

**Digital Hermeneutics. From Interpreting with Machines to
Interpretational Machines**

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Abstract

Today, there is an emerging interest for the potential role of hermeneutics in reflecting on the practices related to digital technologies and their consequences. Nonetheless, such an interest has not yet given rise to a unitary approach nor to a shared debate. The primary goal of this paper is to map and synthesize the different existing perspectives in order to pave the way for an open discussion on the topic. The article is developed in two steps. In the first section, the authors analyse digital hermeneutics “in theory” by confronting and systematising the existing literature. In particular, they stress three main distinctions among the approaches: 1) between “methodological” and “ontological” digital hermeneutics; 2) between data- and text-oriented digital hermeneutics and 3) between “quantitative” and “qualitative” credos in digital hermeneutics. In the second section, they consider digital hermeneutics “in action”, by critically analysing the uses of digital data (notably tweets) for studying a classical object such as the political opinion. In the conclusion, we will pave the way to an ontological turn in digital hermeneutics. Most of this article is devoted to the methodological issue of interpreting with digital machines. The main task of an ontological digital hermeneutics would consist instead in wondering if it is legitimate, and eventually to which extent, to speak of digital technologies, or at least of some of them, as interpretational machines.

Keywords: hermeneutics, digital hermeneutics, political opinion, data, digital traces, methods, information, information technologies, interpretational machines.

Introduction

Classically, hermeneutics has been defined as a *Kunstlehre*, i.e. an art, technique, and technology for the (correct) interpretation of cultural productions, mostly texts. In the twentieth century, hermeneutics became a philosophical movement dealing with interpretation and understanding as the main features of humans’ “being-in-the-world”. To put it differently, philosophical hermeneutics deals with human beings as “interpreting animals”.

Hermeneutics has rarely being concerned with technology. For sure, from Augustine’s *De doctrina christiana* on – a text Heidegger (1999, 9) referred to as “the first hermeneutics in the great style” – hermeneutics has been focused on writing, which actually *is* a sort of technology. However, (1) it generally did not question the material nature of the means for the meaning’s transmission, and (2) it considered language as the universal mediator between the human subjects and the world.

Such indifference towards technology must not be considered an intrinsic limit. For instance, Don Ihde (1999) has worked hard for “expanding hermeneutics”. First, by renouncing the primacy of language: against the “literalization” of the world, i.e. the fact that in hermeneutics as well as in all philosophies of the linguistic turn everything turns out to be “textlike”, he insisted on the centrality of perception (notably sound and images) and embodiment. Second, by accounting for the role of technologies in mediating between the human subjects and the world. In this respect, one might distinguish between a “special” and a “general” hermeneutics in Ihde’s thought. On the one hand, he calls “hermeneutic” a specific kind of technologically mediated I-world relations, in which the technology offers a representation of the world that must be “interpreted” in order to access the world. This is the case, for example, of maps, thermometers and flight instruments (Ihde 1990, 80-97). On the other hand, Ihde implicitly recognizes that all technologies are hermeneutic “by nature” when he discusses their “magnification-reduction structure”, namely that they are selective — by stressing some aspects of the world, and neglecting some others — and do not simply replicate non-technological situations. One may argue that in philosophy of technology it is always a matter of interpretation, in the sense of distributing the right amount of interpretational agency among humans and machines, an amount that can considerably vary from a closed-to-zero importance of the machine to an inversion of roles or, as Latour (1994) called it, a “delegation”.¹

In the specific field of digital technologies, hermeneutics is not out of the picture, both in a “special” and in a “general” sense. First, because language, signs, and symbols, which have been brutally defenestrated by philosophy of technology after its “empirical turn”, have come back in force. In

¹ He (Latour 1993, 63-64) also said that the greatness of the philosophies of the linguistic turn was that “they developed, protected from the dual tyranny of referents and speaking subjects, the concepts that give mediators their dignity [...]”. Yet, their great weakness (which, to say the truth, concerns more linguistic structuralisms and poststructuralisms than hermeneutics) was “to render more difficult the connections between an autonomized discourse and [...] the referent”.

computation, indeed, it is a matter of special kind of signs, which are both human-readable and machine-executable. Second, because several reflections in the field today concern precisely the amount of interpretative agency we are willing to entrust to some of these machines in delicate contexts such as human health and security – and, of course, the one we already, often unwillingly, entrusted.

Today, there is an emerging interest for the potential role of hermeneutics in reflecting on, and, in some cases, in contributing to the design of digital technologies. Nonetheless, such an interest has not yet given rise to a unitary approach nor to an open and shared debate. The primary goal of this paper is to map and synthesize the different existing perspectives in order to pave the way for an open discussion on the topic. The article will be developed in two steps. In the first section, we will analyse digital hermeneutics “in theory” by confronting and systematising the existing literature. In particular, we will stress three main distinctions among the approaches: 1) between “methodological” and “ontological” digital hermeneutics; 2) between data- and text-oriented digital hermeneutics and 3) between “quantitative” and “qualitative” credos in digital hermeneutics. In the second section, we will consider digital hermeneutics “in action”, by critically analysing the uses of digital data (notably tweets) for studying a classical object such as the political opinion.

In the conclusion, we will pave the way to an ontological turn in digital hermeneutics. Most of this article is devoted to the methodological issue of interpreting *with* digital machines. In other terms, our concern is mainly about demonstrating how dealing with digital methods and digital objects for approaching specific entities such as political opinion is still a form of interpretation, no matter how automated and quantified these methods are. This can also imply a more philosophical reflection on interpretation in a digital milieu as the result of a complex series of interactions between humans and non-humans. The “with” does not indicate here just the instrument used in order to perform the interpretation, but also a relation in which the digital technology becomes a “quasi-otherness”. And yet, there is an even more radical way of understanding digital hermeneutics as a discipline dealing with the emerging properties of some digital machines such as unsupervised machines learning algorithms. The main task of such digital hermeneutics would consist in wondering if it is legitimate, and eventually to which extent, to speak of digital technologies, or at least of some of them, as interpretational machines.

1. Digital Hermeneutics, in Theory

To the best of our knowledge, we can say that digital hermeneutics began in 1986 with Mallery, Hurwitz, and Duffy’s “Hermeneutics: From Textual Explication to Computer Understanding”. This publication was immediately followed by some pioneering texts by Rafael Capurro (1986; 1992),

whose later work will be briefly considered in the conclusion. What is particularly interesting about Mallery, Hurwitz and Duffy's article for our purposes is that it articulates two tendencies that over the years have excluded each other. On the one hand, it refers to the effort of authors such as Dreyfus, Winograd, and Flores for using hermeneutics in the field of AI research. Hermeneutics — the main reference is Heidegger's early principal work, *Being and Time* — is seen as a rehabilitation of the pre-theoretical and pre-symbolical structure of human intentionality. This would represent the main limit of the GOFAI or, as Dreyfus (2007) more recently suggested, of AI as such, since machines do not and cannot "dwell" in the world. On the other hand, it considers the attempt of some researchers to automatically extract the affective structure of a text. In particular, the authors refer to Lehnert, Alker, and Schneider (1983), based on Lehnert's earlier work on "plot units". Plot structures were computationally extracted using a program for finding the most strategic and highly connected units, and to find the "essential" Jesus story — the texts in question was the Gospels. Hermeneutics coincides, in this sense, with an ensemble of techniques and technologies for for interpreting and understanding texts. A unitary problem was at stake for the authors, i.e., the possibility of AI to understand natural language. For us, it is noteworthy that the literature on digital hermeneutics has taken, instead, two different directions. For some interpreters, digital hermeneutics is a *Kunstlehre* for the interpretation and understanding of digitalized or digital native texts, texts corpora, data, or databases. For other interpreters, it rather has to do with the recognition of similarities and differences (mostly differences) between human and AI intentionality. For now, we are putting aside this major distinction between a "methodological" and an "ontological" attitude, as we will discuss it in the conclusion; until then, we will remain within the context of "methodological" digital hermeneutics.² Methodological hermeneutics does not represent a unitary field either. Some academics, usually with a background in linguistic or digital humanities, affirm or implicitly admit that digital hermeneutics is about computer-mediated interpretation and understanding of texts or texts corpora, or about a texts reading-inspired attitude towards elements of digitality such as the code. Rastier (2008; 2010; 2012) and Mayaffre (2002; 2006), for instance, have developed in France a computer-mediated approach to texts' corpora, inspired by the "interpretative semantics" (Rastier 1996). For them, computers and software (database + algorithms) produce ontological (here to be understood as the "reality" and the "texture" of the object in question), technological, and methodological variations in the interpretational practices in human and social sciences: 1) ontologically, they bring forward the proper object of linguistics: neither the word, nor the sentence or the text, but the corpus, i.e. the

² "Methodological" does not mean that these approaches are not concerned with problems of meaning, reference, context or even existence. It just means that the methodological issues are dominant, and philosophical concerns are often no more than vanishing points. In classic hermeneutics, this is the case, for instance, of Peter Szondi's material hermeneutics. For him, "material" means both object-oriented – i.e., for him, a rigorous internal philological analysis of the text – and context-interested – in the sense of the Frankfurt school, the material conditions of production and reception of the text.

context from which a single text, sentence or word derives its own meaning. According to Rastier (2011, 25. Our translation), “any text must be led back to a corpus in order to be interpreted”; “the morpheme is the elementary unit, the text is for an evolved linguistics the minimal unit, and the corpus is the whole in which this unit takes its meaning” (Rastier 2011, 33); 2) technologically, they enable articulation of the “ocular linear traditional reading” with “quantitative”, “paradigmatic”, and “hypertextual” forms of reading (Mayaffre 2006, 4); 3) methodologically, they invite the researcher to use a trial and error approach rather than the deductive one that characterizes theoretical linguistics (Rastier 2011, 13).

Burnard (1998) brought the attention to the hermeneutic implications of text encoding. For him, in the end, all markup is interpretive. Moreover, “markup maps a (human) interpretation of the text into a set of codes on which computer processing can be performed. It thus enables us to record human interpretations in a mechanically shareable way”. Using texts’ interpretation as a paradigm rather than as a research goal, van Zundert (2016) has recently argued that digital hermeneutics must not be reduced to a post-processing of what remains after the automated process of curation, analysis, and visualization. He cites, among others, Ramsey (2010), who theorized the “hermeneutics of screwing around”. The only solution to the information overload — “so many books, so little time” is Frank Zappa’s phrasing which the author discusses at the beginning of the article — that we are facing because of digital technology, especially the Internet, is to find a purposively selective and subjective path through it. The hermeneutics of “screwing around” is, then, a “highly serendipitous journey replacing the ordered mannerism of conventional research” (Ramsay 2010, 7). For van Zunden, instead, digital hermeneutics should be thought as an intimate engagement with digitality and the software itself. In other words, as argued by Hayles (2012) before him, it is a matter of going beyond the alternative between algorithmic analysis and “hermeneutic close reading”.

If several researchers have theorized digital hermeneutics through the lenses of (digitalized and digital native) interpretation and understanding of texts, some others, usually with a background in “digital sociology” (Marres 2017),³ argue that digital hermeneutics should be more widely concerned with all forms of digital data.⁴ For us, this perspective is to be preferred because it reflects the same process of universalization/deregionalization that has been accomplished by classic hermeneutics at the beginning of the twentieth century. Such a movement started with Schleiermacher between the eighteenth and the nineteenth century. Before him, there was philology for ancient Greek and Latin texts, on the one hand, and exegesis for the Old and New Testament, on the other hand. Moreover, in

³ Here we use this general and recently coined term for referring to a plethora of approaches such as “digital social research”, “digital methods”, “computational social science” and “cultural analytics”.

⁴ It must be said that even in this case texts interpretation often remains a paradigm or a metaphor through which data and data analytics are understood.

both these domains, interpretation used to take as many forms as there were texts. Schleiermacher's effort consisted in trying to overcome these particularities.

And yet, it is Dilthey who definitely brought hermeneutics beyond its regional use: the specific issue of texts' interpretation flowed with him into the wider domain of historic knowledge. In other words, hermeneutics strived for being the proper methodology for *all* human and social sciences. Its objects are not just texts, but more generally all the expressions of what Hegel called the "objective spirit": texts, monuments, documents, etc.⁵ In the field of human and social sciences, the access to the author/actor intentions is always indirect, through an interpretation of the traces he or she (or someone else for him or her) left behind. To use Dilthey terminology, understanding (*Verstehen*) in human and social sciences always depends on the interpretation of an expression (*Ausdruck*) of someone's lived experience (*Erlebnis*). The Italian historian Carlo Ginzburg (1989) has spoken of "evidential paradigm", which is based on the interpretation of "clues" — "*spie*" in Italian, and "*traces*" in the French version of the article. And it is not by chance that the notion of "digital trace" is playing an important role in France in theorizing digital technologies (David-Sebbah 2015). As argued by Marres (2017, 54), "whereas the notion of data presumes a particular architecture, the notion of trace is more minimal, positing merely the detection of a thing or movement and the recording of this". Moreover, "whereas the notion of 'data' entails a belief in the 'extractability' of information from the setting that produced it, the notion of trace preserves a reference to the device by which it was detected".

At the time of Dilthey, there was a scarcity of externalizations and materialization of subjective spirits. Furthermore, they were either a privilege of the cultural and urban elites or a damnation for the marginalized people such as prisoners and sectioned patients. During the twentieth century, we observed an enormous growth of the "documentality" (Ferraris 2012). But, on a closer inspection, documents and traces still concerned few acts and (social) events such as births, marriages, deaths, fines, and criminal records. Today, mobile and wearable digital devices, along with the increasing presence of digital recording systems in the environment we live in, has made digital traceability to be a "total social fact". One might argue, then, that digital technologies, and especially the Internet, are paving the way to the realization of the epistemological dream of the later Dilthey, in that they represent an exploitable source of knowledge for human and social scientists.

Now, digital hermeneutics can aspire to universality as far as it aligns itself with digital traces and data, the presence of which is henceforth as great as the human and social reality, a "map" that finally *almost* corresponds to the "territory". We say "almost" because digital data hermeneutics can be actually defined as a general problematization of the supposed homology between (social) reality and

⁵ This perspective has been developed by the later Dilthey, especially when he rejected psychologism in *Der Aufbau der geschichtlichen Welt in den Geisteswissenschaften (The Formation of the Historical World in the Human Sciences)*, published in 1910.

its digital representations. Such problematization is based on 1) ontological, 2) methodological, and 3) technological considerations:

1) For Østerlund et al. (2016), the hermeneutical dimension of digital social sciences depends on the ontological structure of the “trace data” themselves, which are a) “found”, i.e. not produced by the researcher, and not originally intended as measures of a concept of theoretical interest; b) “event-based”, i.e. not summary data, but rather records of actual behaviors that have to be interpreted in order to make any conceptual connection; c) “longitudinal”, since they occur over a period of time, and this raises questions about their temporality; d) “semi-structured”, because they are composed by some structured metadata fields such as date and time, ID, etc., but also by unstructured elements like the content of the posts. Classic hermeneutics was concerned with texts but not with their materiality, that is to say the apparatus for gathering the texts. Digital hermeneutics must be rather focused on the sociomateriality, the details of the specific system technology that captured the data.

2) Gerbaudo (2016) has proposed a “data hermeneutics” as a methodological reply to the anti-interpretative ideology of contemporary “dataism”. For him, data hermeneutics should be based on two processes: a) qualitative sampling procedures to reduce the size of (social media) datasets; b) the development of a “close data reading” that may help interpretation in relation to individual narratives, dialogical motivations and social worldviews. In the first case, the author indicates three possible procedures: α) sample for top, by focusing on the messages that can be considered as the most visible or important within a conversation; β) random sampling, selecting by chance a subset of messages from a given conversation using appropriate software; γ) “zoom-in sampling”, involving concentrating on a particular period of time in the conversation, which is considered particularly significant.⁶ In the second case, he speaks of proceeding in different steps, allowing to progressively “close-in” on the meaning structures of posts and conversation. This process, too, is made of three possible steps: reading posts α) as rows in a dataset; β) as part of the conversation; γ) as part of a certain social discourse.

3) Finally, van den Akker et al. (2011) defined digital hermeneutics as “the encounter of hermeneutics and Web technology”; “interpretation of information in a digital environment”, the “main aim of which is to investigate the relation between the human interpretation process and Web application supporting that interpretation process”. In particular, the authors have proposed a technical solution called Agora to support users of the Rijksmuseum Amsterdam collection database in their contextual interpretation and understanding of single objects by allowing them to build around it “historically meaningful narratives”. Amarselu and Jones (2016) have analyzed the users’ responses to the

⁶ Boullier, Crépeil and Jacomy (2016) have recently complexified the powerful zooming metaphor in the context of graph analysis. For them, it must be integrated with variations on the initial settings, such as the algorithm, the connections with the totality of the graph and the categories that were used for the first clusterization.

different visualization forms offered by Transviewer, an XML-TEI-based platform allowing the exploration of historical documents.⁷ Bachimont and Blanchette (2006) briefly presented the MUSTICA preservation tool, which was meant to help the French IRCAM (Institut de Recherche et Coordination Acoustique/Musique) in cataloguing all intellectual and material elements of a commissioned piece so that it may be recreated at a later date, and the follow-up project “Record/Replay”, the aim of which was to develop the theoretical and practical tools needed to ensure the long-term preservation, repurposing, and cultural appropriation of videogames.⁸

A third important distinction in digital hermeneutics is between qualitative and quantitative approaches. As we have just seen, Gerbaudo (2016) believes that digital hermeneutics is the qualitative corrective — however, not a substitute, and this is why he speaks of “quali-quantitative” methods — to the dominant quantitative and automated tendency in digital social data studies. Similarly, Gibbs and Owens (2013, 162) argued that digital data does not always has to be used as evidence. It can also help with “discovering and training research questions”: “as more and more historical data is provided via, or can be viewed in, tools like Google’s N-gram viewer (to take a simple example), playing with data [...] is more important than ever”. Data visualization can also be used not only as a source of information, but as forms of aesthetic provocation.

And yet, Mohr, Wagner-Pacifici, and Breiger (2015) have presented “computational hermeneutics” rather differently. For them, in older automated texts’ analysis, the subtleties of expressions, the complexities of phrasing and the nuances of textual corpora are discarded. But the arrival of Big Data has changed things: “the central idea of computational hermeneutics is that all available text analysis tools can and should be drawn upon as needed in order to pursue a particular theory of reading [...] contemporary technologies give us the ability to consider a textual corpus in its full complexity and nuance” (Mohr, Wagner-Pacifici, and Breiger 2015, 3). In other words, Big Data and the advanced techniques of text analysis supersede the “subjective regard”, that could operate just on selected samples, towards an exhaustive in-depth analysis in which the quantitative finally absorbs the specificities of qualitative data analysis. It is not our purpose, in this context, to account for the effectiveness or not of the methodology they propose, which is based on Kenneth Burke’s distinction of five elements in dramatic logic: “what was done” (act), “when or where” (scene), “who” (agent), “how” (agency) and “why” (purpose). Yet, we would like to stress that this perspective is not really interpretative: it is capable of providing an explanation of infra-textual and inter-textual structures,

⁷ Armaselu and van den Heuvel (2017) have recently analyzed how interpretation is supported and shaped by metaphors embedded in an interface. Their article is based on the analysis of three uses of the z-text model and Z-editor interface that allows to create and explore zoomable texts.

⁸ Bruno Bachimont is certainly one of the most interesting, but less internationally known, authors in the field of digital hermeneutics. In the course of his career as an epistemologist and a computer scientist, he has explored digital hermeneutics in all its forms, from AI-related issues to “methodological” and “ontological” issues (Bachimont 1996; 2010; 2018).

but not an understanding of para-textual and extra-textual cultural, social, and sociotechnical conditions of production and reception. In fact, Burke's approach itself is less close to hermeneutics than to structuralism or, as Lentricchia (1983) has called it, "cultural structuralism".

For us, the task of digital hermeneutics consists in unveiling the "hot" side of the mostly "cold", i.e. highly quantitative, patterns characterizing the contemporary "digital dataism". "Hot" and "cold" must not be considered here as an alternative. In his major work *Truth and Method* (2004), Hans-Georg Gadamer introduced a distinction that played a fundamental role in the hermeneutic debate during the second half of the twentieth century. According to him, hermeneutics must be understood in contraposition to the scientific, methodological, and quantitative perspective that reduces truth to the analytic explanation of discrete facts. Gadamer maintains that "hard" tendencies in sciences stand on an artificial separation between subject and object. Yet, such a separation is fatal for all significant fields of human experience such as art, history, and language in general (these are, in fact, the three parts that compose *Truth and Method*). According to Ricoeur (1991, 70-74), the merit of Gadamer consists in having taken seriously the epistemological question of Dilthey while remaining within a Heideggerian framework. His concern, indeed, is to confront the Heideggerian concept of truth with the Diltheyan notion of method. And yet, "the question is to what extent the work deserves to be called *Truth AND Method*, and whether it ought not to be entitled instead *Truth OR Method*" (Ricoeur 1991, 71). In other terms, Gadamer's distinction is in reality an alternative: "either we adopt the methodological attitude and lose the ontological density of the reality we study, or we adopt the attitude of truth and must then renounce the objectivity of the human sciences" (Ricoeur 1991, 75).⁹ Ricoeur's effort has precisely consisted in overcoming this alternative in the three steps: 1) by changing the immediate object of the hermeneutical inquiry, which is not anymore existence and spoken language, as it was for the earlier Heidegger, but language's materializations and externalizations such as signs, metaphors, texts, and narratives; 2) by adopting some ideas and practices of structuralism, the methodology that seemed in those years allow reducing the gap between natural sciences and humanities; 3) through a radical critique of the limits of structuralism, in particular its intratextual and intralinguistic suspension.

For Ricoeur there are two ways of doing hermeneutics. There is the "short route", which is the one taken by an ontology of understanding à la Heidegger. It consists into breaking with any discussion of method and in carrying "itself directly to the level of an ontology of finite being in order there to recover *understanding*, no longer as a mode of knowledge, but rather as a mode of being [...]. One does not enter this ontology of understanding little by little [...]: one is transported there by a sudden

⁹ For a more nuanced perspective on Gadamer and on the difference between Gadamer's and Ricoeur's hermeneutics, see Vallée (2013). And yet, as recently argued by Michel (2017, 243-244), one should not underestimate the crucial difference between the predilection for appropriation and tradition in Gadamer, and the interest for distanciation and critical understanding in Ricoeur.

reversal of the question” (Ricoeur 1974, 6). And there is the “long route”, the one he has tried to travel, which rather consists in undertaking a detour through semantics and aspiring to ontology as a very last degree of meditation. For the French philosopher, there is no opposition between method and truth. The exploration of the method paves the way to a more instructed ontological or existential reflection: “to explain more is to understand better” was his favourite maxim. Digital hermeneutics can be understood as an actualization in the digital age of the Ricoeurian plea for the methods without losing touch with existence. Digital hermeneutics does not consist for us in opposing the “hot” existence to the “cold” digital methods and objects, but rather into articulating them, in making existence emerge from an internal analysis of the methods and the objects themselves.

A similar attitude can be observed in Introna (1993) and his hermeneutical understanding of information and information systems.¹⁰ For him, the current (at that time) conceptions of information have some points in common: 1) information is the result of a transformation and conversion process. Data must be converted into information; 2) information has a recipient or a user. The recipient must experience that which is received as meaningful or of value; 3) the purpose of information is to effect change in, or affect choice of the receiving system. These points can be subsumed in the statement according to which “the only condition for data to become information is that it must be meaningful to the recipient”. In the semantic theory of information developed by Floridi (2005, 2010, 2015) this perspective has been neglected, because semantic information is defined as meaningful (and true) *per se*. Meaningfulness and truthfulness are directly “encapsulated” into the notion of information rather than being problematized in their context-dependency. As argued by Adriaans (2010, 43), Floridi’s theory of semantic information cannot explain the subjective and relational character of information: “It is bound to make information a monolithic static notion that exists independent from any individual observer”. On the contrary, Introna insists on the fact that meaningful information is the result of an interpretation-understanding process that is always-already oriented by the prejudices and the interests of both the sender and the receiver – and, one might add, by the affordances of the medium and its materiality. Hence, hermeneutics is important in order to become aware of these fundamental orientations. For the author, it is a matter of “correcting” the “failed” communication process. But since a transparent communication process is a myth, “it can be argued that all communication is inherently ‘failed’ communication and thus in need of interpretation or hermeneutics” (Introna 1993, no page).¹¹

¹⁰There is a particular interest in the field of information systems for hermeneutics. For a general overview, see Webb and Pollard (2006).

¹¹For a similar perspective on hermeneutics and information, see Diamante (2014). According to Ackers (2015, 73), “There is a role for historians of computing to tell us more about how this moment of data science came to be by looking at information domains through data and the ways data acquires layers of context to become information. [...] A hermeneutics of data is needed at the micro-, meso-, and macro-scale of networked infrastructures”.

In the following section, we propose to explore such context-dependency in the specific field of the use of Twitter data for analyzing political opinions. In order to do this, we will resort to the notion of threefold mimesis developed by Paul Ricoeur in the last volume of *Time and Narrative*. The first mimesis (prefiguration) has to do with the predisposition of human action to be told, and, more precisely, to be put into writing or, one could say, to be textualized and, in the field of digital hermeneutics, traced and datafied (from traces to data). The second mimesis, (configuration), corresponds to the emplotment (*mise en intrigue*): it is the moment in which the different textualized or datafied elements of the human action are combined and recombined according to a specific coherence (from data to methods). Yet, narrative is never “*for its own sake, for its own glory*”. Language and all its forms always have a reference that is external to the language itself, and which is both its origin and destination. The third mimesis (reconfiguration) has precisely to do with the application of the text to the world of the hearer, the reader or the author herself (Ricoeur 1988, 71). To put it slightly differently, reconfiguration represents the heuristic value of narrative. In the field of digital hermeneutics, it is the moment when the researcher makes sense, through interpretation and understanding, of the articulated traces – or, the other way around, when digital traces make sense for the researcher, responding to some of her research questions (from data to information). The notion of threefold mimesis is interesting then in that it fits the threefold process of collecting, analyzing and interpreting digital traces. The task of digital hermeneutics consists for us in revealing the “hot” tendencies in each of these supposedly “cold” moments.

2. *Digital Hermeneutics, in Action*

In order to consider digital hermeneutics in action, recent studies about political opinions based on Twitter data appeared to us as an excellent fieldwork for at least three reasons.

First, political opinion¹² as a theoretical object has a very long history and its interpretational complexity makes it suitable to be approached through a hermeneutical approach. Indeed, the study of public opinion is a classic field in the social sciences. In the last century, scholars strongly debated on the definition of this concept.¹³ *Political* opinion is conceived as a sort of *public* opinion: scholars have not been interested in studying private sentiments, but rather sentiments publicly expressed which can influence others opinions and eventually policy making. Studies related to elections, political parties and representatives filled the pages of the social science journals in the last century.

¹² In the concluding remarks to this section, we will show how even the use of the singular “political opinion” or of the plural “political opinions” corresponds to embracing different theoretical conceptions.

¹³ For a history of the concept see Habermas (1991) and Noelle-Neumann (1984). “Toward a Science of Public Opinion” (1937) by Floyd H. Allport can be considered as the paper that officially opened this academic field of research, even if the previous contributions of Gabriel Tarde and Walter Lippmann do not have to be forgotten.

They are generally grounded in empirical analysis based on classical methods such as surveys, focus groups or interviews. Robert Entman and Susan Herbst (2001, 211) show that “scholars claiming to represent public opinion through their research data and analyses also engage in framing”. Indeed, without examining in depth here the different definitions of political opinion (that will be presented below by describing the reconfiguration phase), we can already notice both the impossibility to provide a clear and unique definition of this theoretical object and the influence of the empirical workflow on its conception.

Second, it is interesting to note that digital traces have drawn a great deal of attention from researchers in this field. Classical empirical methods, such as opinion polls, today are frequently replaced by digital data mining. Indeed, the fact that politicians and citizens are moving away from the offline public space towards new online arenas of discussion generates new digital data that offers fresh sources of information to empirical research. From blogs and forums, to Facebook pages and Twitter accounts, the availability of bottom-up data for mining public opinions makes traditional techniques old-fashioned and uselessly expensive. In particular, Twitter has got a lot of attention by scientists both for the ease of data collection and treatment, and for the wide scope of topics that exchanges can cover. What make this literature suitable to study the threefold mimesis is the fact that none of the studies that use Twitter data to analyse political opinion discuss and argue the equivalence between digital traces (tweets) and opinions.

Finally, the third reason that justifies the choice of this case study is the great variety of data and methods that have been used in this field. Studies vary on the size of corpora, from small to big data, on the type of data, from content- to interaction-based approaches, and on methods, from statistical analysis, to semantic analysis or network analysis.

Taking into account these three elements, it becomes intriguing to follow the threefold mimesis (preconfiguration, configuration and reconfiguration) as it has been built in these studies, which are based on the collection of digital traces of political opinion (tweets), their exploitation as digital data and their interpretation in order to obtain new insights about political opinion. In order to perform such a case study, we built a corpus of papers related to the analysis of political opinion on Twitter¹⁴. Based on the analysis of this corpus of papers, we could identify three ways to build the threefold

¹⁴ We carried out several keyword queries on bibliographic databases (Scopus and Google Scholar). We selected only conference papers, articles in journals and book chapters (thus excluding books, thesis and reports). By considering the query “political AND opinion AND twitter” in Scopus, we obtained a corpus of 255 abstracts. Among them, several were not pertinent to the analysis because the focus was on a specific aspect of the data treatment or presenting more general questions as cross-platform communication. In particular, all papers related to the relationship between broadcasting events and commenting on Twitter have not been considered. As regards Google Scholar, searching in the full text of publications, the query “political opinion AND twitter” (2010-2017) returned 3530 results. In order to identify a relevant sub-sample of interesting papers, we considered the most cited papers in both databases and excluded papers that were simple reproduction of already tested methodological workflows on different case studies. Globally, we considered 70 papers.

mimesis that we called *preference*, *sentiment* and *interaction*. These three approaches are summarized in the following table and described in depth in the following paragraph.

Approach	Prefiguration (data)	Configuration (method)	Reconfiguration (conceptual form)
1) <i>Preference</i>	Tweet as a unit (volume of tweets)	- Statistics - Basic sentiment analysis (lexicon)	Mass opinion
2) <i>Sentiment</i>	Tweet as a content (words and images inside the tweet)	- Advanced sentiment analysis (unsupervised and supervised learning)	Latent opinion
3) <i>Interaction</i>	Tweet as an interaction (context of tweets)	- Network analysis	Activated opinion

Table 1. The three approaches of political opinion

2.1 *Prefiguration: From Traces to Data*

In this specific field, the prefiguration consists in the phase of selection and collection of tweets. Once the object of study is identified, the researcher has to select the digital traces useful for answering her research questions. In practice, she has to build a protocol of collection of tweets that will define which tweet will be selected (based on a keyword query, a user query, a geographical query, etc.), which time period will be considered, which items of the tweet will be stocked in the database (text, image, user information, location, metadata, etc.), which system will be used to collect the tweets (stream API, REST API, buying data with GNIP or other services, etc.). All these choices have important consequences on the following phases and notably on the format of digital data and the methods that can be used to analyze them. In our corpus, we can distinguish three ways to approach the preconfiguration phase.

In the first, most frequent case (*preference*), tweets are considered as a unit, as a whole (without considering the content of the tweet or its context of usage). Researchers adopting this approach build corpora of tweets including specific keywords or hashtags, such as the name of a candidate, a political party or more rarely a specific topic. Then, they are not interested in collecting metadata or to analyze the content of message, yet they mainly count tweets and observe the variation in volume of tweets according to different parameters (time, space, user, topic, etc.).

Taking into account the limits of an approach based simply on the count of preferences, in more recent studies scholars have focused on individual attitudes. Researchers adopting this definition (*sentiment*) also build corpora of tweets including specific words or hashtags, yet they are interested in the tweet as a content rather than as a mere countable unit. It means that in the collection phase, particular attention is paid in capturing all texts. Several researchers also work on collecting other

types of items that are included in the tweet, such as URL, images, video or emoticons.

Some researchers not only focus on the tweet itself but also on its context in order to identify the network of interactions related to the creation and circulation of opinions (*interaction*). In this case, the collection of data has to consider not only the tweet but also two other types of data. First of all, the digital traces related to the circulation of the tweet, that is to say all retweets and citations of the studied tweets. Such data allows for rebuilding the network of diffusion of the message. Secondly, it is also interesting to collect data related to the user of the tweet. In particular, the prefiguration phase can consider the “following” and “followers” of the user and the “mentions” of the user. This data allows for rebuilding networks of users related to a message.

2.2 Configuration: From Data to Methods

Once the corpus of tweets is built in the configuration phase, the researcher chooses the methods. Yet, we can note that the choice is strongly influenced by the type of collected data. The fact to have or not have metadata, to know or not know the content of the tweet, to own or not own contextual information concerning the message and the user sending the message (such as her following/followers network) helps in deciding the selection of a method rather than another.

In the first group of studies (*preference*), considering that the researcher has only collected volumes of tweets, methods are limited to statistical analysis for studying spatiotemporal variations or very basic sentiment analysis techniques (manually built lexicons) that produce a simple word count. Here, we have mainly studies that try to predict election results or that simulate opinion polls (Tumasjan et al. 2010; Livne et al. 2011; Skoric et al. 2012). With different kinds of quantitative techniques, they aim at verifying whether there is a correlation between the number of tweets mentioning a candidate and the number of votes he/she receives.

When the content of each tweet is known (*sentiment*), researchers may study co-occurrences of words or more advanced textual structures by trying to interpret the individual sentiment expressed by the message. A tricky issue in this field is how “sentiment” is defined. In the last few years, the so-called sentiment analysis has become very popular. According to the definition of Wilson et al. (2005), the sentiment is a question of contextual polarity: “Sentiment analysis is the task of identifying positive and negative opinions, emotions, and evaluations”. The authors propose a lexicon based on unsupervised learning. The most representative paper in our corpus is surely O’Connor et al. (2010), cited 635 times according to Scopus and 1487 times according to Google Scholar. Even if authors are quite prudent in their paper, their approach has been reproduced dozens of times in the following years. For example, Conover et al. (2011), the third most cited paper in Scopus, developed a content-based method on manual annotation (labeled data). More recently, scholars, such as Bermingham and

Smeaton (2011), have proposed supervised approaches for building sentiment classifiers. Sentiment analysis has not only been used in relation to elections, but also for studying perceptions related to governmental decisions for improving policy making. Akkineni et al. (2016) based their analysis on the identification of positive and negative adjectives on Twitter through the analysis of context and polarity. We can also include in this approach studies that qualify sentiments in a more qualitative way based on small corpora of data. Here Twitter is used as fieldwork where researchers follow a specific account or a topic or an event by considering a few hundreds of tweets. The common point of all these studies embracing the sentiment approach is that they can perform (more or less advanced) techniques of textual analysis because in the prefiguration phase researchers were careful in collecting data related to the content of the tweet.

Similarly, following the *interaction* approach, scholars collect in the prefiguration phase a large variety of data related to the context, which can be analyzed through network analysis techniques in the configuration phase. Here we can mention quantitative studies trying to identify opinion leaders based on network metrics. Scholars interested in the environment consider more generally network dynamics in order to qualify the political orientation of people based on their tweeting, retweeting and mention activity. As an example, we can consider Bastos et al. (2013). Through the analysis of a corpus related to the political hashtags #FreeIran, #FreeVenezuela and #Jan25, they study the structure of gatekeeping in Twitter by analyzing retweet, mention and followers-following networks for each hashtag. They reject the idea of the existence of hubs acting as gatekeepers by underlining the importance of committed minorities. For doing this, they use a statistical correlation analysis on nine variables of the dataset to evaluate if message replication in Twitter was correlated with network topology.

Some researchers combine content analysis with network analysis. Xu et al. (2012) focusing on activism networks (studying the #wirecall hashtag during Wisconsin Recall Election of 2012), explore both opinion leadership through network statistics measures and political involvement through the analysis of the information profile and the content of tweets. As regards the first objective, it is interesting that they obtain opposite results of Bastos et al. (2013) showing the connection between centrality and leadership. In order to predict political affiliation of Twitter users, Conover et al. (2011) combine content-based methods with structure analysis of political information diffusion networks (retweet and mention networks) and actually validate network analysis as a more efficient solution for identifying political alignments of users.

In conclusion, even though they take into account the difference of methods of the considered papers, what they clearly share is the strong dependency between the method for building the corpus and the one for exploiting it. It does not mean that one determines the other but that the distinction between prefiguration and configuration as separate phases is a theoretical abstraction and choices made by

the researcher from the beginning of the research have consequences on the transformation of the digital traces into data and information.

2.3 Reconfiguration: From Methods to Information

In the phase of reconfiguration, the researcher finally attributes some meaning to the treated data. Generally, this phase is considered the real challenge for the researcher who has to be able to interpret the traces previously collected, transform into data and treat with different techniques in order to extract some kind of information. Yet, what we want to show here is that a researcher already has a conceptual view of political opinion that will influence her methodological choices of collection, selection and exploitation of digital data and, consequently the transformation of the traces in information. In order to do this, we will consider the contribution of Robert Entman and Susan Herbst (2001) which has been mentioned above. In the paper “Reframing Public Opinion as We Have Known It”, the authors try to classify the definitions of public opinion by identifying four forms of framing public opinion based on methods used by scholars for capturing the public thinking.

The first form is “mass opinion”. According to this form, which is surely the most popular, public opinion can be defined as “the aggregation or summation of individual preferences as tabulated through opinion polls, referenda or elections”.¹⁵ Here opinions are not “reflective of thoughtful, informed citizens”. They are rather pre-existing attitudes and artefacts of the tool used to collect them. In this frame we can include all the literature about opinion polls, but also the papers of our first approach (*preference*). Indeed, as we have seen, in these studies the political opinion is considered as a cumulative preference in relation to an object determined by the researcher. By collecting just the volume of tweets, political opinion can be framed only as mass opinion in the reconfiguration phase of these studies. Opinion is treated as quantifiable, measurable and countable. Tweets are used to study it as an aggregate phenomenon. So, similarly to traditional polls, the researcher is imposing a question on a pre-existing sample of data, considering that it contains the answer and obtains as a result the aggregate opinion concerning the studied object.

The second form is “latent public opinion” that “underlies more fleeting and superficial opinions we find when conducting polls of the mass public”.¹⁶ Studies based on Twitter data, which we included

¹⁵ Already in 1901, Gabriel Tarde (1989) underlined the aggregate nature of the opinion, by introducing the connection between the opinion and the mass. Then, the succeeding contribution of Walter Lippmann that obtained a greater notoriety, insists both on the mass character of public opinion and on the difference between the opinion conceived as a mental image (a “picture in our head”), a stereotyped and selected view of the reality, and the reality itself (“the vast world”).

¹⁶ The idea of a deeper preference depending on individual attitudes was already developed by Valdimir Orlando Key (1961; 1966) and by John R. Zaller (1992). Key (1966, 7) affirms that “the electorate behaves about as rationally and responsibly as we should expect, given the clarity of the alternatives presented to it and the character of the information available to it”. He also underlines that this more latent opinion is difficult to measure. Key notably criticizes surveys that

in the *sentiment* approach, provide effective empirical alternatives to the surveys in order to study individual attitudes. The fact to collect data related to the content of tweet and to perform sentiment analysis techniques (based on supervised or unsupervised techniques) allow researchers in the reconfiguration phase to have information to study “stable, individual-level traits that regulate the acceptance or non-acceptance of the political communications that people receive” (Zaller 1992, 22). Indeed, papers in this second group may have a wide range of objectives. Researchers can try to build alternatives to classic pools to know individual perceptions related to candidates. Or, other studies try to identify positions and emotions related to controversial topics. Yet, the final common goal is to go beyond “mass opinion” and to obtain a complex view taking into account the individual positions related to the object of study according to the form of the “latent opinion”.

The third form is called “activated public opinion”. With this expression, Entman and Herbst refer to opinion “of engaged, informed, and organized citizens – those who are mobilizable during campaign periods and between elections as well”. In it, we can clearly include all studies that focus on the role of people and on the importance of people’s interactions in the formation of opinions. This is the case of the famous two-step flow theory (Katz and Lazarsfeld 1955; Lazarsfeld et al. 1948). The authors demonstrate through statistical analysis that horizontal opinion leaders, also called “influentials” (Merton 1968), are more important than media in the formation of political opinions. Indeed, only few people read the newspapers and the others access second-hand news through these readers. Moreover, according to this theory, influence is based on personal contact. Opinion leaders are more engaged in political discussion and they can hence largely diffuse their ideas through the interaction of other people.¹⁷ If we consider studies of the *interaction* approach, similarities with this conceptual view are evident. In this approach, opinions are individual sentiments generated not only by the predispositions of a person, but also and foremost influenced by his/her role in the society and the interaction with other people. The main result of collecting contextual data and performing network analysis in the reconfiguration phase is to obtain new insights about the role of influentials or of other categories of user on the creation and diffusion of opinions.

Finally, the fourth form, called “perceived majorities”, refers to the situations where the term “opinion” indicates “the perceptions held by most observers, including journalists, politicians, and members of the public themselves, of where the majority of the public stands on an issue”. In contrast

are not suitable to know opinions of individuals, that is for example opinions of political elites, of activists or of influentials.

¹⁷ More recently, Watts and Dodds (2007) suggested that the importance of influentials must be relativized. Indeed, they demonstrate through computer simulations that “cascades do not succeed because of a few highly influential individuals influencing everyone else but rather on account of a critical mass of easily influenced individuals influencing other easy-to-influence people” (Watts and Dodds 2007, 454). In this way, they did not aim at negating the two-step theory but they rather proposed a more complex model of network influence emphasizing flows amongst the three parties involved in influencing public opinion (i.e., media, influencers and general public).

to the previous forms, in this case, opinions do not correspond to the preferences of people considered collectively or individually but rather to the representation that the media produce about the opinion. They are not the actual sentiments but what the media report, thus influencing politicians and citizens behaviours. Consequently, these studies are not pertinent to our analysis because they do not try to evaluate people's opinion by converting digital traces (tweets) into data and information, but focus on the role of the media with other kinds of methods.

To sum up, all these forms help in underlining one main point related to the reconfiguration. There is confusion between the concept of aggregate public opinion (where "opinion" is always singular) and the one of individual opinions (plural). If we apply the distinction between "opinion" and "opinions" to the four forms, we can easily see that the "mass opinion" and "predictive majorities" correspond to an aggregate view of the opinion, while the "latent opinion" and the "activated opinion" are based on the idea of multiple individual opinions. Taking one approach or the other has important consequences on the empirical techniques useful for analyzing political opinion. So, if we adopt the viewpoint of social statistics (Reynié 1989) and we consider that one opinion is equivalent to the other and consequently that the public opinion is an aggregate phenomenon, it means that *preference* techniques based on the count of tweets (similarly to opinion polls) will be considered as effective techniques of measurement. Conversely, if we consider that opinions can only be related to the individual, we will need methods and techniques able to measure the contribution of each person and the interaction between each other.

In conclusion, we might say that at a first level studies in this field can be distinguished according to the techniques of collecting digital traces and the methods of treatment that allow for transforming them into data and information. And yet, at a second, deeper level, we also discover that political opinion is not just a neutral evidence emerging through empirical analysis, because pre-conceptions about what political opinion is and previous choices/affordances (in fact, one should not forget that the choice of a technique often depends on the competences of the researcher or even on the funding/time at her disposal) has a relevant impact on the final results.

Conclusion

Until now, as previously said, we have remained within the limits of a "methodological" digital hermeneutics. It is now time to enter the ontological (or, at least, ontological-anthropological) discussion. Indeed, we believe that digital hermeneutics would not have any specificity if it were merely a series of (critical) considerations on the context-dependency of digital traces collection, treatment and interpretation. Digital hermeneutics would not be much more (which, incidentally, would be already fairly enough) than an extended and improved version of Marres and Gerlitz's

(2016) “interface methods”, who propose to account for the discrepancies between new digital methods, classic social research and social reality.

In the introduction, we have stated that during the twentieth century hermeneutics became a second-degree reflection on the specificity of human beings as interpreting animals. In digital hermeneutics, one might distinguish between three uses of this perspective. First, several authors including the aforementioned Hubert Dreyfus used this idea to stress the intrinsic difference between humans and digital machines (AI). According to him, there is an essential difference between human beings and computers: “[t]he human world, then, is prestructured in terms of human purposes and concerns in such a way that what counts as an object or is significant about an object already is a function of, or embodies, that concern. This cannot be matched by a computer, for a computer can only deal with already determinate objects [...]” (Dreyfus 1972, 173). Human beings have goals, which are realized on the basis of a system of values and emotional states that are usually not explicit. Machines, instead, have ends, which are rather realized (Dreyfus is referring here to symbolic AI) thanks to a predefined list of specific criteria. Even in more recent publications, he has insisted on such intrinsic difference between humans and machines, by denouncing for instance the insufficiency of the attempts to build an “Heideggerian AI”. The fact is that, for him, we would need “a model of *our particular way of being embedded and embodied* [...]”. That is, we would have to include in our program a model of a body very much like ours [...]” (Dreyfus 2007, 1160). It is interesting to notice how Dreyfus’ Heideggerian radicalism is in this context more radical than Heidegger himself. He refuses, for instance, the notion of as-structure, which plays an important role in *Being and Time*. For him, “when absorbed in coping [with the world], I can be described *objectively* as using a certain door *as* door, but I’m not *experiencing* the door *as* a door” (Dreyfus 2007, 1141). In other terms, the as-structure is already a derivative way of understanding our dynamic and immediate coping with the world.

Second, authors have questioned the interaction between human beings within a digital milieu, and between human beings and digital technologies in interpretation and understanding. For Capurro (2000, 80), according to existential hermeneutics, a human inquirer is not an isolated system trying to reach others from his or her encapsulated mind/brain. He or she is rather always-already sharing the world with others. Similarly, “the information-seeking process is basically an interpretation process having to do with the (life-)content and the background of the inquirer and with that of the people who store different kinds of linguistic expressions having a meaning within fixed contexts of understanding (as, for instance, thesauri, keywords and classification schemes)”¹⁸. More recently, Capurro (2010) affirmed that what is new with regard to digital hermeneutics are two sides of a single weakening process of modern technology. On the one side, there is the weakening of the interpreter

¹⁸ In this sense, Heidegger’s perspective on the *Mitwelt* completes in the field of digital hermeneutics the Ricoeurian effort of articulating truth and method.

that finds herself within a network of human and nonhuman actants that she cannot really control. On the other side, information technology is a weak technology, since it deals with human conversations. The digital and hermeneutics are then entangled: the former questions the autonomy of the interpreter, the latter seems able to analyze and eventually reconfigure the structure of the technological system. From an anthropological perspective, then, digital hermeneutics questions the interpretational autonomy of human beings, our general loss of control on the way we interpret, and hence see the world.¹⁹

Such general loss of control due to digital technologies has been seen both positively and negatively. Recently, Wolfgang Sützl (2016) has highlighted this tension in Gianni Vattimo's hermeneutics of media. Earlier works of the Italian philosopher suggest that we should embrace the aestheticization of experience caused by interacting with digital media and technologies. Indeed, for him, mass media render society complex and chaotic, and it is precisely in this "relative chaos" that our possibilities of emancipation lie. The same could hold true today for digital media. And yet, in the course of the years Vattimo has become more and more sensible to the anesthetizing effects of media. From his more recent works, and in interaction with the work of the Korean-German cultural theorist Byung Chul-Han, one can deduce the idea according to which "the dominant digital media are not capable of furthering processes of emancipation that are anything more than a *liberal* model of emancipation and as such can be utilized for furthering the neoliberal neutralization of politics" (Sützl 2016, 755). Third, there is a perspective that still has mainly to come, and that would consist in wondering if it is legitimate, and eventually to which extent, to attribute to digital technologies, or at least to an emerging part of them, an autonomous interpretational agency. For instance, machine learning algorithms have been already considered as (a)responsible moral agents (Floridi and Sanders 2004). Would it be possible to pave the same path for hermeneutics, inverting an anthropocentric attitude that has characterized most of its history?²⁰ Is there any room for what might be called a non-anthropocentric or posthuman hermeneutics?

In "Making a Mind versus Modelling the Brain" (1988) Hubert and Stuart Dreyfus have proposed an interesting analogy between hermeneutics and connectionism. According to them, the symbolic AI and the rationalist tradition it refers to have failed. On the contrary, "Frank Rosenblatt's [the inventor of the perceptrons] intuition that it would be hopelessly hard to formalize the world and thus give a formal specification of intelligent behavior had been vindicated" (Dreyfus and Dreyfus 1988, 34). According to them, "neural networks may show that Heidegger later Wittgenstein and Rosenblatt

¹⁹ In continuity with the thesis of Capurro, Tripathi (2016, 147-148) affirms that technology is directly related to our bodily selves. In the digital age, it means that we are facing the issue of the digitized body, that is, a body as (digital) data.

²⁰ Some authors such as Gens (2008), De Mul (2013) and Clingerman (Clingerman et al. 2013) developed in those years a hermeneutics of the nature, considering the interpretational patterns in intra-species and inter-species communications, but also at micro levels like those of the cells and the DNA.

were right in thinking that we behave intelligently in the world without having a theory of that world” (Dreyfus and Dreyfus 1988, p. 35). Does it mean that neural networks are actually similar to human minds? For the authors, the answer is negative. First of all, because human beings have bodies, needs, emotions, et cetera, and are then much more holistic in nature than neural nets. Second, because artificial neural networks’ abstractions are not by force similar to human abstractions. If this happens, it is just in order to make the machines’ choices understandable to us. In the words of the Dreyfus brothers, “[t]he designer of the net has a specific definition in mind of the type required for a reasonable generalization, and counts it a success if the net generalizes to other instances of this type. But when the net produces an unexpected association can one say it has failed to generalize?” (Dreyfus and Dreyfus 1988, 38). Similarly, we might ask: when an unsupervised algorithm of machine learning produces an unexpected abstraction, association or correlation, could not we say that we are still before a form of interpretation, however not human anymore? In the field of digital art and aesthetics, Al-Rifaie and Bishop (2015) have proposed to distinguish between weak and strong computational creativity. While the former does not go beyond imitating the human creativity, the latter leaves the machine free to express its “genuine understanding” and “other cognitive states”. Can such distinction be applied to other domains than art and aesthetics? And which would be the ethical and political consequences of such perspective? These are questions that certainly deserve further investigations.

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