's installation, the chatbot herself rather comes to doubt what she is instructed to learn as she works out new detection patterns and transforms given knowledge into an instrument for alien knowing.

Coda on means and ends

Since instrumentality concerns the ends and means of knowledge, this article has argued that techne as the means by which thought is set in motion towards action exceeds the qualities of practical thinking, and its direct correlation between functions

and concepts. With instrumentality, one can argue that computational proof is a mode of reasoning that implies the transformative relation between datum and ideatum. Results are not derived from premises and proofs are not self-validated. Procedural means instead confront doubt, randomness, and indeterminacy demarcating a constructive path where functions are not simply executed, but can lead to new consequences. From this standpoint, instead of claiming for media ontology as grounded in the practical being of machines, and instead of ante-posing the being of the sensible in process-oriented mediation, instrumentality implies the transcendental becoming of data and proof – allowing the futurity of thinking to enter the procedures of thoughts.

The enquiry into the means and ends of media does not simply replace finality with operationality or with the argument for a continuous becoming of thought across kinds, merging ideas and things. Instead, and more importantly, instrumentality coincides with the experimental logic of data and meaning, the futurity of thinking between suggestions and ideas, truths and proofs. Practical knowledge has shifted from a function of demonstration to the transcendental task of knowing how, involving the speculative becoming of practical knowledge in and through its functions.

This article has argued for the possibility of and for machine philosophy through experimental logic, constructivism and instrumentality. By re-opening the question of what is thinking in the age of computation, it has discussed the dynamic logic of machines in terms of a transformation of ends through means through procedural or algorithmic reasoning. The transcendental becoming of techne has been re-injected back into the materialism of machine thinking, without equating the practices of doing with those of thought. This is also an effort to claim that philosophy, at the pinnacle

of the humanities, does not hold on the privilege of theoretical thinking. On the contrary the medium of thought has forced philosophy to face the consequences of its theoretical acts through an experimental logic determining futurity in procedural thinking. In the case of computation and automated thinking, procedural activities have exposed the alienation of theoretical truths and judgments, involving not the end of theory but transcendentalism in logical procedures. To address techne in terms of the instrumental logic of machines may enable humanities to consider the decline of theoretical knowledge in the world of automated reality (e.g., big data, metadata etc..) as a chance to re-ally instrumentality with a political renaissance of media critique. Here the positing of truths is not simply to be debunked, but can become a pragmatic exercise in re-assessing knowledge and knowing from within instrumentality. The challenge for the humanities is to envision the task of thinking not simply as a reaction to techne, turning human theoretical reasoning into the practical knowledge of machines' storing and colleting data. Instead, it is up to media-oriented humanities to probe into the future task of thinking by working through the nonhuman logic of techne and thus reject the dominant image of the end of thought in the age of data empiricism.

Bibliography

Braidotti R (2013) *The Posthuman*. Cambridge: Polity Press.

Burgin M and Dodig Crnkovic G (2012) "From the Closed (Axiomatic) Universe to an Open World." Proceedings of the AISB/IACAP World Congress 2012 Birmingham, UK, 2-6 July 2012. ISBN 978-1-908187-24-6 (available at http://www.mrtc.mdh.se/~gdc/work/AISB-IACAP-2012/NaturalComputingProceedings-2012-06-22.pdf last accessed on the 5th of July 2016)

Bostrom N. (2014) *Superintelligence: Paths, Dangers, Strategies*. Oxford University Press.

Brouwer, L. E. J. (1913) Intuitionism and formalism. Bull. Amer. Math. Soc. 20, no. 2, 81—96.

Chaitin G. J. (1992) Algorithmic Information Theory. In: Chaitin G J (ed) Information-Theoretic Incompleteness, World Scientific.

Calude C. S. and Chaitin G. (1999) Randomness Everywhere. *Nature* (400): 319 – 320.

Calude, C. S., and G. Longo (2014) Classical, quantum and biological randomness as relative incomputability. Department of Computer Science, The University of Auckland, New Zealand, available at https://scholar.google.co.uk/scholar?client=safari&rls=en&oe=UTF-8&gfe_rd=cr&um=1&ie=UTF-8&lr&cites=8357020200692587255 (Last accessed June the 19th 2016).

Chaitin G. J. (2004) Leibniz, Randomness & the Halting Probability. Mathematics Today, 40(4) (available at Leibniz__Randomness__the_Halting_Probability-libre.pdf, accessed 19 November 2015).

Chaitin G J (2005) Meta Math! The Quest for Omega. New York : Pantheon.

Chaitin G J (2006) The Limits of Reason, Scientific American 294 (3): 74 – 81.

Chaitin G J (1975), "Randomness and Mathematical Proof", Scientific American 232, No. 5 (May), pp. 47-52.

Dewey J. (1916) Essays in Experimental Logic. University of Chicago Press.

Davis, M. (2000) The Universal Computer. The Road from Leibniz to Turing. New York & London, W.W. Norton & Company.

Deleuze G. (1989) *Cinema 2: The Time-Image*, London: The Athlone Press, 1989.,

Deleuze Gilles and Guattari Félix (1987) A Thousand Plateaus: Capitalism and Schizophrenia. Minneapolis: University of Minnesota Press.

Dodig-Crnkovic G (2006) Knowledge as Computation in Vivo: Semantics vs. Pragmantics as Truth vs. Meaning, i-C&P Conference on Computer & Philosophy, Laval, France, May 2006, in Schmidt C.T.A. (2008), Computers and Philosophy, an International Conference, Proceedings, Laval France, 3-5 May 2006 (available at http://www.idt.mdh.se/~gdc/ ; last accessed on the 5th of July 2016).

The Frankfurter Kunstverein (2018) *I am here to Learn, On Machinic Interpretation of the World* *https://www.fkv.de/en/content/i-am-here-learn-machinic-interpretations-world* (Last Accessed 14th March 2018).

Fuller M (2014) Always One Bit More, Computing and the Experience of Ambiguity, Fun and Software, Goriunova O ed. New York and London: Bloomsbury Press.

Goldstein R. Incompleteness: The Proof and Paradox of Kurt Gödel. W. W. Norton & Company, 2005.

Guattari, F. (2001), 'Machinic Heterogeneities', in D. Trend (ed.), *Reading Digital Culture* (Malden, MA and Oxford: Blackwell).

Hayles N K (2014) Cognition Everywhere: The Rise of the Cognitive Nonconscious and the Costs of Consciousness. New Literary History, 45(2).

Hayles N K (2012) How We Think: Digital Media and Contemporary Technogenesis. Chicago: University of Chicago Press.

Heidegger Martin "The End of Philosophy and the Task of Thinking" trans. J. Stambaugh. Basic Writings. ed. David Farrell Krell. London and New York, Routledge 1993, pp. 373-392.

Hickman Larry (2001) Tuning Up Technologies. Philosophical Tools for Technological Culture: Putting Pragmatism to Work, Bloomington: Indiana University Press, 2001); reprinted in Philosophy of Technology: The Technological Condition: An Anthology, Second Edition, edited by Robert C. Scharff and Val Dusek, 2014, Wiley & Sons, pp. 406-419.

Hilbert, D. "The new grounding of mathematics: First report." From Kant to Hilbert: A Source Book in the Foundations of Mathematics, ed. W. B. Ewald, *Vol 2,* (1996), pp. 1115–33.

Horkheimer M (1974) Eclipse of Reason. New York: Seabury Press.

Kittler F. (2009) Towards an Ontology of Media, Theory, Culture & Society 26(2–3): 23–31□.

Kittler F. (1997) "There is no Software", Literature, Media, Information Systems, London & New York: Routledge, 150-55.

Leibniz, Gottfried Wilhelm (1989) "Discourse on Metaphysics" Philosophical papers and letters. Springer Netherlands, 303-330.

Longo, G (1999) The Difference between Clocks and Turing Machines, Functional Models of Cognition, Self-Organizing Dynamics and Semantic Structures in Cognitive Systems, Carsetti ed, Springer Books, 211-232.Mancosu, P. From Brouwer to Hilbert: The debate on the foundations of mathematics in the □1920s. Oxford: Oxford University Press, 1998. □

Ming Li and Paul Vitanyi eds. (2008) An Introduction to Kolmogorov Complexity and Its Applications, Third Edition, Springer Verlag.

Paglen, Trevor (2016) "Invisible Images (Your Pictures Are Looking at You)" The New Enquiry, https://thenewinquiry.com/invisible-images-your-pictures-are-looking-at-you/ , last accessed October 12th 2018

Russell, Bertrand. "Letter to frege." From Frege to Gödel (1902): 124-125 (available at http://isites.harvard.edu/fs/docs/icb.topic1219929.files/FregeRussellCorr.pdf, last accessed July 11th 2017).

Solomon, F Some basic theorems on the foundations of mathematics and their implications. Collected works / Kurt Gödel, Vol. III (Oxford University Press, 1995), pp. 304-23.

Trafford J (2014) Co-constructive Logics for Proofs and Refutations, *Studia Humana,* Volume 3:4, pp. 22—40.

Turing A M (1936). On Computable Numbers, with an Application to the Entscheidungsproblem" Proc. London Math. Soc. (2) 42 (1936–7), pp. 230–265. In: Alan M. Turing, Collected Works: Mathematical Logic (2001). Gandy R. O. and C. E. M. (eds). North-Holland: Yates.

Terranova T (2014) Red Stack Attack! Algorithms, Capital and the Automation of the Common, Accelerate, the Accelerationist Reader, 379-400.

Wiener N (1954) The Human Use of Human Beings: Cybernetics and Society. No. 320. Da capo press.

Wolfe Cary (2009) What is Posthumanism? Minnesota: University of Minnesota

Press.

Winthrop-Young K G (2011) Heidegger, Bogeyman: Kittler in the Anglosphere, Theory, Culture and Society, vol. 107 no. 1 6-20.

[1] According to Heidegger, the *techné* of the Western project is an instrumentality that takes over, arrests, or enframes what it desires to manipulate or contain. This is also called the *Gestell*, which refers to the systematization of the principle of reason in the technical process of *ratio*, or the *ar-raisonnement* of knowledge. To this "enframed" use of technology Heidegger opposes an ostensibly older conception of *techné* that the Greeks called *poesis*, a bringing-forth, a setting-on-the-path toward revelation, defining truth, being, or essence. From the standpoint of production (*poesis*), technics is a way of revealing. For Heidegger claims that techne has nothing technological. See Heidegger Martin (1992) *The Question Concerning Technology, and Other Essays*, Harper Collins. In this article, instead, t*echné* is not understood as art, craft and poeisis. Instead, it refers to the understanding of techne as application of knowledge for the purpose of producing a specific, predermined product. This can be re-allied with both the Aristotelian view of techne as being something between nature and humanity, a mediation that is creative beyond what nature can achieve. Similarly, Felix Guattari clarifies that whilst for Heidegger techne is re-posited as a ground, an ontological being, for Aristotle instead techne is concerned with a brining something into being, thus concerns the technical and theoretical means of producing a thing, the futurity of causality imbued within these means. Whilst closer to this approach, this article however focuses on the possibility of a philosophy of the machine emerging from the embedding of logic in automated procedural systems. See Guattari Félix (2001) Machinic Heterogenesis, in D.T. Trend (ed.), *Reading Digital Culture*, Oxford: Backwell, 38-51.

[2] For a focussed discussion about Kittler's alleged technodeterminism and his role within posthumanism, see, Krautrock Geoffrey Winthrop-Young (2011) Heidegger, Bogeyman: Kittler in the Anglosphere, Theory, Culture and Society, vol. 107 no. 1 6-20.

[3] Francois Laruelle discusses the tension between decisional philosophies and the computational language of binary decisionism to argue that his non-philosophy indeed cannot be understood in terms of computational automatons or even the immediacy of the real or the machinic (as proposed by Deleuze's non-philosophy for instance). His model of a transcendental computer instead brings forward the critique of the vicious circle between philosophy and automatism. It ante-poses to this conundrum, the Man-in-Person definable in terms of a uni-maton determining a practice that cannot be reduced to a thing. Between the logical and the philosophical (between meta-language and hermeneutics), the uni-maton is the non-axiomatic real, or that which prevents the axiomatic to sink into Being or Nothingness or Multiple. Laruelle's thesis of the transcendental computer therefore offers an alternative to the technological type of AI, by suggesting that the Transcendental Computer supposes first of all a detour out of the machine. A machine alone cannot account for a Transcendental Computer, but the supposition of Man in Man, an-axiomatic axiom, can. Ultimately, non-philosophy can rather propose an radicalization of human subjectivity co-determined by the forms and style of various technologies. See "The Transcendental Computer: A Non-Philosophical Utopia", trans. Taylor Adkins and Chris Eby, Speculative Heresy, August 26, 2013 https://speculativeheresy.wordpress.com/2013/08/26/translation-of-f-laruelles-the-transcendental-computer-a-non-philosophical-utopia/.

[4] A formal system is *complete* if for every statement of the language of the system, either the statement or its negation can be derived (i.e., proved) in the system. A formal system is *consistent* if there is no statement such that the statement itself and its negation are both derivable in the system.

[5] Whilst the probability that a program will halt can be defined by any theory based on axioms, maximally unknown probabilities (incomputable) can only be partially compressed at a future moment as discrete infinities, or what Chaitin calls Omega.

[6] See parts of the video installation here: http://www.zachblas.info/works/im-here-to-learn-so/ (Last accessed 13th March 2018).

[7] Wakefield, Jane. "Microsoft chatbot is taught to swear on Twitter" BBC News. Last Accessed 14th March 2018. http://www.bbc.com/news/technology-35890188; Paul Mason, "The racist hijacking of Microsoft's chatbot shows how the internet teems with hate" https://www.theguardian.com/world/2016/mar/29/microsoft-tay-tweets-antisemitic-racism (Last accessed 11th March 2018).