Towards an Ontology of Computational Technologies as Tools for Aesthetic Creation

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ABSTRACT

Computational technologies have significantly expanded the horizons of aesthetic creation; nonetheless, their wider ontological status as tools remains poorly understood. This limitation hinders our ability to assess their true impact on aesthetic practices and limits our means to establish the relationship between computer generated artefacts and previous forms of 'media'. This paper argues that understanding and categorising the things computational technologies are able to do as aesthetic tools also requires understanding what type of tools they are. Following recent insights from philosophy of information and post-phenomenology, this paper begins by showing computational technologies are no ordinary mediators, but truly 'multi-stable' appliances which are leading us to reformulate our very notions of reality and self-understanding. While delivering a fully-fledged ontological model falls outside of its scope, this paper nonetheless suggests that within aesthetic contexts, computational devices may be initially described as information modelling appliances. This characterisation offers an alternative to their increasingly less adequate portrayal as 'media'.

KEYWORDS

Aesthetics; Computational Technology; Media; Modelling; Ontology; Philosophy of Information; Post-phenomenology.

1 | INTRODUCTION

It took computers approximately 3 decades to evolve from specialised single-task mainframes for administrative, financial and scientific tasks, to personal programmable appliances for the technologically inclined. A couple of decades later, our relationship with these systems has become one of dependency, provided that some form of computational technology is now present anywhere from our buildings to our wrists. In the process, it has transformed everything we do and how we do it; but more importantly, it is changing how we represent and think about our world and ourselves. Computer systems (i.e., the conjunction of hardware and software) have become our utmost 'intellectual tools' (Dyson, 1997), for they allow us to model and objectify every single process we are able to formulate algorithmically, including aesthetic artefacts. Being truly multi-purpose devices, computer systems have also become our first 'metamedium' (Manovich, 2013) for audio-visual representation and simulation. Understandably, many contemporary practitioners have adopted them as their primary tools for creation. But while this change has greatly broadened the horizons of aesthetic possibilities, our scholarly grasping of this technology remains comparatively limited.

Arguably, the most basic questions summoned by the entrance of computational technology (i.e., any artefact or process involving computation) into the realm of aesthetic creation are: (a) what are the artefacts it produces, and (b) how they relate to previous forms of representation. Being fundamentally *ontological*, both problems involve some form of rational description and categorisation. While most contemporary views approach the first problem by classifying computer generated aesthetic artefacts as some form of 'new media', the second problem invokes greater disagreements. The most common being whether 'new media' constitutes a truly (ontologically) distinct form of representation, or a mere re-iteration of 'old media'; and whether its widespread adoption and development signals the debacle of audio-visual tradition. Defending an ontological kinship between old and new media on the basis of their formal resemblance, models such as the one developed by Bolter & Grusin (2000) see no compelling reason to regard the later as anything but a 'remediation'. In recent years, however, more pragmatic approaches (see Fuller, 2008; Manovich, 2013; Mateas, 2005) argue such misconception is symptomatic of the humanities' long-standing disregard for the material and technical conditions behind new media, while noting that software has effectively become the medium of a new audio-visual language.

In this paper I argue that, while acquiring a basic understanding of how computational technologies work is fundamental to comprehend and analyse the artefacts they generate, it is equally important to investigate what kind of instruments they are. By showing that computer systems are no ordinary 'tools', I argue that understanding their ontological nature as an unprecedented form of technology is crucial for understanding their impact on aesthetic creation and their place as aesthetic tools. Following insights from the philosophy of technology and philosophy of information, the analysis begins by locating computer systems as a 'third order' technology (Floridi, 2013) before addressing why we need to pay attention to their 'multi-stabilities' (Selinger, 2014; Verbeek, 2005) and why they constitute the 'quintessential' (Floridi, 2009a) form of Information and Communication Technology (ICT). Moreover, while challenging the primacy of the notion of media as a de facto descriptive category for computational technology in the context of aesthetic creation, this paper sketches a description of computer systems as the ultimate 'modelling machines'. Finally, it invites the reader to regard computational technologies not simply as mediators of reality, but as its actual builders, and to ponder the potential implications following such shift.

2 I THE IMPACT OF TECHNOLOGY

In his 1998 essay, *Being Digital*, Nicholas Negroponte declared the 'Digital Revolution' was 'over', arguing computers would become so common as to make digital technology 'noticed only by its absence'. Furthermore, he advised against paying too much attention to technicalities such as the exponential growth in bandwidth, processing power and storage capacity; claiming instead that the 'really surprising changes' would be 'happening elsewhere': in how these appliances would transform science, industry and society. But while many of these predictions have crystallised, the revolution is not over; it is thriving. First of all, binary code is not the only digital code: the alphabet and the Roman and Arabic numerals are also digital codes (see Lopes, 2010); therefore, digitisation *per se* is not necessarily something revolutionary. Secondly, the transformations experienced by humanity over the last decades cannot be reduced to the fact that our technologies became overwhelmingly digital. The truly revolutionary aspect is that *information* revealed itself as a 'key resource' (Floridi, 2010) —as the 'steam engine of our times' (Frank, 2013), and that we realised it holds the potential to transform not only our economy and our society, but also our long-standing metaphysical frameworks.

2.1 A DIFFICULT NOTION

Devising and using tools in a systematic manner is a distinctive (although not exclusive) human trait; we have been doing it for millennia and it would be difficult to overstate its influence over our evolutionary success. But even though 'technology' is nominally a Greek word, the concept itself is fairly recent both in origin and use. Coined in 1802 by Johann Beckmann (see Kelly, 2010), the term only became popular in the second half of the Twentieth Century[1]. Its resurgence coinciding with the dawn of the Space Race and the 'Computer Age', which may explain why computer systems are so often referred to simply as 'technology' – and, more recently, as 'tech'. From a scholarly perspective, the synecdoche is historically and conceptually problematic; a fact which does not prevent a considerable number of analyses from overlooking it. This tendency, however, cannot be attributed solely to some scholars' reluctance to clarify their understanding of the term, but perhaps to its inherent haziness and – more importantly – to its complex relationship with *culture*.

2.2 A CULTURAL SHIFT

Over the last decades technology has grown to become the ethos of mainstream cultural expression. Arguably, the 'liberation' of computational technology into consumer society at the end of the 1970s was largely responsible for the emergence of what Kelly (1998) describes as 'nerd culture': 'a pop culture based on technology for technology'. Somewhat following C. P. Snow's (2000) lesser-known idealisation of a – scientifically literate and yet artistically sensible – 'third culture', Kelly argues 'nerdism' is more than a mere fad or naïve pop 'celebration of engineering'. According to his description, nerdism is an offspring of science and therefore holds a general respect for its authority. Nonetheless, unlike its forefather, the objective of nerdism is not to reveal ultimate truths about Nature and the Universe, but to explore the potentially endless novel experiences offered by technology. Consequently, members of this culture are avid testers and tinkerers, they are early adopters of gadgets and algorithmic processes; their heroes are contemporary 'tech' moguls (e.g., Steve Jobs, Bill Gates, Elon Musk, Stephen Wolfram) and all-around 'geeks' (Nicola Tesla or Douglas Engelbart). Above all, Nerd culture is pragmatic; it does not proceed from theory, but from practice and improvisation. Its members approach problems not through axioms but through adaptive modelling; their willingness to experiment is endless as long as the potential solution involves some form of technological development, their haphazard attitude sometimes resembling vanguardist unorthodoxy and playfulness. Needless to say, many nerds are also designers, developers, creators, and artists.

3 | SOME THEORETICAL APPROACHES

Oversimplifying, (an) ontology is a method for rationally understanding (see Poli, 2010), describing, defining, categorising, and making sense of entities (and their relationships) within a particular knowledge system (see Smith, 2004). Ontology is fundamentally a descriptive strategy, which – as hermeneutics – is frequently (albeit unknowingly) employed within aesthetic contexts. Nonetheless, for decades, both artists and scholars have outsourced the conceptual frameworks guiding their interpretations of 'media' — but also of science and technology – to other regions of the humanities (see Wilson, 2002). Therefore, their views have been heavily informed by the outlooks of 'social relativism' (Bogost, 2012), critical theory, and media philosophy. As a consequence, most analyses of computer generated artefacts coming out of aesthetic contexts have echoed the same preoccupations as their theoretical sources: the cultural and socio-political impact of the discourses conveyed through 'new technologies'.

3.1 REMEDIATION

Many of the resulting models privileged the analysis of the formal and discursive elements of audio-visual representations, while treating the specialised technical knowledge necessary to generate them as somewhat negligible 'grey areas' beyond their interests (see Mateas, 2005). When addressing the impact of computational technology and attempting to establish the relationship between computer-generated aesthetic artefacts and previous forms of audio-visual representations, their strategy remained virtually unchanged. One of the best-known models following this tradition is 'remediation' (see Bolter & Grusin, 2000), which argues there is no significative (ontological) difference between traditional (printed and electronic) and 'new' (computer-generated) media. In their view, the latter is but the latest 'refashioning' of old media and therefore has the same purpose as all forms of representation since the Renaissance: to 'put the viewer in the same space as the objects viewed' (p. 11) while simultaneously concealing the factuality of their intermediation.

3.2 SOFTWARE STUDIES

Unlike remediation, the more recent Software Studies approach recognises an ontological distance between 'traditional' and 'new media'. Subscribing to the views of early personal computing pioneers, it portrays computers as a 'metamedium' (Kay & Goldberg, 2003; Manovich, 2013) and software itself as the indisputable location of contemporary media creation. This approach tacitly endorses technological agency and chastises the humanities' traditional disregard for technical knowledge associated with science and engineering and, in particular, of programming (Fuller, 2008; Mateas, 2005). Authors such as Lev Manovich (2013), a key figure within software studies, argue the constantly evolving language of contemporary audio-visual artefacts is symptomatic of software's idiosyncrasies, in particular, of its ability to simulate not merely all previously distinct forms of media, but also their tools and techniques. What ultimately characterises this and other recent fields of analysis (such as video game studies) is their technologically-centred outlook on 'media'; their insistence on claiming that acquiring a basic technical knowledge is paramount for understanding the nature of the new aesthetic artefacts. Such pragmatist outlook is easily correlated with 'nerdism' and, it is symptomatic of the generalised transdisciplinary 'empirical' (see Selinger, 2014) shift in our attitude towards technology.

4 | A METHODOLOGICAL ALTERNATIVE

Overall, the remediation model presents an even-tempered counterweight to the hype present in most analyses of 'new technologies' – in particular the early prefiguration of Virtual Reality (VR). However, by concluding that 'new media' is little more than a rehashing of old forms of representation, Bolter & Grusin (2000) overlook the profound ways in which computational technology has transformed not only aesthetic creation, but culture itself. This approach does not consider computer generated aesthetic experiences, which do not necessarily rely on sheer audio-visual communication (e.g., haptics). Conversely, software studies grant computer generated aesthetic artefacts a new ontological condition and, most importantly, recognise this is due to their origins in a particular form of technology. But while their approach offers powerful insights regarding what software is capable of accomplishing and why, it does not help to understand what kind of technology software might *be*. Both remediation and software studies are ultimately concerned with the ontological nature of the output (the artefacts) generated by computational technology. But to understand its wider impact on aesthetic fields it is also useful to determine what *kind* of tools we are dealing with, and what makes them so different from their predecessors.

4.1 THE ORDERS OF TECHNOLOGY

As Floridi (2013) points out, one of the most elementary characteristics of technology is its 'inbetweeness': its location between a potential user (traditionally a human agent) and an 'affordance'[2] (an item in the world, whether natural or otherwise). Floridi suggests that according to their level of development and – consequently – to the chain of relationships they enable between users and affordances, technologies may be placed within 3 categories or 'orders'. First order technologies are the most elementary kind: those which stand between a user and an (usually natural) affordance in the world. Although they may be quite complex and dependent on other technological systems, first order technologies may be produced by other "non-human animals" (p. 112). Second order technologies (by far the most common type) require a higher degree of specialisation; they are those 'whose affordances are other technologies' (p. 112). The most elementary example would be a screwdriver (which stands in between the user and a screw), while its paramount form is the engine. Finally, third order technologies are those which treat *other technologies as users*; they excise the human subject from the chain of interaction and hence become autonomous. Information Technologies (IT) and computer systems in particular are the utmost example of third order technologies.

4.2 INFORMATION TECHNOLOGY

Information technology – also known as 'Information and Communication Technology' (ICT) – and other related concepts such as 'information systems' and even 'media technology' are difficult to characterise under a single consensual definition. Strictly speaking the concept refers to systems that merge data processing and telecommunications (see Mitcham, 2004) and thus only emerged when computational technology assumed the roles previously assigned to various forms of electronic communication systems (which include everything in between the telegraph and TV). However, under a broader understanding, IT could refer to *any* system used to communicate and store information – as Floridi (2009a, 2010) argues, this would push its origins back to the invention of writing and, therefore, of history. It follows the so-called 'information age' did not begin with computers but some 5,000 years ago and, consequently, that humanity has experienced not one but many information societies (see Floridi, 2010). Throughout its existence, IT has served three basic functions (Floridi, 2009a); each one associated with a particular historical stage. The period spanning from the earliest written records to the arrival of the printing press represents the evolution of *recording*. The next stage, communication, began with the invention of telegraphy and continued through subsequent electronic technologies or 'media': cinema, radio, and television. The third stage began with the arrival of computers, the moment where 'IT acquired its new meaning, the one we currently associate with it, as it came to refer to a technology used to elaborate information by processing data electronically and automatically' (p. 228). Contrary to what some media scholars stipulate, with each iteration, IT did not replace its predecessors, but rather incorporated their functions [3]. In the last three decades, computational technology has been steadily assuming virtually every function that was previously scattered throughout various dedicated technologies and, in the process, has developed new ways to implement them. Computational technology thus constitutes the 'quintessential IT appliance' (p. 228).

4.3 TECHNOLOGY'S 'MULTI-STABILITY'

Also underlining technology's 'inbetweeness', 'post-phenomenology' – the phenomenological take on 'post-humanism' as Italian philosopher and game designer Stefano Gualeni (2014) describes it – contends that technologies are the inescapable interlocutors between humans and the world, because all human perceptions are *already* mediated by some form of technology [4] (see Gualeni 2014). Showing a pragmatist vein, post-phenomenology argues technological artefacts do not have intrinsic properties or essence because their meanings as objects are entirely dependent on the context of their use. Following Bruno Latour's (1993) 'actor-network theory', post-phenomenology sees the technology as mutually constitutive with human users. Given the biconditional nature of this relationship, philosopher Don Ihde, a key figure in the development of post-phenomenology, argues we cannot speak about technology independently of the humans using it, for if the tools are 'divorced of human practice' they become but 'junk lying about' (cited in Verbeek, 2005, p. 112). This context-dependency clause determining the identity of technological artefacts is what Ihde refers to as 'multi-stability' (in Selinger, 2014; see also Verbeek, 2005). And it implies that, ontologically speaking, the ultimate nature of technological artefacts is necessarily undetermined because they may be 'many things at once' (Verbeek, 2005, p. 112); they may be 'stable' in multiple and simultaneous ways [5].

5 | THE LARGER LIFE OF COMPUTATIONAL TECHNOLOGY

Through its unprecedented flexibility (its ability to simulate virtually all forms of audio-visual representation or 'media'), computational technology has undoubtedly broadened the horizons of aesthetic practices. But our understanding of the ways this technology is transforming not only this particular realm but also our entire metaphysical frameworks (the way we think about the world and ourselves) remains comparatively poor. Contemporary aesthetic interpretation of the artefacts generated by computer systems recognise the role tools play in shaping experience. But most analyses continue to overlook the fact that computers are no ordinary mediators, and therefore tend to engage them as if they were another second order technology. To overcome this handicap it is necessary to analyse its larger life and how its 'inbetweeness' is in fact an unprecedented reshaping of our metaphysical commitments.

5.1 COMPUTATIONAL DEVICES ARE NO ORDINARY TOOLS

Computer systems are 'universal machines' (see Turing, 2004); they are (at least theoretically) capable of automatically solving *any* problem that can be first translated into algorithmic form. As such, their architecture is permanently extendible. From a technological standpoint, both automation and their truly multi-purpose nature make computer systems extra-ordinary and complex [6] tools. But computational technology is also unprecedented because, to borrow Floridi's (2010) words, it constitutes a 'radical new form of engineering', which is 're-ontologising' our world. Being the 'quintessential' implementation of Information Technology, computer systems are changing our knowledge, our ethics, our self understanding and our conceptualisation of reality – which has gone from being that which could be measured or empirically perceived, to anything which might be *experienced* (see Floridi, 2009b). Through these appliances we are able to access other possible worlds and interact with other (not necessarily) human agents; computational technology is thus 'augmenting' our reality. As a consequence, argues Floridi, our world is being increasingly populated by objects (cars, buildings, tools) that we previously regarded as 'dead', but are now becoming 'a-live' (artificially 'alive') and able to interact. This paradoxical reminder of pre-modern and non-western ontologies is perhaps the most visible example of why computational technology is forcing us to re-evaluate our modern 'Newtonian' metaphysics (see Floridi, 2010).

5.2 COMPUTATIONAL TECHNOLOGY AS INFORMATION TECHNOLOGY

While the multi-stable character of technological artefacts implies that their identity as particular objects depends largely on the context of their use, it does not follow that we cannot categorise them in terms of some shared set of characteristics. When engaging computational technology, most contemporary aesthetic analyses identify some formulation of 'media' as the common denominator for both the tools and the artefacts they generate. But if we agree that a fundamental aspect of all forms of technology is to stand 'in-between' agents and affordances, using mediation as a defining category results in a trivial, if not tautological description. A more appropriate alternative would be to regard computers as a technology that, above all, generates, stores and communicates *information*. Now, replacing 'media' with a much fuzzier term would seem unwise, nonetheless, despite all the semantic instability of the term, describing computers as prime examples of Information Technology (IT) does helps to distinguish them from other 'mediating' technological artefacts (e.g., a screwdriver, which mediates the relationship between a human hand and a screw). Furthermore, this apparently innocuous shift of perspective also allows us to relate computational technology with other technologies whose purpose is handling information, i.e., electronic communication systems and writing.

5.3 THE ULTIMATE MULTI-STABLE MODELLING MACHINE

Computational technology is the most 'multi-stable' technology we have ever witnessed. To paraphrase Manovich (2013), computer systems (or rather, their software) are permanently extendible. They are communication devices, memory devices; they are our 'analytical engines', and our tools for 'clear thinking' as the British polymath Freeman Dyson (1997). Depending on its configuration, the same appliance may be used to analyse statistical data, to control a drone, to watch a film, or to edit a photograph. Like writing, computer systems are not only means to enhance our memory, but also to externalise it; they are technologies meant to process and communicate our thinking. But unlike writing, the results of this thinking may be objectified beyond interpretable code. Computers are *modelling* appliances that rely on information – i.e., well-formed, meaningful and truthful data (Floridi, 2004) – as their raw material. Computers allow us to experience and interact with other possible worlds; the epistemological and aesthetic possibilities of such 'augmented ontologies' (see Gualeni, 2014) are beyond anything we ever imagined. Computers are the ultimate *tinkering* devices. They are the pragmatists' dream machines.

6 I A LOADED CONCEPT

For decades, the go-to category to describe both computer systems and their outputs has been either 'media' or one of its multiple variations. But while mediation is certainly a core function of computational technology, so it is of all technologies. Media is a high frequency but low content term; as a conceptual tool its own 'multi-stability' plays against its descriptive power. Understanding what kind of tools computational technologies are from the perspective of aesthetic creation requires both a theoretical and a methodological shift away from the constant rehashing of media-centred theories. A good starting point would be to ask what is it that we mean when we talk about media and whether the concept is theoretically sufficient for describing the tools and artefacts produced by computational technology. From a methodological perspective it would be useful to expand our research of computational technology beyond its particular use as an aesthetic tool, for it is in its wider multi-stable life that the clues leading to its understanding rest. Moreover, given the constantly evolving nature of information technology at large, and the permanently extendibility of computer systems, a potential ontological model would require the same degree of flexibility and extendibility. 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 computational technology within a larger critique of its extended form: information technology.

7 | CONCLUSIONS

Computers are no ‘ordinary’ tools for art because they are no ‘ordinary’ technology at all. As a third order technology en route to acquire exponentially more autonomy (if not true intelligence), these tools are no longer passive mediums for conveying aesthetic information, but actual agents capable of generating novel forms of experience. Computational technology cannot continue to be regarded as a mere intermediary between our supposedly pristine gazes and the world, but as the actual entities responsible for shaping it. Computer systems are not the first, nor will they be the last form of information technology. Our ‘smart’ devices substituted 1990s PCs, and they in turn will be replaced by increasingly more sophisticated third order technologies (i.e. artificial intelligence, biorobotics, etc.). The challenge is thus to develop not an ontology of computer systems as artefacts, but one that encompasses computational technology at large as a modeller of information. From the point of view of aesthetic analysis this provides a twofold advantage: on the one hand it offers a means to understand what kind of tools are we dealing with (modellers, not simple mediators); on the other, it hints the ‘stuff’ this tools transform: *information* itself.

ENDNOTES

[1] It is even absent from Vannevar Bush's (1945) highly influential article, As We May Think.

[2] Floridi notes the concept of 'affordance' already has an established technical connotation — presumably the one Gibson (1986) imbued on the term – but that he is using the word in a slightly different sense.

[3] It is fair to remember that McLuhan (1994) and Bolter & Grusin (2000) have more or less made the same point.

[4] A view shared by Kittler (1999, p. 203) who, quoting Nietzsche, reminds us that 'our tools are also working on our thoughts'.

[5] In a sense, aesthetic examples of multistable artefacts are appropriation art pieces; since they acquire entirely different meanings through what anthropologist Granés (2011) calls 'discursive alchemy'.

[6] As McLuhan (1994, p. 356) argued, complexity is inversely proportional to specialisation.

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