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Modelling Media, Reality and Thought: Ontological and Epistemological Consequences Brought by Information Technology

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Computers are our ultimate modelling machines. In the last decades, they became our first "metamedium"; the foremost means through which we generate, store and exchange media, but also our primary instruments for thinking. As a consequence, these "quintessential" products of information technology forever altered the way we think about reality, the world and ourselves. This paper argues our limited understanding of such transformations is one of the major impediments for developing adequate descriptive models for computational media. By showing how information technology is "re-ontologising" our world and stimulating a "permanent beta" attitude within contemporary technological culture, this paper shows that, without an adequate reformulation of our ontological commitments, our future analyses of media will be significantly hindered. By focusing on the metaphysical implications of current technological development, this paper shows the often neglected overlapping between philosophy and media analysis, but also the theoretical benefits of promoting it.

1 Introduction

In less than four decades, computers, the "quintessential information technology product" (see Floridi 2009) went from being highly specialised tools to become multi-purpose instruments present across every conceivable area of human activity. Having a seemingly endless range of applications, computers turned into our foremost "intellectual tools" (see Dyson 1997) and "media machines" (Kay and Goldberg 2003). As such – and to paraphrase Lev Manovich (2013), they have "taken command" of virtually all forms of communication and representation, thus becoming our first *metamediums*. Through this 'digital revolution', technology at large has been recognised as a crucial factor for social and cultural change and even embraced as a form of culture in and *for* itself (see Kelly 1998). Within this 'post-digital' setting, understanding contemporary media implies analysing the contents, reception and social effects of audio-visual communications, and understanding the history, functions and idiosyncrasies of the instruments responsible for generating them. Given the constantly evolving nature of information technology and the profound ways in which it has transformed our view of the world and ourselves, this is far from being a simple task.

Over the last decade, media analyses experienced important changes. While Bolter and Grusin's (2000) *Remediation* still remains an even tempered response to the hype sparked by 'new technologies' – in particular the early prefiguration of Virtual Reality (VR) – their overall analysis ended up reducing 'new media' to little more than "refashioned" representations of traditional media. In contrast, pragmatist models began to shift their focus away from the contents and discourse of audio-visual representation and towards their technical aspects and history (see Kittler 1999; 2009). Unlike the dominating traditions within the humanities, these approaches no longer dismiss the possibility of technological autonomy and agency as 'deterministic' ideas. More to the contrary, they belittle the humanities' traditional disregard for technical knowledge (see Fuller 2008) – in particular of programming – and advocate for incrementing our overall computational literacy (see Mateas 2005; Hayles 2002), and for the recognition of software as the new dominant medium (see Manovich 2013). Finally, influenced by the philosophy of technology and video game studies, new transdisciplinary models are beginning to explore the relationship between computational technology and philosophical analysis (see Bogost 2012; Gualeni 2014), concentrating on the metaphysical problems brought about by computational tools and media.

The fact that computational technology became our primary information medium – that is, the foremost means through which we generate, store and communicate our *thinking*, has deep epistemological and ontological consequences[1]. This paper argues that our limited understanding of those consequences and their implications constitutes one of the major impediments for developing effective descriptive models for contemporary media. Following Luciano Floridi's (2010) description of the "information revolution", Kevin Kelly's (1998) portrayal of the "third culture", and various accounts belonging to the philosophy of technology, this paper will describe some of the most salient ontological and epistemological changes introduced by computational technology. The analysis begins by arguing why information technology is effectively "re-ontologising" our world, before making the case for why our traditional approaches to computational media have failed to recognise these metaphysical shifts. Finally, the analysis closes by showing why, given its role as our very first intellectual *metamedium*, the computer has become our ultimate modelling machine. The overall, theoretical implication stemming from this analysis is that – without an adequate reformulation of our ontological commitments – it will be increasingly complicated to generate adequate critiques of computational technology and media.

2 Technology's role

The word 'technology' is nominally Greek[2], but the concept itself is a (relatively) recent invention. Johann Beckmann, a German professor of economics who realised the tools and techniques used by all trades were not a haphazard collection of unrelated artefacts, but elements of an interconnected *system*, coined the term *technologie* in 1802 (see Kelly 2010). Despite the importance of such finding, both the newly minted concept and the systemic nature of technology would remain obscure notions[3] for the following 150 years[4]. The resurgence of the term coincided more or less with the dawn of the 'computer age'; a circumstance that may partially explain why, for many media scholars, 'technology' was (and still is) synonymous with computational devices. Being a "functional category" (Levitin 2014) technology refers to all sorts of artificial devices and techniques, but the 'technology ≈ computer' equation continues to resurface every now and then in contemporary media analysis[5]. This incidence cannot be attributed solely to some media theorists' reluctance to clarify what they mean by technology, but to the inherent haziness of the term and the multifarious nature of the phenomena it refers to.

Devising tools is an intrinsically (although not exclusively) human trait; we have been doing it for over three million years

1 The most obvious being that we now conduct most of our thinking through the very instruments we are attempting to describe.

2 According to Kevin Kelly (2010), the only classical treatise where the construction *technelogos* appears – albeit only a handful of times and with a rather unclear meaning – is Aristotle's *Rhetoric*.

3 Even Vannevar Bush (1945), in his influential article, *As we may think*, refers to his imaginary artifacts as "machines" or "instruments" and not as 'technologies'.

4 A quick search in Google's *Ngram Viewer* shows that before the 1920s the term is virtually inexistent. In the following decades its usage experiments a steady growth until 1952, where the curve shows a dramatic surge.

5 The rather nebulous term 'new technologies' is a telling example of such tendency.

(Wong 2015), and it would be difficult to dismiss its importance for our evolutionary success. It is precisely this role and how it relates to 'culture' at large what makes the definition of technology such a complex problem[6]. Cultural and technological change are quite difficult to trace, and establishing which one exerts more influence over the other at any given time is equally troublesome. For the critical theory and cultural and literary studies traditions, there is little point in attempting to do so, since, in their views, technology is but a manifestation of culture. Consequently, they dismiss any suggestion that technology might be an autonomous agency capable of inciting social change without direct intentional involvement of a human subject as a "deterministic" (Bolter and Grusin 2000; see also Dusek 2006) or "reductionist" idea. That technology has indeed agency and is well beyond human control are precisely the views of thinkers such as Friedrich Kittler (1999; 2009; Gane 2005) and Kelly (2010). For its part, middle-ground positions between "cultural determinism" (see Dusek 2006) and 'technological determinism', portray technologies as "hybrid" systems (Ihde 2009; Latour, 1993) comprising "hardware" (tools and machinery), "software" (institutions, ideas, customs), and the agents that apply them (see Dusek 2006; Li-Hua 2009). Under this view, potentially "every creation system beyond the basic apparatus of the body" (Wilson, 2009, 9) qualifies as technology.

With the arrival of the PC, Internet, mobile communications and other information technologies, humanity thrust itself into a *revolution* (Floridi 2010) with profound cultural, social and philosophical consequences. In terms of aesthetic creation, the evolution of mainframes into "media machines" (Manovich 2013; Kay and Goldberg 2003) brought about a significant shift in the way we produce and understand audio-visual communications and art. Software's 'ability' to simulate most previously distinct physical media *and* its tools (Manovich 2013) calls into question the adequacy of the 'medium' as a descriptive category. With digitisation came the inevitable loss of materiality; and theoretical approaches that relied on the 'objectness' of aesthetic artefacts found themselves engaging a new form of presence. Overall, the introduction of computational devices implied that aesthetic analysis would have to engage technology from a theoretical standpoint and assume that this dimension of cultural production could not continue to be ignored and treated as an alien province reserved for science and engineering.

3 Theoretical approaches to 'new media'

Heavily influenced by the critical theory and cultural studies traditions, early analyses of computer-generated media tended

6 For a more complete overview of the various definitions of technology see: "Dusek (2006), Verbeek and Vermaas (2009) and Ihde (2009)."

to focus solely on their hidden dynamics and possible social effects, while disregarding the technical conditions which bring them to life. Amongst the most well known accounts stemming from this tradition is Bolter and Grusin's (2000) "remediation"[7] model, which essentially claims that there is no meaningful difference between traditional (electronic) and so-called 'new media' because both constitute 'remediations' of previous forms of representation. In their view, new media is but a "refashioning" of old media and therefore shares the same goal as all forms of representation since the Renaissance: to "put the viewer in the same space as the objects viewed"[8] (Bolter and Grusin 2000, 11) while simultaneously concealing the factuality of their intermediation.

Other models focus instead on the "material structures" (see Gane, 2005) – i.e., on the tools – responsible for generating media. Unlike their content-centred counterparts, these approximations no longer regard the idea of technological agency as anathema. Their views can be traced to the pragmatist tradition, particularly, the notion that theory and practice work together[9] (see Haack 2003) and, consequently, that our knowledge of the world is mediated by our instruments as much as by our concepts. Friedrich Kittler (1999, 2006), a vocal critic of "anthropocentric"[10] interpretations of media, was perhaps one of the most influential figures within this 'camp'. He believed that technology ought to be critically analysed (see Gane 2005) precisely because it is increasingly beyond human control. Kittler's overarching arguments portray media technology not just as objects of representation, but also as mediators of information. His approach consisted in understanding media by analysing the historical and technical conditions that surround their production.

For its part, software studies – a relatively recent tradition, which advocates for a richer understanding of the history and idiosyncrasies of computational technology, tacitly endorses technological agency while it chastises the humanities' for their insistence on dismissing the importance of programming and computational culture. More or less in the same tone, scholars such as Michael Mateas (2005) and Matthew Fuller (2008) argue 'procedural' knowledge should not be regarded by the humanities as the exclusive domain of science and engineering, but embraced at large as a new form of literacy. As a theoretical approach, software studies aim to understand contemporary media through the specific technology responsible for generating it. Subscribing to the views of early personal computing pioneers, they regard the computer as the first "metamedium" (see Kay and Goldberg 2003; Manovich 2013) and software itself as the indisputable 'place' of contemporary media creation. Contrary to the remediation approach, they do recognise a fundamental distance between

7 Which they admittedly built upon McLuhan's (1994, 8) claim that the "'content' of any medium is always another medium".

8 Which, to a certain extent, is a rehashing of Heidegger's claim that the invention of the radio answered "man's existential tendency to 'de-distanciate', to diminish distances" (Kittler 2009, 29).

9 Because, in their view, the meanings of concepts become clear *precisely* as a result of their practical implementation, otherwise, they remain ungraspable abstractions. For pragmatists, models that dismiss the active role of practice (and hence, of technical instruments) are inherently suspicious (see Haack 2003).

10 He was particularly critical of McLuhan's portrayal of media as "extensions" (see Gane 2005, 28).

traditional and computational ('new') media. They argue that the constantly evolving language of contemporary audio-visual artefacts is symptomatic of software's idiosyncrasies, in particular, of its ability to simulate virtually all previously distinct forms of media, their tools and techniques (see Manovich 2013).

Although philosophical speculation on technology has been more or less present for various centuries, it was not until the 1970s that it became fully recognised as a particular branch of philosophical inquiry (see Dusek 2006) – whether the rise of computational technology played a significative role in this process or not is a matter open to speculation. For philosophy, computers are deeply transformative devices, not only because they played a fundamental role in the development of contemporary theories of the mind (see Pinker 1998), but also because the prospects of attaining AI and VR have serious implications for most long-standing philosophical areas. In particular for those concerned with existence, knowledge, life, mind, and ethics. The philosophical outlook on computational technology has attracted the attention of various media and video game scholars (see Bogost 2012), given that many aspects of programming and information systems deal with metaphysical problems and this, evidently, is a distinctively philosophical area of enquiry. Moreover, this interaction has given rise to various forms of cross-fertilisation leading scholars to regard computational technology as useful appliances for conducting philosophical research (see Gualeni, 2014).

4 A conceptual framework

4.1 The third culture

Over the last decades, technology has not only been recognised as a defining aspect of human culture but – as Kevin Kelly (1998) would argue – as a form of (pop) culture based on technology and *for* technology. Kelly describes this "third" or "nerd" culture as an "offspring of science" which, unlike its forefather, does not seek to discover ultimate truths about the Universe but generate "experience and novelty" through technological development. Although by no means a fully-fledged descriptive model, Kelly's characterisation offers a thought-provoking basis to describe not only the social consequences of widespread technological adoption but also – more importantly – the epistemological shifts that accompany it. Kelly credits C. P. Snow (2000) with already having described a middle-ground culture capable of bridging the gap between the two supposedly irreconcilable cultures described in his (infamous) lecture. Kelly, however, loses the moralising tone and modernist idealisations that pervade Snow's work, and

describes this cultural tendency as an overlapping of scientific and engineering outlooks fuelled by an unrestrained desire to generate experiences – an attitude which, we should note, closely resembles vanguard's artistic experimentation. As described by Kelly, the third culture is rather indifferent to theoretical restrictions, boundaries and credentials. Consequently, it favours 'transdiciplinarity' and 'remixability', and is willing to embrace "the irrational" (Kelly 1998) if it holds the promise of a new experience. In order to solve a problem members of the third culture would rather build a functional artificial *model* than come up with an abstract theoretical solution for it.

4.2 Information technology

By definition, History begins with writing, and writing constitutes the first means to *register information* as "non-biological memory" (Floridi 2009, 227). It follows that writing marks the first stage in the evolution of information technology (IT) and thus, the dawn of the 'information age' (see Floridi 2010). IT has three main functions (Floridi 2009): to register, communicate and generate information; and each of these functions has dominated the various stages IT has gone through over the millennia. Contrary to what some analysis of media stipulate, with each novel iteration, IT does not *replace* its previous incarnations, but rather *incorporates their functions*[11] – neither analogue, nor digital audio-visual technologies have made writing obsolete. In the last three decades, computational technology has been steadily incorporating all the functions that were previously scattered throughout various dedicated technologies and, in the process, generating new ways to carry out those same functions. The computer thus constitutes the quintessential IT appliance (see Floridi 2009). As far as functional categories go, 'information technology' is no less nebulous than 'technology' alone; after all, the former harbours everything from handwriting, to a magazine or a social network. Nonetheless IT does indicate what is the practical and historical *common denominator* shared by all the entities it refers to, and what their general functions are. It follows that both computers and 'media' (whether analogue or digital) can be described in general terms as IT.

4.3 Ontology

As a specific branch of philosophy, ontology is concerned with 'what there is' (Floridi 2004). To paraphrase Barry Smith (2004), ontology is a fundamentally descriptive enterprise concerned with types, kinds, structures, properties, events, processes and

11 It is fair to remember that McLuhan (1994) as well as Bolter and Grusin (2000) have commented on this idea.

relations amongst entities, and with the various interpretations of reality; it involves "exhaustive classification" and *categorisation* within "all spheres of being". Unlike science, ontology does not seek explanation or prediction, but *description*. Ontology is a core element of metaphysical analysis (often both terms are treated as interchangeable) and its preoccupations sometimes overlap with those of epistemology – which is essentially concerned with 'how' we know what we know, and how we can say that such knowledge is true. In the first half of the Twentieth Century, logical positivism (the tradition that would give rise to contemporary philosophy of science) began to promote science as the most effective means to attain true knowledge of the world and, consequently, began to dismiss non-scientific metaphysical speculations as a "meaningless quest for answers to unanswerable questions" (Dupuy 2009, 214). Although this view has become significantly less reductive, ontology evolved into a method for analysing not the ultimate constituency of reality, but the entities and relations that science discovered (Proudfoot and Lacey 2010). Ontology hence became a "metalevel discipline" (Smith 2004) concerned not with the objects of the world itself, but with the objects within the various systems of belief (theories) that frame our views of the world.

In the last decades, ontology became an important aspect of computer and information science and a fanciful means to refer to a "conceptual model" (Smith, 2004) tasked with describing objects (entities, modules, etc.) and their relationships within artificial information systems. Ontology in this sense is not concerned with the dynamics of *alternative possible worlds.* An ontology is thus a system containing descriptions, definitions, rules, taxonomies, and axioms that establish a framework for representing certain kinds of structured information within a system that may or may not interact with other systems (see Smith 2004). Outside of this specialised usage – albeit, still related to it, ontology could be seen as the method through which we categorise and make sense of the entities that surround us. In recent years, however, this translated into making sense of increasingly overwhelming amounts of *information* and the various forms in which it is generated. Thus, ontology implies not merely describing, but finding ways to organise, filtrate and discern the very things that inform and *mediate* our views of the world.

5 Ontological and epistemological changes

5.1 Computational technology is "re-ontologising" our world

Information technology (IT) is driving a revolution comparable to those initiated by Copernicus and Darwin (see Floridi 2010). This process, however, does not entail that we will all turn into cyborgs, or that virtual environments will supplant physical reality. In order to understand why and how this revolution is coming about, we could, as Floridi (2010) suggests, begin by distinguishing between 'enhancing' and 'augmenting' devices. An *enhancement* technology works in the cybernetic sense of extension and control (Dupuy 2009) (categories that include anything from spectacles to prosthetics). For its part, an *augmenting* device is one that allows users to interact with "different possible worlds" (Floridi 2010) (a microscope or even the Mars rovers would certainly fit within this category). Now, computational technology does not enhance or augment in the senses just mentioned because it allows users to *enter* an alternate environment – an "infosphere" (Floridi 2010) – in which they may interact with other human (and perhaps, eventually non-human) users.

Most of us already spend the better part of our waking hours within this environment. While our bodies remain 'tied' to a physical surrounding, a significant amount of our work, leisure and social activities take place online. But since our gadgets are now permanently within our reach (either in our pockets or around our wrists) and the 'internet of things' is gradually expanding, the once meaningful distinction between being 'online' and being 'offline' is rendered moot. By allowing us to communicate and interact with 'otherworldly' (Gualeni 2014) objects and environments (which evidently need not be as sophisticated as VR), computational technology is radically altering core tenets of our (still) modern "Newtonian" understanding of reality (Floridi 2010). One that – to paraphrase Floridi (2010) – remains populated by "dead" entities such as cars, buildings and refrigerators; but will gradually become "a-live" (artificially live) as the world becomes inhabited by *animated* gadgets controlled by invisible forces – a paradoxical reminder of pre-modern worlds.

5.2 The inadequacies of our ontological frameworks

Although our world is now filled with artefacts that sometimes contradict our modern understanding of reality, our theoretical approximations to media remain stubbornly informed by

Newtonian metaphysics. Whenever we download music or move it within or across devices we *know* we are not handling actual physical objects. What we 'download' and exchange are *instructions* that 'tell' our storage units to assume a particular magnetic configuration. Having spent most of our modern existence surrounded by physical objects, dealing with these abstract entities becomes cognitively taxing, hence, we devised visual and conceptual metaphors that allow us to handle and think about them as if they were in fact physical objects. For daily transactions, thinking about various types of digital 'files' and 'folders' is useful because it spares us the cognitive strain caused by metaphysical ambiguities. However, if what we are trying to do is understand, describe and criticise these entities, the otherwise helpful metaphors become an obstacle, because they make it seem as if digital and 'a-live' entities could be approached with the same ontological framework as traditional media.

Nowadays, computational technology (and technology at large) is often described through biological metaphors. Terms such as 'environment', 'hybrid' and 'evolution' are increasingly common across information sciences and media analyses. That media scholars turn to the natural sciences for nomenclatures is symptomatic of the absence of an adequate ontological model for digital media artefacts, and of their tacit recognition of the growing 'a-liveness' of technology at large[12]. Computational technology clearly brings about phenomena that we do not know how to categorise; hence, we lack a *précising* definition (i.e., one that goes beyond a mere dictionary description or an awkward neologism). To a great extent, this means that we have not yet found a proper place for computational media within our conceptual framework. If these circumstances remain unchanged, our ability to describe ever more complex information (and thus media) systems will be significantly hindered.

5.3 Modelling machines

Computers are no ordinary instruments. Thanks to software's "permanent extendibility" and "modularity" (see Manovich 2013) they have become our first multi-purpose appliances: instruments for science and engineering, but also "media machines" (Kay 2003; Manovich 2013) and entertainment centres. Computers are "intellectual tools"(Dyson 1997), which means they are not merely transforming how we do and create things, but how we *think* and understand the world, and ourselves. Like writing (our first information technology) they, are not simply means to enhance our memory, but to externalise it, to process and to communicate our thinking. Unlike writing the results of this

12 The seemingly unavoidable arrival of AI, is bringing back old romantic metaphysical questions and anxieties (as recent calls to action by Elon Musk and Stephen Hawking show).

thinking can be objectified beyond interpretable code. Computers are *modelling* appliances that rely on information – i.e., well-formed, meaningful and truthful data (see Floridi 2004) – as their raw material. Provided that someone is capable of formulating an adequate algorithmic translation of a problem, a sufficiently powerful computer will be capable of generating a simulation through various forms of perceptible outputs. In other words, computers make abstractions tangible in a way that no other technology can. Because of them, our ideas are progressively less constrained to the limits of our 'mind's eye' or by the limitations imposed by laborious analogue representations. As epistemological tools, computers both augment and permanently extend *our minds*.

By altering our epistemological boundaries (by turning the notion of 'medium' into a mere operational category and by encouraging transdisciplinary approaches) computational technology has forever changed the way we structure knowledge. Computers are radically transforming not only how we regard certain phenomena within a demarcated scientific field, or how we communicate and entertain ourselves and represent the world; they are changing our view on reality *itself*. They are transforming how we understand perception and experience, two fundamental aspects for all human activities, in particular for aesthetic creation. For all the ways computers are changing art and media, the most profound are not necessarily those associated with practical matters; but those resting at an intellectual level. Our theoretical difficulties do not originate solely on media theory's long standing neglect of technology as an object of analysis, but in a deeper handicap affecting *all* human disciplines. The fact is we simply don't *know* what entities such as software, data and information are, and to what category of 'objects of the world' they belong.

6 Some implications

By allowing us to build all conceivable kinds of models, computational technology has given rise to a new epistemic stance based not on theoretical models, but on *tinkering*; a kind of *permanent beta attitude*, which regards experience and artefacts as always susceptible to upgrades. Fully embraced by the third culture, this attitude and the instruments enabling it are shifting our epistemological protocols and boundaries, forcing us to rethink the way we structure and categorise our knowledge. With the computer as a primary tool, "nerd culture" is blurring the lines between craft, art and engineering and thus wreaking havoc amongst traditional disciplines by rendering their theoretical models anachronistic. The problems brought about by computational technology are not so much theoretical as they are practical. The current is

a promissory age for artists and engineers, but a complex one for theoreticians planning to keep up with their creations.

In light of such transformations, it is clear that media analyses are bound to revise both their theoretical and methodological frameworks. Given the constantly evolving nature of information technology and the permanently extendible character of the media it produces, a potential descriptive model requires the same degree of flexibility and extendibility. Nonetheless, this requires a strong ontological commitment, a core architecture over which to proceed and build future analyses; a kind of flexible 'source code' able to withstand extreme 'debugging' without falling apart. A good starting point would be to situate contemporary media within a larger critique of the phenomena responsible for producing it: information technology.

Conclusions

Our limited understanding of the metaphysical consequences brought about by information technology is one of the major impediments for developing effective descriptive models for contemporary media. This problem is further complicated by the fact that computational technology *itself* is extremely difficult to characterise, since we lack a functional category in which to place this unprecedented form of "engineering". For media and art theorists, computational aesthetic artefacts thus present a rather difficult object of analysis. On the one hand, new approaches have to overcome the humanities' traditional refusal to engage technology and computation beyond a superficial critique. On the other hand, art and media theory need to establish new epistemic compromises that would allow them to know, at least temporarily, what type of objects they are dealing with. Software-centric approaches go a long way towards explaining the working and history of the tools responsible for generating media. The latter problem could be better engaged by turning to philosophical approaches since they are already concerned with trying to generate appropriate models to fathom the actual nature of the artefacts transforming our world and ourselves in such profound and irreversible ways.

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