Chapter 1. Irremediability: On the Very Concept of Digital Ontology

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The Implications of the Digital for Ontology

This essay discusses what we and many others have termed 'digital ontology' (hereafter DO). We begin by posing the following linked questions: What is DO? Does DO 'exist' at all? If so, how does DO differ from 'traditional ontology,' or, at least, from 'non-digital' or 'pre-digital' ontology? What does the adjective 'digital' signify here? How does it differ from adjectives that may seem quasi-synonymous with it, such as 'data' or 'information'? Why should we speak about *ontology* or perhaps even *ontologies* (plural) at all, let alone *digital* ontologies? Should we not rather speak — as many have and do — of something like 'digital physics'? And how would we go about answering these questions if we did not avail ourselves of what seems to be a fundamental feature of ontological questioning, that is, a search for a method? Yet what if it is precisely the search for a method that the 'digital' undermines or overturns? Indeed, does the digital also overturn the concept of 'ontology' itself? Could it be that DO is a paradoxical, nonsensical, or contradictory phenomenon that resists its own consistent formalization?

We reuptake these difficult questions here in order to offer some background, arguments and provisional answers, and do so in a sequence of regulated steps. First, we stage some of the new issues raised by digital technologies, precisely by bringing out the problems that digital technology itself poses for research into digital technology. This staging is done by way of what has only very recently become — in the last two decades — one of the most commonplace of everyday acts: a browser search on the internet for a phrase. Although the very many complexities of such searching are by now well-studied and well-known, we briefly rehearse some of these here in order to draw out a few of their consequences for re-search.

Second, in doing so, we identify, situate and explicate several major strands of thinking regarding DO today, with respect to three modalities in particular: the anthropological, the analytic, and the physical, represented here respectively by the recent work of Tom Boellstoerff, Luciano Floridi, and Edward Fredkin/Stephen Wol-

fram and others. We will show that each of these modalities comes to be caught in something like a contradiction, which derives from their uncertain self-positioning between epistemological and ontological concerns. Precisely because they begin with the new *propositions* concerning *knowledge* that seem to be generated by digital technologies, they end attempting to *know* by constructing doctrines of *being* out of their own contingent epistemological closures. Here, the conceptual restrictions derive from a commitment to a covert dialectic of the limited/unlimited/delimited, whereby what we know becomes either a limit to our knowledge of the being of the other (e.g., being as the other of knowledge), thereby alternatively refusing *or* projecting an empty vision of being onto the other side of this knowledge *or* they project this knowledge in an unlimited fashion *directly* onto 'being itself' (e.g., the universe is itself a digital computer). This apparent divergence derives from their systematic solidarity with each other regarding the priority of *epistemic* questions.

Third, following this summary, analysis and critique of these key contemporary positions regarding DO, we return to some of the most influential 20th century thinkers of the relation between technology and ontology, including Martin Heidegger, Gilbert Simondon, Bernard Stiegler and Alain Badiou. This return enables us to establish certain requisites for *any* ontology that avoid the difficulties that beset Boellstoerff *et al*., even if, in turn, we will disagree with these thinkers regarding the proper method and sense of a *contemporary* ontology. Our disagreement will hinge on certain new pragmatic and conceptual phenomena exposed by digital technologies that have no real precedent in any metaphysical or logical tradition, whether mathematical or naturalist, materialist or idealist.

Here, the evidence is provided by three essentially contemporary problems, simultaneously conceptual and technical. The first of these is the so-called 'P v. NP problem,' formalized in 1972, an as-yet unsolved dilemma which poses whether certain computational problems whose solution can be rapidly checked in polynomial time can also be solved in polynomial time. The second concerns the claims made by non-classical ('paraconsistent') logics developed in the wake of operational difficulties that emerged first in post-WWII computing, which don't uphold an absolute exclusion of contradiction, in contrast to classical logic which depends upon the Law of Non-Contradiction. Third is the operational necessity that all data be simultaneously

modular and modulated, that is, at once created as elemental 'bits,' yet bits that are essentially mutable. We will treat these aporias as opening onto ontological questions.

So, fourth, taking up the challenge of these aporias — that is, *impasses* of *knowledge* that do not thereby necessarily designate immutable *limits* to our thinking of *being*— we suggest that it is in this epistemological rift opened by digital technology that the new lineaments of a properly DO can be discerned. In conclusion, then, and on this basis, we briefly present a new theory of DO, which doesn't treat contradictions as explosive or entailing only trivialities. Rather, we maintain that: ontology is always onto-technology, that is, digital; onto-technology is always a-temporal, impersonal, and in-consistent; its contemporary character is discerned through the *new impasses* that have been revealed to us by binary computation; these impasses deliver a new sense of being that also immediately and irremediably affects the grounds of knowing and action too. For reasons that will hopefully become apparent in the course of this presentation, we will name this paraconsistent DO *ir-re-mediable*.

Too much, too little, too fast, too diverse, too repetitive

On 7 January 2017, an online search from Melbourne, Australia, for the syntagm 'digital ontology' turned up 'About 1, 040, 000 results' in '(0.59 seconds).' Almost nothing in this sentence would have made any sense that was not science-fictional until very recently — perhaps not even until the beginning of the twenty-first century. Yet, through a version of a paradox well known to media scholars, the unprecedented speed, reach, size, and accessibility of such an information search seems, through its very power, to have been almost-immediately 'naturalized.' This paradox — that what is most novel and most shocking about contemporary information technology is also its most banal, everyday feature — should induce us to think again about the status of this 'banal estrangement.' For the rapid transformation of irreality to banality hasn't necessarily served media scholars well. Part of the problem with such 'an approach to an approach' is that it may have already been irremediably falsified by the new technologies themselves. The very self-evidence and extremity of the information revolution may, by another, associated paradox, seriously inhibit, if not render impossible, any viable account (e.g., well-founded, evidence-based, plausible, or persuasive) of its status. Perhaps it is the case that these technologies make it impossible to know the

very knowledge that they alone make possible to know. Modern media may be, precisely, *ir-re-mediable*.

Even trying to face this truly gigantic set of results, available to us practically immediately, should suggest some serious, perhaps constitutively disabling practical difficulties (see Andrejevic 2013). No one person — nor two people, nor even a dedicated team of people — would be able to sift through this vast array of results in any acceptable fashion in any acceptable time. Given the global extension, sheer number, speed and instability of the information, the evidence itself beggars any possibility of a synoptic account, let alone the viable reproduction or review of the results by a third party. To refer to a Hegelian concept: the paradox of absolute knowledge is that its instantiation entails its evacuation. This is a theme foundational to our argument, to which we will return throughout this essay.

Let us simply take the first page of our search, on which there are 11 results: 'Against Digital Ontology – Luciano Floridi'; 'Digital Ontology — Cultural Anthropology'; 'Is There an Ontology to the Digital — Cultural Anthropology'; 'Digital Ontologies | Material World'; 'What is Digital Ontology | IGI Global'; 'Against Digital Ontology – PhilSci Archive'; 'Digital Physics – Wikipedia'; 'Against Digital Ontology | SpringerLink'; 'Against Digital Ontology - Oxford Scholarship'; '[PDF] Against Digital Ontology – Luciano Floridi'; 'For Whom the Ontology Turns: Theorizing the Digital Real.'

There are a number of relevant features about this short list. First, the repetitions: Luciano Floridi's paper *Against Digital Ontology* appears five times, in at least three different versions (the author's prepublication manuscript, a paper in the journal *Synthese*, and a chapter in the book *The Philosophy of Information*), linked to four different sites, two of these academic sharing sites (Philsci-Archive and Philosophy of Information), two of them proprietary publishing sites (Oxford Scholarship Online and Springer). Two of the links are to '*Cultural Anthropology* (print ISSN 0886-7356; online ISSN 1548-1360), the peer-reviewed journal of the Society for Cultural Anthropology, a section of the American Anthropological Association'; another to the blog 'Material World,' based at University College London, which hosted workshops which led to the *Cultural Anthropology* publications already noted; one link is to an article by Tom Boellstorff, who is also a contributor to the aforementioned *Cultural Anthropology* issue; another is to a Wikipedia article on 'Digital physics'; yet another

is to the proprietary site IGI Global, which provides the definition 'The view that reality is essentially digital in nature,' and linking to 'Learn more in: A Scientist-Poet's Account of Ontology in Information Science.' All the sites are English language, linked to powerful institutions based mainly in the UK or the US.

The well-known issue of algorithmic closure — that Google searches operate according to proprietary algorithms that select results on the basis of prior searches, among other factors — is alarmingly patent from the outset. Searches in French for '*ontologie numérique'* turned up 'About 163,000 results (0.34 seconds); in German, for *digitale Ontologie*, 'About 223,000 results (0.69 seconds).' Despite the literalism of such translations of 'digital ontology,' it is clear that, even in closely-related modern European languages, there is a notable divergence of terms and results. Presumably it is also of some significance that the comparable Wikipedia pages for '*Physique numérique (théorique*)' and '*Digitale Physik'* also turn up on the first page of search results, offering very similar accounts to the English version. The problems of filter bubbles, repetitions-too-numerous-to-handle, uncategorized or miscategorised links, indefinite linkages, and incommensurable multiple languages, can thus be added to the difficulties regarding any initial basic efforts to delimit the field.

These difficulties may be overlooked or treated as they were de facto simply just a matter of size and speed that so-called 'big data' methodologies, software, and hardware would be able to handle; indeed, be the only ways to handle such vast unstable quantities of information. Unfortunately, we need to specify right away that, for structural reasons, this cannot be the case. On the contrary, big data simply exacerbates the problems, rather than resolves them — and in a number of important ways. We have already mentioned the fluctuating semantics of philosophical keywords, as well as their variable translation both intra- and inter-lingually. We could also immediately invoke the gap (discussed below in more detail) between terminology and concepts. We could also point to the difficulty of deciding the status of a model of the logic of a system which takes place within the system that it is itself nominally modelling. Certainly, some of these problems are ancient, even foundational philosophical *topoi*, and therefore not dependent upon digital technology. Yet they are by no means circumvented or resolved by the new technologies: on the contrary, they are radicalized.

Even if we were to act as if these difficulties had not insuperably altered the very status of knowledge itself, and were to turn to the content of the first-page articles in English, we would still encounter severe, perhaps irreconcilable differences regarding the sense and reference of the syntagm 'digital ontology.' Let's take only three of these, that is, three quite different projects which turned up, albeit in different guises, on our first page of English-language results, Luciano Floridi, Tom Boellstoerff, and the so-called digital physicists. As we shall see, these are quite different projects; yet, despite these differences, we will also suggest some unexpected continuities. Whether our demonstration holds at all, even constrained to the very first page, is something that, as we have said, is today *absolutely indeterminable*, given the affordances of digital technology itself.

An informational ontology?

Floridi's much-circulated and much-cited attack on the very notion of 'digital ontology' takes the phrase in a highly technical sense: the doctrine that "the ultimate nature of reality is digital, and the universe is a computational system equivalent to a Turing machine."[1] Floridi wishes to criticize this account in favour of his own sceptical proposal for an *informational ontology*, that is, that "the ultimate nature of reality is structural."

Drawing on Immanuel Kant's famous account of the antinomies of pure reason in the first *Critique*, he seeks to show how the difference between considering nature as discrete (digital) as opposed to continuous (analogue) is itself a consequence of "features of the level of abstraction modelling the system, not of the modelled system in itself" (Floridi 2009, p. 160). In reconstructing the alleged claims of digital ontology, Floridi considers its fundamental thesis to be that the physical universe is founded on discrete entities, that all "reality can be decomposed into ultimate, discrete *indivisibilia*" (Floridi 2009, p. 153). Floridi gives an extended thought experiment in which four agents, which he angelically names Michael (an ontological agent, "capable of showing that reality in itself is either digital or analogue"), Gabriel (a translation agent), Rafael (an epistemic agent) and Uriel (who shows the irreducibility in observations of reality), all resembling Turing machines, interact in such a way as to render it moot whether reality in itself is either digital or analogue. If there is not the

space here to examine Floridi's impressive neo-Kantian argument in the requisite detail, it is worth underlining that it depends upon an intricate faculty structure which relies on there being a gap between the *noumenal* ('reality in itself') and any possible knowledge we might have of it. For Floridi, again, "digital and analogue are features of the level of abstraction," and not at all of reality itself. (One might suggest that this judgement is itself a consequence of the theory's initial separation of knowledge and the real, which, in giving priority to epistemology, already happily determines the outcome of the case.)

Floridi is therefore concerned to separate the 'informational' from the 'digital,' precisely because, depending on the level of abstraction, the former can present *either* as analogue or digital, continuous or discrete. Moreover, as Janice Richardson specifies, Floridi elsewhere "distinguishes between the infosphere, as the environment in which our information is transferred, and the Infosphere (with a capital I). The reference to the 'Infosphere' involves a bolder ontological claim. The Infosphere refers to everything that exists; the whole of Being" (Richardson 2016, p. 139). Such Being is constituted by "structural objects that are neither substantial nor material…but cohering clusters of data" (Richardson 2016, p. 139). It seems that Floridi is proposing an ontology that gives us transmaterialist organizations of data as its basic, well, *data*.

In his more recent work on the conceptual logic of systems modeling, in which Floridi offers criticisms of the resources of both Kantian (conditions of possibility as feasibility requirements) and Hegelian options (conditions of systemic in-stability) while calling for a third way, he continues to insist on the priority of the epistemological over the ontological. Here Floridi's own imagery is (unconsciously) revealing: "compare the conceptual logic of a watch with the conceptual logic of the design of a watch," he says (Floridi 2017, p. 496). But a watch is exemplarily an eighteenth-century mechanical time-piece, whereas the logic of contemporary design, no matter its level of abstraction or, indeed, whatever its alleged materiality, is that it is a construction of *information about the information from which it is made*. This suggests that the opposition Floridi offers, between the (allegedly more) modest claim to simply model a system ('epistemological') and the alternate claim that "the logic of a model of a system is the logic of the system" ('ontological') is false or, at least, insufficient. His own third option is to propose one that attends to "a design logic of future conditions of feasibility of a system" (Floridi 2017, p. 516). But another third (or

fourth) option — which doesn't, *contra* Floridi, presume that *knowledge* is paramount for such a program — is precisely that 'the logic of a model of a system is included in the system which it models.' We will see how this latter option functions below in our discussion of Heidegger and others.

A digital ontology?

Boellstorff relies on a different, far less technical sense of 'digital ontology' than Floridi, taking off from what he sees as a deleterious general opposition between 'the digital' (or 'the virtual,' which he understands, relatively plausibly, as essentially synonymous in most of the articles he surveys) and 'the real' (see Boellstorff 2016). Noting that influential scholars from a variety of disciplinary backgrounds make the same reduction of physical to real, and digital to unreal, Boellstorff presents rather a 'quadrant,' in which we find the more complex set of oppositions 'A physical and real,' 'B digital and real,' 'C physical and unreal,' 'D digital and unreal,' before proceeding to a potted account of the imbrication of ontology in anthropology along the lines of a 'turn,' i.e., a trope with many 'entailments,' some good ('helpful'), other bad ('unhelpful'). As Boellstorff continues: "Metaphors are not all-determining, but their entailments matter, shaping and revealing pathways of thought and practice. With regard to ontology, the most damaging entailment of the turn metaphor is that turning takes place around an axis, a still center held constant." Boellstorff's method requires him to be at once anthropologically/sociologically self-locating (he speaks of his personal and institutional background) and linguistically saturated (he self-reflexively interrogates the work done by the dominant metaphors in the field), as he surveys a slew of contemporary academic material dedicated to the theme of 'ontology.' By doing so, he comes to an axial decision regarding this material:

> If the ontological turn pivots around a bolt of difference shared with its epistemological foil, the danger is a form of closure, rather than an extension that opens to new conceptualizations of the human and parahuman. One reason I do not cast my intervention in the language of critique is that such language has largely served to further rotate analysis around the bolt of difference (Boellstorff 2016).

Boellstroff's proposal is to shift to an 'archipelagic' account of ontology, which, instead of privileging difference *per se*, draws on the work of Gabriel Tarde to consider imitation as "a relation of similitude that preserves difference." Here, then, we have an open and relational ontology in which diverse materials which are themselves already bundles of mimetic relations constantly enter into new relations that create, as they preserve, existing differences.

In these two presentations we have too-rapidly summarized, the disciplinary methods, sets of references, conceptions of 'digital ontology,' and conclusions are so wildly different that it is difficult to see how they are even speaking about the 'same' 'thing.' Floridi, drawing on a broadly analytical philosophical framework deriving from Kant, discusses the abstract structuring of information by new technologies according to the conceptual projections made by their adherents onto the structure of physical being itself; he argues that such a projection falls prey to the Kantian account of the antinomies that necessarily arise when forms of presentation are taken for things themselves, and counters accordingly that the proper response is to recognize the primacy of the operations of the multiple structures that produce information (representation) as such. The universe is not, therefore, a computer (discrete, computational, deterministic), but rather a totality of structures of information. Boellstroff, by contrast, relies integrally upon varied phenomenological-linguistic experiences to make his points, which for the most part circumvent the technical aspects of the new media — such as SecondLife — of which he gives some 'thick' descriptions. Neither Floridi nor Boellstroff are working with the same sense of the terms, the same evidence, the same references, the same arguments, nor perhaps even with the same object.

A digital philosophy?

Defining an ontology by and through epistemological claims is especially evident in the work of the so-called *Digital Physicists*, as exemplified chiefly by the scientists Stephen Wolfram and Edward Fredkin. Positing the universe as a digital computer, the very assertion that Floridi attempts to do away with, in a manner that is eminently susceptible to Floridi's Kantian argument of the antimonies as discussed above, the assertion nonetheless bears more than a passing resemblance to Floridi's own infor-

mational epistemology-as-ontology. The basics of the theory are properly characterised as *it from bit*, a concept first proposed by the quantum physicist John Wheeler in 1989, where "every physical quantity, every it, derives its ultimate significance from bits, binary yes-or-no indication" (Wheeler 1995; see also Floridi 2009 for a concise summation). Digital physics attempts to show that all of everything – not just matter, but also movement, thought, evolution, literally *everything* – is the result of ongoing, elaborate processes of computations built of fundamental binary operations. Yet it ultimately offers a description of a process-based philosophy that is not so dissimilar to other such philosophies prominent in the 20th Century, including those of Bergson, Whitehead, Simondon and Deleuze.

Stephen Wolfram's *Principle of Computational Equivalence*, for example, states that "any process whatsoever can be viewed as a computation" (Wolfram 2002, p. 716). Based on Turing machine-like finite-state computations, as expressed in *cellular automata*, Wolfram has done an impressive amount of experimental work investigating rules to apply to cellular automata in order to show that enormous complexity, including such that can imitate physical processes, can emerge from relatively simple starting states. He goes further to assert that not only can universality (i.e., that any complex process of computations can imitate, or actually become, any other complex process of computations) be achieved by these processes, and not only that any sufficiently complex process is in fact universal, but that there is an upper limit to computational sophistication and that "almost all processes except those that are obviously simple actually achieve this limit" (Wolfram 2002, p. 721).

Wolfram goes on to assert that this kind of computation therefore subtends all phenomena in the universe, without actually doing any philosophical, or even logical, work to show that this assertion can be true, rather than simply a representation of observable phenomena. For his part, Edward Fredkin makes this same assertion and goes so far as to call his ideas *Digital Philosophy* (Fredkin nd). Underlying this philosophy are several key assumptions, most notably that discrete entities ultimately constitute all qualities and therefore can be represented in binary form. This assumption certainly allows the systematic experimentation of Fredkin's digital philosophy to produce results, such as with Wolfram's cellular automata, and as such it bears a resemblance to other attempts at ontology that rely on certain axioms in order to be useful, most notably Alain Badiou's set-theoretical ontology as discussed below. And of

course, such an assumption subtends the idea and practice of digital computing generally. These scientific investigations of process do not self-evidently prove or demonstrate any legitimate ontological claims, which remain simply as descriptions, observations or unsubstantiated claims. This conflation of demonstrable representation of observable phenomena with rigorous philosophical claims is not uncommon in contemporary scientific literature, which sometimes claims, as does Stephen Hawking in the tellingly named *The Grand Design*, that "philosophy is dead" (Hawking and Mlodinow 2010, p. 5), whilst pursuing such baldly philosophical goals as a *theory of everything* without so much as an attempt at showing how this epistemology has managed to, or can, replace ontology.

Nonetheless, scientific experiment and observation continues to yield the, ostensibly foundational, two elements (or, more accurately, *principles*) of quantisation and relation. In quantum physics, as implied in its name, the most basic processes of the universe rely on quantised units (or perhaps rather, values), with no continuous 'in-between'. Some quantum physicists and philosophers are trying to conceive of this as an ontological condition, by asserting that these units or values only have meaning in relation to other units or values. In other words, there are no individuals at the quantum level, only quantised relations (see Barad 2007).[2] The rationale for such an ontological assertion is an assumption that empirical observation has peeled back enough layers that it now reveals the very workings of reality. In the Kantian terms of two such philosophers, the logicians Newton da Costa and Décio Krause, *Empirical Reality* has coincided with *Reality*, inconsistency is in Reality (Hegel was right!), and a reconsideration of inconsistency is required (Costa and Krause 2014). The theoretical physicist Carlo Rovelli has developed a theory called Relational Quantum Mechanics (RQM) to countenance this. In RQM, any absolute value or property (such as state, time, quantity, event, etc), is replaced only with informational relations. The ontological move comes in the assertion that "quantum mechanics is a theory about the physical description of physical systems relative to other systems, and this is a complete description of the world" (Rovelli 1996, p. 1637), and that there is no need to distinguish between systems (for example, observer/observed) because all that exists is information, which is shared between systems in relation.

As David Bohm says, "all that is clear about the quantum theory is that it contains an algorithm for computing the probabilities of experimental results. But it gives

no physical account of individual quantum processes" (Bohm and Hiley 1993, p. 2). For Rovelli, in a move that perfectly aligns with Simondon's transductive process as described below, this is because it is ontologically true that there are no individual processes, but only relations of information.[3] Recently, Newton da Costa and Olimpia Lombardi have attempted to formulate a paraconsistent logical modal ontology that is adequate to this assertion of non-individuality (Costa and Lombardi 2014). Of paraconsistent logics, we will speak more later. For now we note the reliance, proposed in RQM, on an informational model that echoes Floridi's notion of information structures and exchange, even if in RQM it is a more strictly Shannonist definition of information, i.e., as the number of alternatives, or choices, available to any interaction when one alternative "is chosen from the set, all choices being equally likely" (Shannon 1949, p.1). At the same time, it reinforces certain assumptions that motivate the experiments of the digital physicists.

No ontology?

'Digital ontology,' then? It seems that there is now simultaneously too much to know, too little to know, too many ways to know, and that things are too fast to know. This perhaps suggests the need for a radical scepticism about the very possibility of digital ontology. We therefore underline that the theories of information and their operations we have quickly examined above still take the problematic of epistemology as the entry point to any possible ontology, where 'ontology' comes to be the term deployed as a supplement to the epistemological issues, whether as a uncircumventable cognitive metastructure or as a shifting embodied topology. Yet if ontology is still often seen as an addendum to epistemology, the global impact of the new technologies has evidently been so intense that ontology — the question or problem of being, of existential possibilities — cannot be entirely avoided. In other words, it seems we can't circumvent the problem of the ontology of our new technological real — which undoubtedly fuels the contemporary enthusiasm for ontologies of all kinds. But what is, if anything, specifically new — or, if you like, 'emergent' — about the contemporary enthusiasm for 'digital ontology'?

This might seem a familiar issue in any scholarly field, 'the experts disagree.' But this would be to miss, in addition to the features we have already listed — scale,

number, speed, redundancy, proprietary, automation, etc. — the peculiar centrality of the term 'ontology' in the realm of the 'digital.' For perhaps the current situation constitutes the beginnings of ontology, rather than its ruin. We might even be tempted to assert that the contemporary enthusiasm for ontology is a direct consequence of the new technologies. 'Ontology', which was traditionally an extremely technical component of the metaphysics of being (the word was only coined in the 17th century as an orientation and support for early modern taxonomies of ancient metaphysics), has become a crucial signifier across an enormous range of disciplines that previously would have subordinated, ignored, or even rejected its claims, not least for working computer scientists themselves.

This suggests that ontology has become central to the lived lives (e.g., the phenomenology, the experiences, the practices, the thoughts, etc.) of people globally as something that affects them — us! — integrally, as a direct consequence of digital networks and devices that now constitute a new dispensation of action and knowledge. In fact, as our too-short shortlist already indicates, we find an astonishing range of ontological questioning everywhere, and it is clear that this ontological questioning is explicitly integrated with the questions concerning technology. Moreover, it is attempting this along extra-epistemological lines. Having already suggested the difficulties of ontological questioning that begins from the epistemological issues, we now turn to several peak moments in the theorization of this integral bond between ontology and technology which try to circumvent the priority of epistemology. If it is impossible to do justice to the thought of the pertinent figures examined here, we will nonetheless attempt to extract certain key innovations in the thinking of onto-technology without undue reduction. From there, we briefly sketch an ontology that, while seeking to integrate these strong modellings, also seeks to go past them to establish the elements of a contemporary digital ontology of inconsistency.

Being, Time, Technology: Martin Heidegger

Martin Heidegger remains one of the crucial touchstones for any contemporary thinking of the relation between ontology and technology today. The central figures of so-called 'Object Oriented Ontology' (OOO), Graham Harman, Ian Bogost and Timothy Morton for example, explicitly take off from and constantly return to, Heidegger's

thinking, while media theorists such as Friedrich Kittler and Rafael Capurro also point to Heidegger as key to the thinking of technology per se (see Kittler 2006, Capurro and Holgate 2011). Even those thinkers who are highly critical of Heidegger's contribution, mark him as indispensable for the return of ontology in twentieth-century philosophy.

It is therefore crucial to underline that one of Heidegger's decisive interventions was to return 'ontology' *per se* to the centre of all thinking, metaphysical, philosophical, or otherwise. Indeed, the declaration of such a return constitutes the famous *incipit* of *Being and Time* (1927), in which Heidegger analyses the history of philosophy not only as a 'forgetting of the question of the meaning of Being,' but, given the forgetting has itself been so thoroughly accomplished nobody is any longer aware of it, 'a forgetting of the forgetting of the question of the meaning of Being.' Yet this state of affairs has in some profound way itself been *destined* by the very thinkers who first broached the question of Being, the ancient Greeks. The opening of the question was therefore already in a certain sense the closure of the question; the re-opening of the question requires an attempt to construct another way of opening-in-the-double-closure-of-the-original-opening. Let us note: Heidegger fundamentally questions the very division between epistemology and ontology we noted above in our discussion of some of the contemporary opinions regarding digital and informational ontology; or, rather, he confronts the fact that epistemology is, at least in modernity, *de facto* presumed as the way into any such ontology.

What is so striking in the current context regarding Heidegger's return to ontology is that from the very first he links the question of Being to the question of technology as absolutely co-dependent phenomena, even if the question of technology comes to be considered in a number of not-altogether-familiar-senses. In *Being and Time*, for instance, institutions of transmission — that is, pedagogical and philosophical institutions — are already considered as themselves particular temporal technologies which, in and by their very success, serve to conceal and betray what they would reveal and faithfully pass down, 'simultaneously' stupefying and staggering the thought-experience of time. Hence, for example, Immanuel Kant 'dogmatically' takes over Descartes' position regarding the priority of the subject, thereby obscuring "the decisive connection between time and the 'I think'" (Heidegger 1996, p. 24). Yet this obscurantism is not a feature that could simply be broken with as if a matter of will or

intention, having been constitutively inscribed within the metaphysical enterprise as such; moreover, even the obscurantism itself offers something 'new,' not only in the forms of the express modes of philosophical conceptuality and technique developed by each thinker, but in the unthoughts that such modes also uncannily project.

At once within and against this tradition of the transmission of the forgetting of the forgetting of the meaning of Being, Heidegger proposes a certain destruction, deconstruction or 'abuilding' [*Abbau*] of this tradition. One of the most famous early moments of the analysis engages the 'damaged tool,' which, for Heidegger characterizes our very 'first' apprehension of a world-qua-world. Since our naïve ways of going about the world necessarily involve a constant deployment of equipment, which, in our very habituated inculcation into its use, simultaneously entails a kind of becoming-invisible of both means and ends, it is only when our intentions and actions are unexpectedly interrupted by a 'disturbance of reference' that we might come to a reflection upon our own situation.

It is only through such a disturbance, through the sudden becoming-un-handy (broken, missing, displaced) of equipment (i.e., *das Zeug*, the familiar technologies of our everyday use), that the already-yet-only-now character of our own 'world' is revealed. We must be careful not to reduce the subtlety of the paradoxes which Heidegger's phenomenological descriptions always seek to expose to us, as this already-yet-only-now character of constitutive belatedness has a number of extraordinary consequences. First, the tool materially obtrudes in becoming-unusable, alerting us to the fact of its materiality-beyond-us-with-us. Unreflective familiarity becomes estranging availability becomes unusable materiality. Second, in this material event of the advent of material that de-tools the tool, the *in-order-to* structuring of our own world simultaneously becomes available. The punctual, accidental un-handiness of the tool alerts us to the limits of our world, as it evinces a certain instability and contingency of that world. A world, *our* world, always has an aspect of handiness to it in the web of practised familiarity, and it is to these 'facts' we have the chance of attending when such basic familiarity is thwarted.

This early account of the absolute centrality of technology qua equipment as crucial in *establishing* any world *as* world for us also, as we have seen, means that it is through damaged technology that we are apprised of the necessary *handiness* of any

world. There is no world that is not in some ways pragmatically 'to-hand.' Yet every world is also contingent, the outcome of a vast history of vanished events. So the very revelation of the limits of our world can turn us towards the realisation that there must be an other, not just of 'our' 'world', but of all possible worlds. If this other cannot be a world (by definition), it is also nothing *but* this world, given being is not a thing that subsists outside of its appearings: hence, those anxious encounters with the nothing, with nothingness. This 'nothing' is a kind of abyssal other-of-world-in-which-worlds-world. There, the claims of technology are themselves momentarily abolished in the affect of anxiety, As Giorgio Agamben phrases it:

> It is not simply a matter… of an occasional unutilizability. The specific power of anxiety is rather that of annihilating handiness, of producing a "nothing of handiness" (*Nichts von Zuhandenheit*). In annihilating handiness, anxiety does not withdraw from the world but unveils a relation with the world more originary than any familiarity (Agamben 2015, p. 43).

This is also where the famous analysis of the 'ontological structure of *Dasein* as care' (*Sorge*) comes in: we must be beings who are constitutionally concerned with (our own) being; this ontological care is essentially temporal (see also Schwartz, Chapter 3, this volume, for a more detailed account of those aspects of care as it relates to our contingent 'thrownness,' its irremediable situatedness in a place and time, and, especially, its feminist implications).

If Heidegger thereafter ceaselessly revises this position, it is still on the basis of this triplet of *establishing-apprising-vanishing* that his later thought of technology develops (and which, by the way, shows that the problematic of what we could call 'ontological obsolescence' is a feature of his thinking from the start). If there is no space here to examine properly the further development and motivations of Heidegger's thought in this regard subsequent to *Being and Time*, we underline that it remains centred on the problem of technology. As Hubert Dreyfus usefully summarizes, there are at least three different stages in Heidegger's thinking of equipment, which are comprised of: 1) craftsmanship (*techné*); 2) industrialization (pragmatism); and 3) cybernetic control (systems theory) (see Dreyfus 1992, p. 173-185; Dreyfus 2004; Dreyfus and Spinosa 2003).

In his thinking-through of these stages, all sorts of concomitant shifts occur in Heidegger's thinking regarding the priority of *Dasein* as well as its orientation to and imbrication with affect, which is displaced after *Being and Time* towards a thinking of the 'mirror-play' of mortals, gods, earth and sky (or, to again simplify: death, force, ground, and transcendence as mutually-indissociable aspects of medium-disclosure); the relation of *physis to poiesis* to *techné* to *aletheia* is further complicated along these lines; and his long-standing analyses of the pre-Socratics and various poets are constantly nuanced and deepened. Because Heidegger is committed to the disclosure of Being by language ('Language is the house of Being,' and so forth), his attentiveness to the ancient establishment of certain philosophical concepts by the Greeks involves a radical philological tracking of their subsequent vicissitudes: *physis*, for example, emerges as a term for the presencing of nature-as-being, before 'nature' itself is fixed into a particular zone of beings; *poiesis* as making is linked originally to *techné*, artisanal knowledge, which at first discloses, then closes over, the un-forgetting of truth that is *a-letheia*, etc (for an exceptionally detailed and persuasive account of Heidegger's work in this regard, see Schürmann 1987).

So the early analysis of 'care' as ontological structuring of the non-relation between equipment and anxiety as dis-jointed temporalizing not only renders technology irrevocably entwined with ontology, but provides the decisive impetus for Heidegger's own life-long rethinking of ontology on the basis of technology, which, as it places the question of presencing through events at its centre, concomitantly comes to think of the essence of technology as an event of *Ge-stell* ['Enframing'] (see Heidegger 1977b), This entails a shift from attending to *this* or *that* kind of equipment or technique — whether handy or not, available or not, reliable or not — to a world-historical modality of revealing of the *essence of technology* in the modern age, basically since Descartes and Galileo. Heidegger's account is absolutely magnificent. If, chrono-logically speaking, modern technology (roughly dating from the late eighteenth-century industrial revolution) relies upon modern physics (early seventeenth century) for its construction and theorization, modern physics must *already* have been an expression of the *essence* of technology in order to get started at all. If this sequence had therefore already encrypted what would only become evident later, in a complex form of jet-lag — the emergence of modern physics, the development of

modern technology, the revelation of the essence of technology as already-there in the physics— this intrication itself has a history.

We shouldn't underestimate the complexity of Heidegger's position: the essence of technology becomes graspable in our time after a century or so of radical technological development, itself predicated on an earlier revolution in mathematical physics, which itself was already indiscernibly governed by the aforementioned essence, and that essence could never have installed itself without a prior history that goes back, in disjoint and contingent modalities, to the ancient Greeks. The history of Being is a history of finite, dis-joint revelations utterly dependent upon forms of technicity. This history also reveals that the contemporary essence of technology is a form of en-framing, which concatenated the totality of what appears into a 'standing-reserve,' that is, entirely unautonomous networks of dependent matter, technologies, and creatures whose energies are unlocked, transformed, stored, distributed, and rerouted (this sequence of inseparable operations, we might say, constitute Heidegger's extension of Aristotle's four causes).[4] Where the Heidegger of *Being and Time* would have stressed the *availability* of tools as integral to the world-making of individuals and societies, and the Heidegger of the 1930s the *reliability of* equipment as exposed in and by the work of art, the later Heidegger stresses the regulating and securing, the *enframing*, of the totality of existence under global conditions that a priori constrain the apparition of anything as always-already formalizable and quantifiable. There is no simple way out of such a situating, which entails that nothing can appear that is not available as a resource. For the later Heidegger, the breaking of a hammer offers no new possibilities either for knowledge or action in a world of near-total de-autonomization — which is tantamount to a world of near-total technological autonomization.

Yet, as is also well known, Heidegger leans heavily on great German poetry, especially that of Friedrich Hölderlin (but also George Trakl and Rainer Maria Rilke) for his theses regarding the destitution of our times, the danger of modern technology, and the constitutive too-lateness of our thinking. 'Where the danger is,' Heidegger quotes, 'There the saving power grows.' And if he will also later notoriously add 'Only a god can save us' (Heidegger 1977a), his point is that poetry, as a form of *techné* that survives into the epoch of modern technology, still retains, if in a seriously attenuated form, a resistance to the present, a power of truth that, in its anachronistic

otherness to the present, perhaps will aid in a questioning that leads beyond our current enclosure. Moreover — and this is a crucial 'moreover'! — what is at stake in poetry is precisely a use of language that, made from language itself, breaks with the very language from which it is made. As such, a poem is an 'event', in which the distinctions between 'empirical' and 'transcendental,' 'ontic' and 'ontological,' etc., are no longer operative nor viable. Yet, since it is only through language that there is any opening of being in the first place, it is only poetry, in its constant reopenings of language that the thinking of being can survive in our time of cybernetic command and control.

From technology to time to transduction: Gilbert Simondon

At the same time as Heidegger is rethinking onto-technology, Gilbert Simondon is elaborating a quite different, if perhaps equally profound, thought of technology and individuation - the process by which beings or objects become differentiated. For Simondon, technology is a genetic proposition, an evolving structuration that mediates humans and the world, as both a theory and a praxis. Yet theory and praxis had been rendered asunder in human culture, opposing representation to activity. In this vein, it is a mistake to think that technology has replaced humans, rather that because of the forced dichotomy between theory and praxis, it was humans "who in fact provisionally replaced the machine before truly technical individuals could emerge" (Simondon 2016, p. 81). Technical reality is human reality, where humans and technology are correlated, constantly involved in a mutually-informing process of co-individuation. . This is only possible because the ongoing process of individuation (for Simondon, there is no principle, only the process) occurs within and through the 'pre-individual', an oversaturated or metastable environment that is both occupied by, and carried within, the individuating process. For Simondon, everything is only ontogenetic individuation through transduction, where two or more disparate entities procedurally combine to create a new entity that carries the previously disparate entities within it. Therefore we must think of 'technology' and 'technical beings' in the same sense with which we think of 'humanity' and 'human beings', i.e., not as some given that exists only as present for something else, rather as an ongoing transductive process of individuation within an oversaturated, or *metastable*, environment that in-forms such individuation

in an ongoing, reticulated system of structuration through information. Broadly speaking, this is Simondon's concept of *transindividuation*. Here we identify a similarity with Heidegger's concept of technology as revealed to have been *already-there*, as well as with the recent efforts towards a relational quantum mechanics. See also Jonas Andersson Schwarz' chapter in this volume for a discussion of the transductive relationship between individual subjects and the wider contemporary digital environment.

In this sense, any technical object should not be understood as a material entity, but rather as the ongoing outcome of an ongoing process of transduction. Similarly, humans and technology are engaged in an ongoing ontogenetic process of transduction, and cannot properly be spoken of as separate individuals, except in a misguided sense that leads to a false dichotomy. Simondon speaks of 'technical being', and sees machines as technical objects only in this ontogenetic sense. Philosophically, he desires that technical being be integrated into human culture, by allowing no opposition between humans and machines: rather each is a part of each other. As Simondon says, "[t]he machine is that through which [humanity] fights against the death of the universe; it slows down the degradation of energy, as life does, and becomes a stabilizer of the world" (Simondon 2016, p. 21). In this, he is relying on a concept of regulative information, saying that although culture adopts a regulative stance towards humanity, it requires the integration of technical being in order to transcend its "specialised and impoverished" (Simondon 2016, p. 20) state to become general. This is in keeping with Simondon's observation of a tendency from the abstract to the concrete, by which he means a process of convergence and adaptation according to a certain inner resonance that ensures a generative coming-into-being.

Some commentators, including Bernard Stiegler, feel that, in this, Simondon becomes trapped in a Bergsonian metaphysics of vitalism, but this inner resonance that Simondon describes is not a vital spirit, and he is careful to point out that between the concepts of adaptation and vital spirit, there is no possible mediation. So he proposes rethinking this in terms of the "individuation of oversaturated systems" (Simondon 2016, p. 168) in an ongoing resolution of tensions through structuration:

> Tensions and tendencies can be conceived as really existing in a system: the potential is one of the forms of the real, as completely as the actual. The potentials of a system constitute its power of coming-into-being without degradation; they are not the simple virtuality of future states, but a reality that pushes them into being. Coming-into-being is not

> the actualisation of a virtuality or the result of a conflict between actual realities, but the operation of a system with potentials in its reality: coming-into-being is a series of spurts of stucturations of a system, or successive individuations of a system (Simondon 2016, p. 168).

This is where we may find a way of understanding digital computing, for the computer is not so much itself a machine as it is all machines, or a universal machine, a machine that can be any other machine. But these machines cannot really be said to exist in the world, and yet equally can it not be said that they do not. We discuss this *dialetheia*, or true contradiction, in more detail below. Further, it allows us to identify the processes and products of digital computing in terms of transduction and ontogenesis, or coming-into-being, for anything that we perceive via computing is never really an 'object', except in the most procedural sense. For example, our search results, with which we opened this article, are an ongoing process of transduction, not only in respect of the continually changing search algorithm and its dynamically modulated results in response to the changing world, but literally, in that to perceive those results is to participate in an ongoing transductive process of amplifying reticulations and resolutions of tensions between electricity, magnetism, wireless signals, light emitting diodes, retinas, hands, memory, language and culture (see also Andersson Schwarz, Chapter 2, this volume).

The challenge therefore is to understand the digital in these terms, as a "culture of technics" (Simondon 2016, p. 81) and, given Simondon's insistence on the tendency to concretisation, explore the implications of the advent of the binary computing universal machine for the history and future of humanity and its world in digital terms. And yet, for Simondon the theory/praxis dichotomy is false. Indeed all binary distinctions are false, despite his insistence on the maintenance of the law of contradiction. And we agree, but only in as far as we understand such a position to positively require the law of the excluded middle, in order to discern whether an absolutely minimal difference subtends the ontogenetic process to allow the possibility that something be and not be at the same time. We discuss this distinction between, and utility of, the laws of excluded middle and contradiction in detail below. For now it suffices to say that Simondon's study of technical process affords useful ground from which to examine the apparent logical inconsistencies that arise in the digital era.

From transduction to technics: Bernard Stiegler

In the wake of Heidegger and Simondon, Bernard Stiegler takes up certain key topics from each. From Heidegger, Stiegler takes the always *already-there* of technics to develop a theory of anamnesis and hypomnesis – roughly, internal and external memory – that shows that technology actually constitutes time for humans. This is because Stiegler takes seriously the Heideggerian notion of being as forgetting. Stiegler reads this as meaning that the history of (our) being is inscribed in technology, and therefore that time must be thought within the "horizon of an originary technicity *qua* an originary forgetting of the origin" (Stiegler 1998). This, therefore, is how the already-thereness of technology works, as an interaction between anamnesis and hypomnesis.

Stiegler relies on Simondon's transductive processes to both think this through and demonstrate its historical, and future, nature. Indeed, Stiegler draws a direct correlation between anamnesis/hypomnesis and Simondon's psychic/collective individuation, with both pairs mapping to internal (within a being, or the being as environment for internal individuation) and external (between a being and its environment for individuation and transindividuation) encounters. Stiegler also shares Simondon's concern with the historical, cultural, rendering asunder of theory and praxis or, for Stiegler, *episteme* and *tekhne*. Again, Stiegler sees this as the cause of the Heideggerian forgetting, thinkable in terms of anamnesis and hypomnesis.

Stiegler sees a parallel between Heidegger's already-there and Simondon's pre-individual, from which individuation proceeds. Further, Stiegler also sees a parallel between Heidegger's being-in-the-world and Simondon's notion of the reticulated relationship between individuation and its environment, or milieu (see Stiegler 2009). In fact, Stiegler sees the differences between certain aspects of Heidegger's and Simondon's philosophies precisely in Simondonian terms, that is, as two disparate fields, within a metastable environment, ready to transduce each other in a process of individuation. In this mode, Stiegler analyses Heidegger's later thinking on technology in Simondonian terms, drawing parallels between Heidegger's notion of technology as the ultimate outcome, and end, of metaphysical thought — where technology is thought of only in instrumental terms of means rather than in its essence or process as way of revealing — and Simondon's idea of technical being.

Stiegler also takes seriously Heidegger's 'question of the question', wanting to reevaluate, even restore, it and its possibility in the contemporary technical era. How-

ever, casting technology as the Derridean *pharmakon* — a term deriving from Plato, which designates simultaneously cure *and* poison — where hypomnesis apparently constitutes the condition of anamnesis, Stiegler thinks that Heideggerian thought is not capable of analysing the relationship between calculation and the incalculable, and this is something that concerns us later in this essay as a crucial aspect of any attempt at a digital ontology (Stiegler 2013, p. 137). Countering the prospect of the end of metaphysics through technics, which may foreclose the possibility of the question, and responding directly in this to the notion of post-humanism, Stiegler wants to insist on Heidegger's *Dasein* as the question of being, by placing in question the very possibility of questioning, and this impossibility of questioning exposes beings as in contradiction with themselves. This brings the thought back around, in Stiegler's transductive process, to Simondon, for whom the subject's incompatibility with itself is fundamental to his ontogenetic philosophy of transindividuation.

Finally, it is worth briefly adding the importance of psychoanalysis in Stiegler's account, particularly regarding the bases and consequences of technics qua affect in the effecting of the human subject. For Sigmund Freud, modern humanity had become 'a prosthetic god,' that is, entirely dependent upon its technical extensions. Yet, as Freud points out, this delivers at least two further important features, in addition to the fact that human being is from the first a technical supplement. First, technology creates the problems to which it purports to be the solution, thereby driving innovations that necessarily obscure their own operative conditions and implications. Second, technology, even as it functions as a kind of libidinal 'extension of man' in ways that Marshall McLuhan would later examine, requires a certain form of organic renunciation in one's enforced submission to it. Here, Freud speaks of assemblages of original events such as the becoming-bipedal of the human animal being articulated to the mastery of fire through *not* putting it out by urinating on it (Freud 1961, p. 90). Whereas many if not most accounts of the history of technology provide fundamentally positivist examples for the co-evolution of the human and its tools, Freud emphasizes how technology develops not only through an active working on the external world, but upon prior or coterminous forms of organic rejection and renunciation. In the aforementioned example, control of fire was (allegedly) achieved by *refusing* to either flee or put it out; that control required internal repression of a variety of instincts to be accomplished; that repression, in becoming embodied in psy-

chophysical practice, was also simultaneously forgotten. Whatever one makes of the Freudian speculative anthropology, what matters in this context is that the forms of his arguments point to a certain self-occluding negation or negativity — creative sequences of forgotten repressions — as the decisive factor in the binding of disparate organic and artificial materials that is accomplished by technology. It is these aspects of the psychoanalytic anthropology that Stiegler takes up (see Howells and Moore 2013).

From applied science as computation to pure mathematics as ontology: Alain Badiou

Let us put momentarily to one side this strong Heideggerean, Simondonian and Freudian lineage in the thinking of technology in order to turn to a purely mathematical and logical ontology. For Alain Badiou famously declares that 'mathematics is ontology,' that is, that modern set theory as it stems from Georg Cantor and its subsequent axiomatization and ongoing development by a host of mathematicians (including Gödel, Cohen, Easton, and beyond) establishes for the first time a pure ontology that is at once infinite and not submitted to the (theological) reabsorption by a 'One' or Presence of any kind. It is crucial for Badiou that, following from Heidegger's realizations, one cannot think ontology according to kinds of taxonomy or hylomorphism (i.e., as a content/form or matter/shape relation). Rather, set-theory is *pure*, that is, utterly independent of any empirical material; in its most popular axiomatization (Zermelo-Fraenkel), it is founded, not on any thing or number, but on the empty-set, whose 'nothing' undoes the one as a foundation and marks a suture to inconsistent multiplicity (Being); it also affirms infinite infinities as the basic, even banal, status of structured Being, to which it simultaneously gives a rigorous conceptual character for the first time (i.e., one that is not metaphysical or onto-theological; see Badiou 2006). For Badiou, set-theory gives an absolutely rigorous way of discussing Being as 'founded' on the empty set (a set with no members and thus 'void'), yet essentially multiple.

Notably, psychoanalysis proves important in the construction of Badiou's system, this time deriving from two formulae of Jacques Lacan's. Above, we noted that Freud had already pointed to a kind of double negativity at the heart of all technology.

Lacan further formalises this negativity, not only famously in terms of the linguistic signifier, but more precisely in terms that implicate formal logics. As John Cleary puts it in a recent study, these hold: "the real is inscribed as an impasse in formalization; the real is the impossible" (Cleary 2018, p. 143). Badiou translates these desiderata in several ways. The real, Being, as impossible, is nevertheless seized by set theory under the heading of the empty set, which binds consistent multiplicity (the hierarchies of infinite infinities without totalisation formalised by the theory) to inconsistent multiplicity, Being as such. Yet, to do so, the mathematics itself has had to have made a *decision*, that is, has had to have *axiomatically* (decisively) declared the stakes of its enterprise. Perhaps unexpectedly, it is axiomatization that bears the trace of subjectivity within any formal system, that is, a certain contingency, a certain thought, and the deliverance of a certain new version of necessity.

Precisely because contemporary technology is an *application* of regional forms of mathematics, it has to be considered by Badiou as downstream of the ontological, operationalizing certain regional forms of Being, which, nonetheless, can be restituted in all their full materialist abstraction by recourse to such mathematics.[5] However, there are three aspects of this ontology which should be noted here. First, it still demands a minimal *technology*; in this case, a writing technology, an auto-securing of the letters that are required for all logical and mathematical proofs (see Clemens 2002; Clemens 2015). By definition, such a (technical) reliance cannot itself be fully thematized by what this reliance conditions. Second, this ontology can only consider the technologies of our time as derivative of the purity of the thinking of the void-infinites with which set theory deals. As such, Badiou has almost nothing cogent to say about such technologies beyond indicating their dependence upon this rationale. Third, the ontology is expressly Boolean, that is, dependent on classical logic, for which the two non-negotiable elements are the law of non-contradiction (LNC) and the law of excluded middle (LEM). LNC holds that something cannot be both true and false at the same time; LEM ensures that there is no third state between something and its negation.

Certainly, Badiou has subsequently extended his ontological account in *Being and Event* with what he calls the 'objective phenomenology' of *Logics of Worlds* (Badiou 2009). This phenomenology relies not so much on Boolean logic *per se* but on its extension and transformation according to a kind of intuitionist logic. We will say

more about intuitionistic logic below; suffice it for the moment to say that it is one in which LEM does not *necessarily* hold. Badiou's phenomenology thereby provides a kind of general theory of the very variable ways in which different worlds allow different kinds of phenomena to appear with very different intensities. Moreover, this theory enables a comparison of intensities of appearing through a kind of transcendental indexing for which the negation of a negation (what Badiou calls its 'reverse') is not necessarily equal to the original intensity. This is not as recondite as it perhaps sounds: the point is that the objective structuring of the world(s) in which we find ourselves has to cohere to some extent (that is, not be contradictory), but also must enable both the proliferation of appearances (of a potentially infinite field of objects) and the relative intensities with which they appear. In such worlds, the 'negation' (or reversal) of the intensity of appearing of objects is not equivalent to their disappearance or destruction, but is rather a *modification* of that intensity.

Badiou acknowledges that this extension is not *ontological*, but bears on the structuring of the *apparition* of worlds, which, if they are ultimately *inscribed* in Being, are not entirely *circumscribed* by the laws of ontology. Nonetheless, the ontological prerequisite remains classical — to be or not to be — which, in being supplemented by a non-classical account of the worlds of appearing — to appear can be to appear a little bit, or alternatively very intensely — still relies upon a materialist synthesis in which 'every atom is real.' Ultimately, all appearance, however mutable, is founded upon an ontological base that is classical. In a word, Badiou's mathematical ontology retains both the ancient logical principles of non-contradiction and excluded middle. Yet, as we have seen, it is such a logic that Heidegger puts into question in his turn to the 'logic' of the poem, as indeed does Badiou himself regarding the status of phenomenological appearing.

Modulation and the end of questioning

We have now come to a critical moment in the attempt to think technology. Following a confrontation between a Kantian informatics as represented by Floridi and a virtual anthropological archipelagics as represented by Boellstroeff, we suggested that both versions remained too epistemologically-oriented, and, in a context in which the internet patently radically undermines established epistemologies, that it would perhaps

be requisite to return to philosophies that attempted to think technology and ontology as indissociable, but without giving any priority to epistemology. We then proceeded, on the one hand, to elaborate a tradition which thinks 'technics and time' together, and on the other, we outlined a mathematical ontology which purports to break altogether with the apparitions of *techné* in the name of infinity.

There is a further difficulty, however. While the ontological interpretations from Heidegger to Badiou are extremely strong and profound, they radicalize the fundamental ontology at the expense of specific technical details, which can appear in their own frameworks as either *regional* ontologies or as giving merely 'ontic' or 'empirical' details; on the other hand, the very many approaches which attend to the technical specifications of the new technologies and media, reduce the ontological import to its *sociotechnical* implications. In addition to those thinkers already cited, we could mention Gernot Böhme, Benjamin Bratton, Roland Capurro, Wendy Chun, Alexander Galloway, Stamatia Portanova, McKenzie Wark, and Yuk Hui among others (see Böhme 2012; Bratton 2016; Capurro 2006; Chun 2016; Galloway 2004; Portanova 2013; Wark 2015; Yuk 2016).

Our own 'solution' will therefore be as follows: to take up the ontological challenge in its fullest sense, but to do so through the salient technical requirements of the present. We have previously discussed in detail (Clemens & Nash 2015) how the *specific* processes of digital computing can be seen as a literal enacting of the Simondonian process of individuation via transduction. We call this *modulation*, for various reasons outlined elsewhere (ibid.), but for our purposes here it is broadly understandable as 'transduction', and we see it as fundamental for any attempt to think digital ontology. We have shown that the digital has literally ended the concept of media, since media before the digital were actually differentiated whereas now they simply individuate as, in practical terms, simulations of differentiated media within a single metastable environment, i.e., the digital.

We have also shown that such an event, or process, unfailingly shines a retroactive light on the nascent tendencies within these prior media that were unable, for whatever reason, to emerge from within the restrictions of their differentiated state. This is Heidegger's *already-yet-only-now* character of the event-of-being operationalised in the digital, and we call this phase of undifferentiated media that nonetheless ostensibly appear differentiated in the world — the *post-convergent* world we

inhabit now — that allows all sorts of aspirational or experimental tendencies to be enacted in the world (Clemens & Nash 2015). And we have also shown how operationalising a Simondonian understanding of digital networks allows certain neo-liberal actors to perpetrate an unbalanced structuration that, while operating technically according to Simondonian processes, is simultaneously able to perpetuate an anti-Simondonian value system of individuality that results in a global anxiety amplifier, with the result that anxiety can be seen as the only true product of global digital capitalism (Nash 2016; Stiegler 2014).

All of these tendencies and acts, carried out digitally, have the seemingly extraordinary quality of both being and not being in the world. A social media update, for example, most certainly can be said to be in the world, and yet at the same it is impossible to say that it is in the world. In this sense, it is like music; music most definitely exists in the world, and yet it is impossible to say that it exists in the world. The sound itself is not the music, nor is its physical (mechanoelectrical transductive) perception via the eardrums and stereocillia of a listener, and nor is the person or computer playing the music. Does music exist only in the mind of the listener? If so, how is it possible that people can participate in music together? The same can be said of colour, and the same can be said of digital operations of any kind. We have shown how Simondonian thought (with some modification that we will discuss below), with Heideggerian, Stieglerian and Badiouan thought supplementing, can account for the operations of the digital, and for their perception and action in the world, by an ongoing transductive process of individuation and structuration within a metastable, or saturated, environment. This allows us to assert that, when using the digital, we are not passively participating in this process of becoming, but actively taking part in it, manipulating the process, as all participants in the transductive process must do, in a moment that Stiegler calls ‘adoption’, as opposed to ‘adaptation’ (Stiegler 2013).

The digital is, then, at the same time as being an active participant in — also a *working model* of — the transductive process of becoming. We do not make this claim in the same manner as the digital physicists like Fredkin do, or such as Descartes did with clocks, in that we are not maintaining that the universe is a digital computer. Similarly, we are not maintaining that the digital is the *only possible* such participant/model, and we already pointed out music and colour as exemplary, to which list we could add, for example, religion (a fact of which Simondon was very

aware), language and globalist economics (of which Stiegler is very aware). And we can make this claim largely with the help of a Simondonian world view. Must it be the case then that a Simondonian process of transindividuation is itself subject to this same process? Certainly, if we stay with Simondon, because for him there is no principle, only the process, so it cannot but be that the process is also in a constant reticulated process of individuation, always incompatible with itself. Since the digital is capable of simulating, or 'containing' to refer back to Marshal McLuhan's notion of the individuating process of media, other prior but similarly exemplary systems as listed above, it would seem that the transductive process of individuation has transduced its self/other into a metastable environment that we all today call the digital.

So far so good, but we have not yet been able to account for *how* such a situation can not only come to be, but to come to be the condition for becoming. How is it that a subject is incompatible with itself, and yet can still be a subject? How is it that a calculation can be in the world by not being in the world? This brings us back to the problem of how to deal with digital ontology when digital ontology clearly shatters any unity of our knowledge of it. For us, it means there are not questions anymore. Heidegger always talked about 'questioning,' and we've shown how Stiegler has attempted to formulate the impossibility of posing questions as a question itself. We sympathise with this attempt at reformulation, and submit our own: not questions, but problems (i.e., with solutions), because, as we have shown, that's what the digital does to *questions* of being — like everything, it turns them into *problems* of being, in other words, *injunctions* that require a *solution*. If the digital means the instrumentalised end (and means) of metaphysics, then we must instrumentalise this very process to transduce this very process. This gives us a method: we take the shattering of unity of knowledge as key to the technology, and ask how it does this. It makes being itself subject to mathematized technology, but how? Digital ontology means the problem of ontology can precisely no longer be circumvented in experience since experience is now precisely the outcome of technology; but the problem of ontology can only be answered by returning to the abstract operations as to how this is done. So, against Floridi, we want to ask, is there a minimal difference, a pure binary, that must subtend yet condition any possible differentiation, even that of digital and analogue? Or is there an infinity of different differences, each a 'true contradiction'? For this, we will turn to the field of logics called *paraconsistency*.

A Digital Aporia

There is a point to mark that is crucial for any ontology: its integral binding to paradox and aporia. At one of the supposed inceptions of philosophy as such, we find the extraordinary character Socrates who is denominated by Plato as *atopic*, placeless or without place. As is well known, Socrates pursues his various interlocutors with savage questions regarding their putative knowledge of this or that practice, until he has reduced them to silence, and the situation to *aporia*, impasse, deadlock, or loss. Such an impasse is the index of an irrationality that marks the impossibility of its being known under the current conditions of knowledge (Bartlett 2015). *Aporias* regularly prove catalysts to ontological thought.

Today, a new class of problems have emerged which constitute such an aporia for contemporary thinking. Moreover, they emerge in precisely the context we are discussing here: digital computing and modern logic. On the one hand, from Gödel, Turing, and others, we know that there are certain kinds of problems which cannot ever be resolved, that is, they are logically impossible. On the other hand, there are certain problems for which no solution can ever be found, or, if found, ever proved. In between, there is a new kind of problem, neither impossible nor trivial. This new class of conceptual formal problems is usually phrased as 'the P versus NP problem.' It is one of the most significant open problems in contemporary mathematics, and is especially important for computer science. In the simplest terms, which hopefully maintain the core attributes of the problem, it poses whether every solution quickly verifiable by a computer is also quickly solvable by computer. There is a class of problems (called *P*) for which an algorithm exists (or can exist) which will solve the problem in polynomial time, meaning an amount of time that varies as a polynomial function of the amount of input. There is another class of problems (called *NP*) for which there is no known algorithm for solving the problem in polynomial time but for which any solution can be verified in polynomial time.[6] A popular method of visualising the difference, while not completely accurate, is the difference between listening to a piece of music and composing that piece of music. Listening (i.e., 'verifying') to the piece only takes as long as the length of the piece of music. Composing it, on the other hand, takes an indeterminate amount of time that quite possibly bears no rela-

tionship to the 'input size' of the problem. Whilst the prevailing assumption, which subtends all manner of contemporary digital operations like cryptography and networking, is that P does not equal NP, it has never been proved either way.

This is an *essentially* contemporary problem. Having first been formalised in the early 1970s, specifically in relation to digital computing, it emerges in our time as *the* aporia of the digital era.[7] Not only did the problem not exist before the mid-twentieth century; it was previously unimaginable, let alone formalisable. The P v NP problem emerges *directly* as a result of the establishment of digital computing, a specific technical condition, yet currently seems irresolvable by the very means that have revealed it. For if digital technologies are today at once the conditions and the instruments for genetic, chemical, physiological, behavioural, situational, social, and environmental manipulations — that is, for unprecedented power over beings — they open between verification and demonstration a gap which is essentially temporal. Certainly, this situation is also linked to a new priority of technology over science, not only in terms of financing and alleged utility, but insofar as technology can now be constructed which works without anybody necessarily having the *knowledge* of how it works.

We wish to assert that it is this aporia which shows that *the one* of knowledge does not hold. Whether it is with the digital physicists, for whom in the end physics and metaphysics fuse or short circuit at a certain point, or for the paraconsistent logicians who believe that ultimately true contradictions are the truth of being, or alternatively the epistemologists who believe that ontology is merely speculative in relation to what we can know, the aporias interrupt and challenge these convictions to show that *the one* cannot close upon itself. We've shown that Simondon, Heidegger and Badiou offer a perspective from which either the void or a constitutive disunity must subtend any attempt at an ontological unification via a *one* of knowledge.

This is why it is wrong-headed to begin with the assured new *knowledges* we have incontrovertibly gained from contemporary computing. Rather, it is the *limit* of these knowledges as expressed in an *aporia*, an impasse that afflicts knowledge as it opens a new phrasing of the problem of the grounds of this knowledge, to which we need to attend in the construction of any possible ontology. Indeed, we suggest that this aporia directs us towards a new ontology, which is that of the irremediable. For the digital is literally *irremediable*: its contradictions do not admit of correction, care,

or cure but, on the contrary, establish the very grounds that enable its irremediability as both constitutive and constituting of our own knowledge economy.

A paraconsistent conclusion

At points throughout this chapter we have alluded to the field of *paraconsistent* logic. A general feature of paraconsistent logic is that consistency is not equivalent to the impossibility of deriving contradictions within a system. Unlike in classical and intuitionistic systems, contradiction is not necessarily 'explosive': some contradictions are tolerated, but such a system is nonetheless not trivial. A trivial system, in formal logic, is one in which everything is true. Another way of thinking of this is that paraconsistency admits inconsistency as potentially useful information. Yet this means that formal negation becomes, as Badiou says, 'more and more evasive' in the system.[8] Da Costa and Krause, in their attempt at formalising a logic of quantum physics, think that contemporary science's search for a grand unifying theory of everything would almost certainly need to be paraconsistent.[9]

In many ways, the idea of paraconsistency is keenly related to aporia, and in the case of the digital, we have mentioned that Simondon's philosophy of transduction and transindividuation seems to require that we dispense with the rule of the excluded middle, if we are to understand how transduction works, since the Simondonian philosophy apparently requires that anything both be itself and be different from itself. Clearly, LEM (there is no third state between something and its negation), does not allow this. Nor, apparently, does LNC, i.e., that something cannot be both true and false at the same time.

We would like to note here that, while Simondon was correct in noting how his theorization of technology demanded a rethinking of classical logic, he felt that LEM should be dispensed with. Yet if it is possible to see his reservations as well-founded, we can modify some of his conclusions. At the time Simondon was writing, he only had the model of L.E.J. Brouwer's 'intuitionism,' dating from the 1920s, as the most rigorous formal attempt available to him to evade classical logic. Brouwer, disturbed by the results that were being generated by post-Cantorian transfinite set theory, noted that these results required the unrestricted application of LEM. For LEM underpins *reductio ad absurdum*: in the absence of a positive demonstration, one can

assume the negation of the proposition one wishes to prove in order to show that, if its negation results in a contradiction, then that proposition itself must be true.

Brouwer, who was expressly Kantian in his theory, applied a Kantian-type discrimination to formal mathematical logic: while LNC must hold universally (it is tantamount to what Kant would call an 'Idea' of Reason), LEM is rather a regularity observed in finite mathematics (what Kant might call a 'concept' of the Understanding).[10] Brouwer's own ingenious formulation of the issues was, on the one hand, '*the rejection of the thoughtless use of the logical principle of excluded middle*,' while, on the other, '*the identification of the principle of excluded middle with the principle of the solvability of every mathematical problem*' (Brouwer 1967, p. 401). As such, if the infinite 'exists,' it cannot be proven; any such proof must be able to be finitely and positively elaborated; therefore, the infinite parts company from mathematics as unwritable.

Paraconsistency, however, is a later development in formal logic, deriving from the work of the aforementioned da Costa and others. If paraconsistent logics seem to have first emerged in the 1960s, they have only taken off in a more public way decades later. This development enables us to reuptake Simondon in a form unimaginable to Simondon himself. Take, for example, a particular type of paraconsistent logic called *dialetheism*, as practised by Graham Priest among others, which is able to accommodate *true contradictions* without 'exploding', i.e., becoming trivial. According to dialetheism, true contradictions can and do exist in the world, not only in language or concepts, and dialetheism is capable of accommodating this (Priest 2006, pp. 52-3). We ourselves are routinely capable, especially when working with the digital, of extracting useful information from apparently contradictory sources. Juries are expected to extract useful information from contradictory witness accounts of the same event. Fictional characters both do and do not exist, as is true (or not true) of music, of colour, and of our ongoing interaction online, where we both do and do not exist. And those of us who live in Melbourne certainly consider its weather a true contradiction!

A transductive ontogenetic model implies paraconsistency in the world, so we must also accept that every 'thing' is dissimilar to 'itself', and is constantly evolving, including the concept of truth. This allows us to assert that we humans both discovered *and* invented the digital, and offers some clue as to why we didn't discover/in-

vent it at some previous time in history, since it seems reasonable to assume the potential was always there. But was it? Potential is a concept that can quickly become unworkable or trivial, especially when considered in the light of the digital.

Say we have a digital 'file' that we have explicitly prepared as an essay in a word processing document, but we open the file in a sound playing app. We have modulated that digital data into a sound in the world, and we cannot say that it is an essay. And yet, we can say that it is an essay, and everyone will know what we mean. Moreover, it would seem reasonable to say that the file had the potential to become an essay, except that the only proof we have of that potential is that it did *not* become an essay. Can we equally reasonably say that it had the potential to become an elephant because it did not become an elephant? Of course not, that would be ridiculous. Dialetheism attempts to formalise true contradictions without making everything true, and therefore may be useful in understanding the concept of potential in this sense. At the same time, we also restrain ourselves from a fully-fledged affirmation of dialetheism as practiced by Priest and others, primarily because it often presents itself as solving or resolving metaphysical problems by forever rediscovering the truth of their irresolvable contradictions. We, by contrast, emphasize that the irresolvability of aporias necessitates new ontological constructions.

Let us summarize. Taking up the Heideggerian thought of the poem as event but without the focus on the poem as such, with the Badiouan commitment to formalising ontology but without the commitment to classicism, along with the descriptions of individuation offered by Simondon and Stiegler, and, finally, the revelations of epistemic-breakage offered by new aporias in computation, we attempt to construct an ontology that exceeds the epistemic closures of the present. Our resultant ontological proposal can be schematized as a stack of three levels. The most basic is provided by LEM. LEM offers a pure principle of difference as such, difference prior to any content. At the next level, that revealed by the development of digital computing, we find that this introduces LNC as well, the Boolean logic that still governs all existing machinery. Third, we find the necessity of modulation of the restrictions that LEM and LNC require in the production of 'content.' Yet the necessity for modulation as a 'derivative' level opens up aporias that tie directly back to a situation that is 'pre'-contradiction: modulation exposes the radical in-stability of data as such.

In relation to digital ontology, it would appear that we are required to engage with a system which is in fact constituted by inconsistency. The irremediability of the digital can only be understood in these terms, and we submit that digital ontology means trying to understand that the digital literally enacts a form of paraconsistency, simultaneously constituting and being constituted by it. If paraconsistency can help us to think about the irremediality of the digital, we believe it opens a new issue: whether there is one minimal difference that underlies all the others (i.e., one pure, 'ultimate' binary) or an infinity of different differences, each a 'true contradiction'.

[1] As mentioned, there were at least three versions available of Floridi's work on the first page of our results (again, note we overlook potential variations here, not to mention the significance of these variations), and restrict ourselves here to the version printed in *Synthese*.

[2] Karen Barad's very influential work self-professedly seeks to produce a 'non-analogical' and non-representational account of 'agential realism' (the scare quotes are hers), 'an epistemological-ontological-ethical framework that provides an understanding of the role of human *and* nonhuman, material *and* discursive, and natural *and* cultural factors in scientific and other social-material practices,' p. 26. To do so, Barad offers tropes such as 'diffraction' and 'entanglement' in the service of her relational anti-dualistic processual thought. As she brilliantly puts it: 'Quantum field theory allows for something radically new in the history of Western physics: the transience of matter's existence. No longer suspended in eternity, matter is born, lives, and dies. But even more than that, there is a radical deconstruction of identity and of the equation of matter with essence in ways that transcend even the profound un/doings of (nonrelativistic) quantum mechanics' (Barad 2012 pp. 209-10). What is remarkable from our point of view is that Barad still takes an interpretation of the performativity of entangled relations as delivered by quantum theory as a guide to the *resolution* of 'unresolved foundational probelems' (Barad 2007, p. 248), according to her own *descriptive* meta-physics.

[3] Simondon speculated that quantum mechanics would reveal the pre-individual: "Below continuity and discontinuity, there is the quantic and the complementary metastable, the more-than-one, which is the true pre-individual" (quoted in A. Bardin 2015, p. 39).

[4] In various of his essays on technology, Heidegger returns to Aristotle's historically imporant theory of the 'four causes': material, efficient, formal, and final. Standard interpretations render the silver of the jug the material cause, the action of the maker the efficient cause, the shape of the jug as the formal cause, and the end for which the jug is made as its final cause. In his analyses, Heidegger always seeks to confront Aristotle in several senses, not least to give a different sense to his thought (indeed, Heidegger carefully nuances this standard account), e.g., 'what technology is, when represented as a means, discloses itself when we trace instrumentality back to fourfold causality' (Heidegger 1977, p. 6). For Heidegger, Aristotle recognizes that these four ways together bring something to appearance; something comparable takes place today under the planetary reign of technology, in which very different scientific operations conspire to bring things to appearance: regulating, securing, challenging, etc., which subtract final and formal causes (and perhaps also the efficient).

[5] In a somewhat passing critique of Heidegger on technology, Badiou remarks that it is not technology but *capitalism* that is globally dominant, and that the possibilities of/for technology is in fact limited by capitalism. This may be true, but it is worth adding: a) this doesn't quite get at Heidegger's point, which concerns the essence of technology as disclosure of Being; b) it shares with Heidegger the conviction that ontology is irreducible to any ontic requirement. See (Badiou,1999). Although this is not the appropriate moment to discuss the issue in any detail, we do also need to note the deleterious political commitments of Heidegger to Nazism, which, as many have argued, are in a deep way articulated with his thinking of technology. For a recent overview, see (Fuchs 2015).

[6] Actually, the problem is framed in terms of Turing machines, but for simplicity's sake we have called them ‘algorithms’. Strictly speaking, the P class describes problems for which a deterministic Turing machine can provide a solution in polynomial time, while the NP class describes problems for which a non-deterministic Turing machine can provide a solution in polynomial time.

[7] Attributed to (Cook 1972). Also described independently and simultaneously by Leonid Levin and now referred to as the Cook-Levin Theorem; formalised by Richard Karp the following year as P=NP? In 1989 a letter was discovered from Kurt Godel to John Von Neumann dated 1956, in which Godel suggests the problem.

[8] See Badiou, *Logics of Worlds*, p. 532.

[9] N. da Costa and D. Krause, ‘Physics, Inconsistency, and Quasi-Truth, I’, *Synthese* (2014) Vol. 191, Issue 13, pp 3041-3055

[10] We owe this brilliant summation of Brouwer’s method to John Cleary, personal communication.

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