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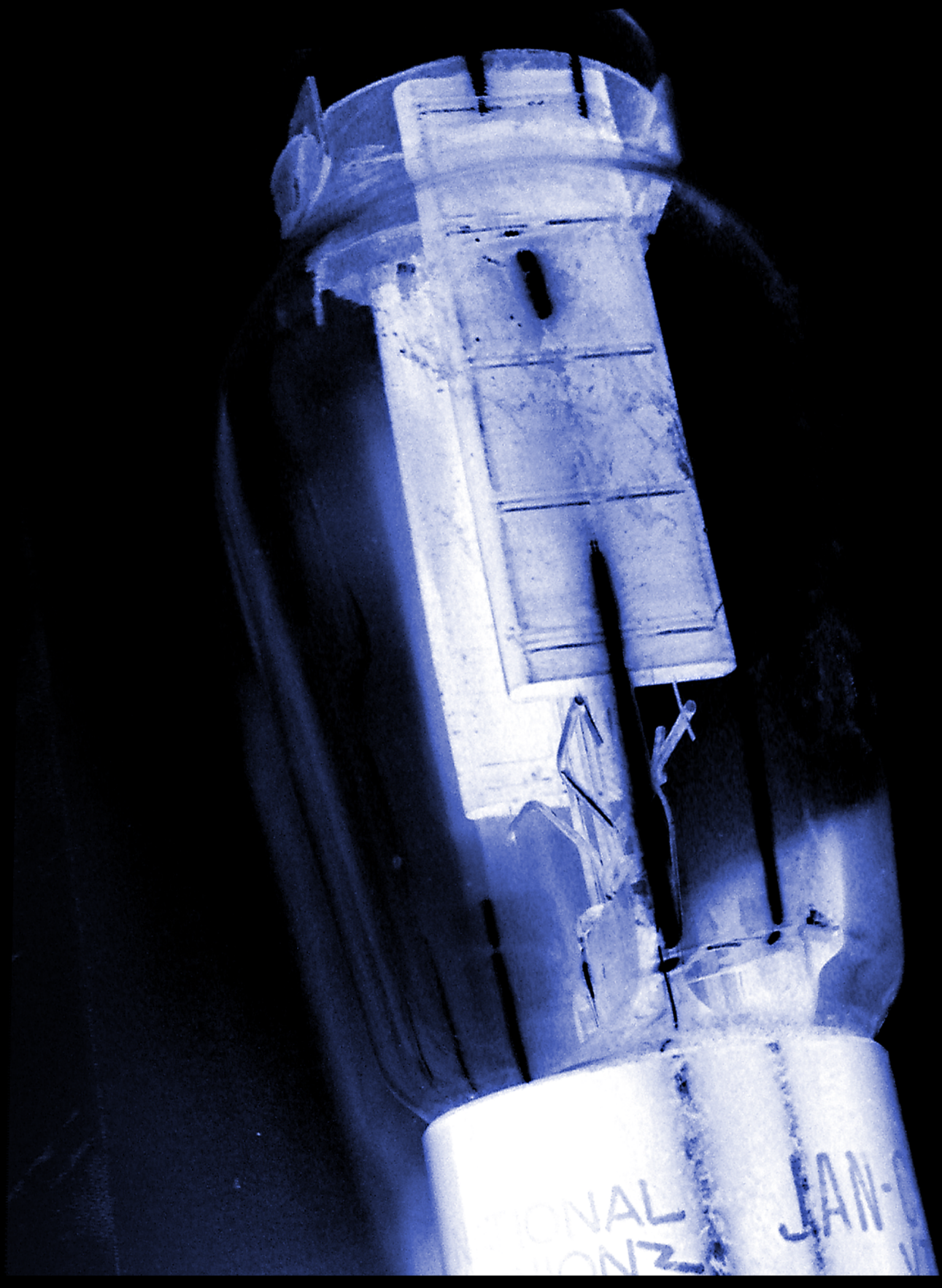

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Gilbert Simondon: Media and technics

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Platforms for the new: Simondon and media studies

Scott Wark and Thomas Sutherland

S.M.Wark@warwick.ac.uk thomas.sutherland@unimelb.edu.au

Since its inception, the mission of *Platform: Journal of Media and Communication* has been to provide graduate students and scholars in the early stages of their careers with an outlet for writing and research within the fields of media studies and communication studies. This issue of the journal is guided by these aims, but it also marks a departure from those that precede it. For us, the media gathered under the rubric of "new media" have lost the sheen and the novelty that justified this phrase's exceptionalism and consistency as an organizing framework. In our contemporary media situation, this sheen has faded to grey (Fuller and Goffrey, 2012). This begs the question: what are media today if these media are not – or are no longer – new? What meaning can this reference to the "new" have, at a time when the production of technological novelty is a constant? (see Wark 2013; Sutherland 2014). We think that this disseverment of media from the new generates a gap in media and communications studies, separating the latter from their working, vernacular conceptions of their eponymous terms.

Such a disjunction requires a range of responses: some that are empirical in nature and that investigate contemporary developments, and some that probe and reconfigure the critical and analytical leverage that present methodologies provide. But we also think that *Platform*'s commitment to emergent research in the fields of media and communications studies makes it the perfect (excuse the pun) platform for investigations that take neither *media* nor *communication* for granted as terms and as objects of research. A platform is a mediator, but it is also a *position*. Our argument obviously reflects the ongoing interests of us, its editors. In an idiosyncratic way, it reflects the wider interests of the broad group of emerging researchers – past and present – that circulate through and around the University of Melbourne's School of Culture and Communication. Most importantly, it makes manifest what we perceive to be a need for a journal that is committed to probing media and communication with the kind of focus and rigour that our contemporary media situation demands.

Of course, media and communications studies encompasses theoretically-inflected work that is, at its best, nuanced, incisive and revealing. But the theories that are put to use in media and communications studies don't always engage media – or processes of mediation – on their own terms. The fields of media and communications encroach upon numerous other disciplines that are organized around singular media (film), communicational processes (literature), or perceptual modes (visual studies). These intersections tempt media and communications research with serendipitous, readymade theories that are applicable to *some* of their areas, producing an often disjointed and critically unformed mélange of theoretical propositions, postulates, and presumptions (a veritable "theory soup").

If *Platform* is to concern itself with the new and the emergent, we take the position that this word, *new*, must signify the burgeoning corpus of theory that attempts to grapple in divergent manners the banal and often opaque media environment within which we reside. Through the medium of this special issue and others to come, we hope to inaugurate a shift in *Platform*'s emphasis: from a broad journal that is open to an array of focused approaches to media and communications studies to a journal that is focused on broad theoretical questions of what media and communication *are*. This is particularly crucial, we would contend, both in the wake of the new media rubric's passing and because a host of new – new materialist, realist, speculative, non-standard, media archaeological and object-oriented – theories have generated positions that hold great promise for media and communications studies today (Bennett, 2010; De Landa, 2006; Galloway et al., 2013; Parikka, 2012). Our aim is to create a node for research that reconfigures such material for the study of media and communication: by asking how media and communication studies can *use* theory, rather than assuming that it is a readymade toolbox awaiting its inevitable application to things in the world.

A special issue on the relation between the work of the French philosopher of technology, Gilbert Simondon, and the fields of media and communications studies constellates these issues. The question – "why an issue on Simondon?" – would elicit, we think, an obvious answer: because of his nuanced philosophical treatment of technology. But surely this answer is not enough in itself. Several journal issues and collections dedicated to Simondon's work have been released in English in the last half-decade or more in anticipation of the perpetually imminent and perpetually delayed arrival of his major works in English translation (Boucher and Harrop, 2012; De Boever et al., 2012; Hayward and Geoghegan, 2012; Gracieuse and Tissandier, 2012). These collections have been accompanied by a few major monographs translated from the French and at least one guide to one of his major works written and released in English (Chabot, 2013; Combes, 2013; Scott, 2014). For us, each of these collections and works has proven to be, on the whole, interesting, provocative, useful – and above all, tantalizing, in the true sense of the word. But they have also been inadequate, because they have yet to fully articulate the suggestive potential of Simondon's philosophy *for* media and communications studies.

We think that Simondon's work holds great promise precisely because of the relevance that his conception of technology holds for our engagement with processes that are *specific to* media and communications. His work seems able to guide research that asks questions about, for instance, what media and processes of mediation are; how network topologies or human-machine ecologies should be understood;[1] or how media and communication should be conceptualized in light of the recent resurgence of theories that engage with the materiality of the real (James, 2012). Simondon's philosophy, as the editors of one of the collections of and about his work notes, also comes equipped with a "fully fledged ontology" (De Boever et. al., 2012, p. vii) – in the sense, that is, that this ontology must be understood in "ontogenetic" terms (Barthélémy in Stiegler, 2009, footnote 2, page 14). His ontogenetic philosophy emphasizes relationality and the transformative force of invention: its assimilation into media and communications studies necessitates the transformation of the ontological predicates and assumptions that subtend theoretical work.

Simondon's philosophy draws some of its catalysing power from its wide-ranging approach to philosophy's raw material. As Joe Hughes (2014) notes in his recent, concise essay on books about Simondon – and, by proxy, Simondon's body of work – his philosophy "is a sophisticated assemblage of discourses which are often thought of as mutually exclusive", moving from fields such as "cybernetics and phenomenology" to "theories of identity and the social" to a "frank reconsideration of the spiritual". But at its base, as Graeme Kirkpatrick (2013, p. viii) argues, the power of Simondon's "thought" lies in how it "brings together a sophisticated theory of technology and an equally compelling account of human becoming". Its premise is a reconfiguration of how human *or* technical individuals are understood by arguing that major theories of how the individual comes to be are contradictory, because these theories understand the *becoming* of the individual, or its individuation, through the *already-constituted individual*: by positing a transcendental term that precedes the individual's becoming (Simondon, 1992).

For Simondon (2009b, p. 4), no principle can produce the process of individuation itself, because that principle would necessarily be of a different mode of being to the being whose individuation it describes; instead, we must "*know the individual through individuation*" – within an ontogenetic framework. Becoming occurs, for Simondon, because the individual supposes a "preindividual reality", a reality that precedes the individual's emergence and whose potentialities guarantee the individual's becoming.[2] Modelled on the pre-Socratic philosopher Anaximander's *apeiron* – that which is unlimited, indefinite, or undefined – this preindividual reality is, simply, what pre-exists individuation (Del Lucchese, p. 185). In

[1] Simondon's theories offer an alternative to Latour's theorisations of actor-networks, because they assert the integrity - or "metastability" - of relational networked individuals. See: Simondon, 1992; Latour, 1988, 1993. On ecologies, see e.g. Parikka, 2010.

[2] *Ibid.* 5. Thomas Lamarre argues that this preindividual reality is explicitly *not* a kind of "material determinism" but is, rather, an abstract means of grasping the "underlying energetics of concrete entities" (Lamarre, 2012, pp. 33-4). With Muriel Combes, Fillipo Del Lucchese argues that the concept of the "preindividual" is what distinguishes Simondon from Henri Bergson's vitalism, with which this point resonates: *contra* Bergson's concept of *elan vital*, Del Lucchese argues that Simondon recognizes "the possibility of fractures and, ultimately, of transformations within Being". (cont'd)

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Simondon's philosophy, the ontogenetic becoming of this individual is powered by what he calls the "disparity" between its pre individual *milieu* – or fields (Toscano, 2006, p. 265) – and itself. This becoming is motivated by its tensions with its environment and its relations to the collectives of which it is a part. So, Simondon's concept of the individual is relational and processual in a basic sense. The relation between the individual and their preindividual *milieu* that he sketches is particularly powerful for media and communications studies, because it is the element that he uses to relate technology to the human – and, thus, to its individuations.

Simondon deals with the "mode of being" of technology in an earlier work (Simondon, 1980), to develop a conception of technology as what Bernard Stiegler (1998, p. 85) calls "organized inorganic matter". For Simondon (1980), the technical being is not a hybrid of the human and inorganic matter, but rather manifests a specific "mode of existence" proper to it and it alone. This mode emerges in the moment that the technical being makes the immanent, materially conditioned leap from inactive collection of parts to active technical individual (Simondon, 1980; see also Massumi, 2009). Simondon (1980, p. 62) develops a concept of the self-defining unity of technical entities by identifying what he calls an "associated milieu" in his treatment of their mode of existence. For Simondon (1980, p. 67), the technical entity is marked off from the "utensil or tool", and gains its internal consistency, because of its relation to its immediate environment. The technical individual's associated *milieu* is thus its "condition of existence"; without it, this individual is simply not "viable" and cannot be said to have been "invented", or to have crossed the threshold from non-functioning to functioning (Simondon, 1980, p. 67).

This discussion does not quite take place in the same register as that concerning human individuals. Humans individuate, but technical objects "concretize": they belong to a technical lineage that they instantiate and that they tend to perfect asymptotically, because they are beholden to logics that are specific to their mode of being (Simondon, 1980, pp. 62-67). But his conception of the becoming of individuals and technical objects respectively provides us with the framework for thinking each of these processes individually – and for thinking their imbrication. Both Marie Combes and Stiegler, in slightly different ways, argue that the technical becomes a *real* element of the preindividual *milieu* that conditions and shapes collective human becoming: Combes (2013, p. 68) by arguing that the technical has come to be articulated as a *network* that conditions human becoming, and Stiegler (2009; 2014) by arguing that technical objects are memory supports, or what he calls "tertiary retentions", that come to constitute the preindividual *milieu* for humans that are, originally, inscribed by technology.

The articles collected within reflect the broad interests that Simondon's writing betrays, swerving between topics, positions and scales, varying from technical instances and television shows to networks, Big Data, and financial markets – and even alchemical practice. Through these articles, we can see how Simondon's work can be brought in to relation with other philosophers with contemporary purchase, like Alfred North Whitehead, François Laruelle, or Gilles Deleuze. Not all of these articles praise Simondon's approach: as some of his critics and some of the articles in this issue note, Simondon's major flaw lies in his politics of technology, and its treatment – or lack thereof – of questions of capital and labour (Hughes, 2014; Toscano, 2012). But the articles that critique his politics also try to work though this problem by finding a solution either immanently, in his philosophy, or by drawing on other material. With this issue, we hope to demonstrate that Simondon's thinking of technology's mode of being, and the suggestive way that his thought can be used to engage with the imbrications between human collectives and network *milieus,* can generate new, thoughtful engagements with media and communication. For Simondon (2009b, p. 8), the "individual" is never a hypostatization, but is, rather, a mediate *resolution* in a process of becoming that is motivated by tensions and inseparable from its relations. So to answer the question – "why an issue on Simondon?" – we might say: because Simondon's philosophy is also, implicitly, a philosophy of mediation. Whilst the articles in this issue are varied in their objects of study, each of them

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As Del Lucchese also points out Simondon can only do this by recourse to a kind of transcendence, meaning that we must think Simondon "beyond Simondon" if we are to re-deploy his concepts today (Del Lucchese, 2009, p. 184). Alberto Toscano provides us with one way of doing this, however, by arguing that this pre-individual reality should be seen not as a continuum, or *apeiron*, but as a series of "pre-individual fields" that must be considered in *real* terms (Toscano, 2006, p. 264). This approach makes sense in the context of contemporary technology's role as the preindividual.

necessarily incorporates some aspect of Simondon's philosophy into their theoretical approach – and necessarily questions, reconfigures, or critiques some aspect of how media and communication are understood.

Jon Hackett's article on Simondon's potential contribution to debates around the invention of early cinema demonstrates how Simondon's nuanced consideration of the being of technology can contribute to the study of a specific media technology, whilst reflecting the broad swathe of interests that can be found in Simondon's philosophy. Using the recent integration of Simondonian concepts into debates around early cinema as his point of departure, Hackett uses a journey back through formative debates between "idealist" and "materialist" cinema studies scholars to both situate a Simondonian approach and to tease out its implications. As Hackett notes, Simondon's philosophy approach offers a contrasting, ontogenetic approach to the technical cinematic object that takes its becoming as a point of departure. As Hackett demonstrates, Simondon's notion of "transduction" provides us with a way to explain how a medium like cinema might operate as a "method of thought". Yet by comparing Simondon's technical approach to Marx's, which emphasizes the primacy of labour to technical development, Hackett's analysis identifies what he calls "the most contentious" aspect of Simondon's peculiar conception of the technical: the latent "utopianism" of its vision of a technical society, which chimes with Toscano's and Hughes' reservations about Simondon's lack of engagement with capitalist processes (Hughes, 2014; Toscano, 2012). But Hackett makes a slight departure from the strong criticisms that these scholars draw from this problem. In Simondon's picture of such a society, Hackett detects a way of imagining how a post-capitalist future – a future that Marx did little to sketch – might be.

If Hackett's discussion of Simondon's politics works *from* a specific technical object *to* what he and others identify as its major weakness, its lack of engagement with capitalism, Laura Lotti's article plunges straight in to its problematic lack of engagement with the "socioeconomic conditions" that afford technical development. Like Hackett, Lotti is able to extract something productive – and ambitious – out of Simondon's normative conception of technology: not just an image of a post-capitalist future, but a proposal that the political economic theory of value can be grounded in transduction and invention. In response to the increasing technical financialization of capitalist economies, Lotti combines a reading of Simondon with an inventive engagement with the work of François Laruelle to place the inhuman at the heart of political economic processes. Gesturing towards algorithmic modes of circulation, like Bitcoin, her startling and compelling conclusion is that "a close reading of Simondon's theory offers transindividuation as a form of radical xenocommunication, a mode of communication that always already implies an alien component". For Diego Viana, Simondon's relevance for analyses of digital technologies – encompassing what Viana calls algorithms, gadgets and the internet – is so strong that it is almost as though his theory had been, until now, "waiting for its time". Viana draws on Simondon to describe the contemporary, networked world as a series of conjoined, "reticulated" clusters of natural, technical and human. Viana argues that it is through and within these clusters that digital convergence occurs – and the contemporary individual is transduced as s/he is *aff*ected by algorithmic, and other, technical processes that co-opt the human to the technical as material. In this situation, Viana concludes, it is incumbent upon us to try to determine how an individual might find agency within massively distributed networks.

Melanie Swan's article in this special issue uses a thorough engagement with Simondon's philosophy to rethink the relation between distributed networks, which she calls "Contemporary Media Environments", and individual and collective development, or individuation. Swan's article begins with the notion that the ubiquity of our media environments and their increasing imbrication with all facets of our lives increasingly positions technology as the human's "other". But rather than seeing this relation as negative, Swan abjures the critical-theoretical perspective and, drawing on Simondon's notion of individuation, argues that the increased exposure to incompatibilities between subjects through network "multiplicities" is a positive force. Her article argues that the "alterity" of the technical "provides a new means for humans to see themselves via exteriority" by exposing them – and their collectives – to moments of subjective anxiety. Swan uses Simondonian concepts to argue that technology's contemporary manifestations are not deleterious, or "infantilizing", but that the disparations they generate have the potential to invent new modes of individuation.

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Simon Mills' article demonstrates the critical leverage that Simondon's philosophy might provide media studies by focusing on a key, if often under appreciated, facet of his thought, the modified concept of information that permeates his work. Mills uses this concept to criticize two informational approaches to modelling and managing the world that rely heavily on cybernetics: the contemporary "social physics" application of Big Data exemplified by the work of Alex Pentland and the "Viable Systems Model" developed by Stafford Beer, which both use information as the basis for models of the world. For Mills, the cyberneticist approach that Pentland and Beer take is amenable to critique because it fails to take in to account problems like the complexity and openness that would otherwise drive the systems it describes or these systems' links to their natural environments; the distinction Simondon makes between secondary, or quantitative, information as opposed to primary information, which emerges with the resolution of a phase of individuation; or the limited applicability of analogy to social phenomena. Mills uses this critical gloss of Simondon's concepts to conclude his article by posing the critical question: "instead of touting Big Data as a means to regulate social homeostasis", how might Big Data "construct new orientations of social development?"

In Glen Fuller's hands, Simondon's theories of individuation and the metastable provide the means, as part of a deftly woven tapestry of other theory, for thinking through questions of value in contemporary pop culture by using *True Detective* as its lens. For Fuller, this show is not a text that is amenable to hermeneutic criticism, but an assemblage that inaugurates a "post-broadcast media event". To engage with this show, he argues, we have to probe the questions of value that arise transversally as this event unfolds. To do so, Fuller proposes a "minor aesthetic category" in the mode of Sianne Ngai's work (Ngai, 2012), the "meta", to encapsulate less its referentiality than the evental aesthetics that emerge both as the show proceeds and that transect the show through its extension into other media. Simondon's concept of "metastability" is crucial here: Fuller uses this notion to grasp the evolving and inventive states that evental experience passes through. Fuller uses the category of the "meta", finally, to analyse *True Dectective* through a nihilist lens: by using nihilism to narrate the "analogical relation" of the "detective work" carried out by both *True Detective* and its audiences. Through the "meta" and its nihilistic instantiation in *True Detective*, we can see how a show "dramatises the value of cultural value" – presenting its audience with the potentiality of a transvaluation.

In a later essay, Simondon introduces a concept that brings his work on the technical and on individuation into a new relation: what he calls the "technical mentality". He describes this as a "cognitive schema" that "founds itself on the discovery of common modes of functioning--or of regime of operation--in otherwise different orders of reality that are chosen just as well from the living or the inert as from the human or the non-human" (Simondon, 2009a, p. 17). But as he also notes, this mentality has yet to fully emerge in the time that he was writing. Whilst modes of what he calls "transcategorial" knowledge had led to the production of technical objects like the oft-cited example of the GUIMBAL turbine (Simondon, 2009a, p. 19), – one of the two examples (as well as planar transistors in contemporary information and communication technologies) that Andrew Iliadis uses in his contribution to the issue, illustrating the concept of concretization as it is developed in Simondon's body of work – we have yet to extend the kind of *affective* generosity to technology that would allow more orders of reality to conjoin. Tyler Fox's essay uses this deficiency as his essay's productive point of departure. As Fox notes, Simondon also claimed that an "extend[ed]" technical mentality "begins to manifest itself in the domain of the fine arts in particular" (Simondon, 2009a, p. 13). This cue leads Fox into a consideration of technical aisthēsis – alongside media arts examples, but also by using Alfred North Whitehead's processual philosophy to extend a Simondonian conception of sensation. Fox argues that the work he analyses, *Biopoesis,* provides is with a compelling, non-computational example of a complex system that produces aesthetic effects. In this work, we come to see how the materiality of technical objects is central to how *they* produce sensation *for* us —and, we see how this work and others like it "may even extend our sensorial register into new domains".

If this issue of *Platform* constitutes a platform for a series of essays on the relation between Simondon and media and communications studies, the novelty of this newly rediscovered work for Anglophone readers also generates another, suitably inventive effect: the confrontation between Simondon's suite of concepts and media and communication's reconfiguration of these fields. It is only fitting, then, that this

collection should end at the scene of a kind of origination or beginning: with Dan Mellamphy's characteristically aberrant explication of the influence of, and similarities between, what Isabelle Stengers calls the "ancient aesthetic of alchemy" – which is also known as transmutation – and Simondon's concept of transduction. Mellamphy notes that a little-emphasized feature of Simondon's theory of technology is its extensive treatment of magic. With this frame in mind, Mellamphy's point of departure in this essay is our discipline's admittedly unspecific but nevertheless central term, *mediation*, and the corollary conceit that alchemy might be mediation's originary source. Like technology (as conventionally understood), alchemy "conceptually conjoins and technically entwines what would otherwise be distinguished as the "natural" and the "artificial"" – and also, more strikingly, "the living and the nonliving". With this in mind, the seemingly-arbitrary relation that Mellamphy makes between alchemy and mediation creates an *allagmatic* moment of exchange that transmutates both: alchemy, as a mode of carrying forward, becoming mediation; and technical media, as an artificial construct, being exposed as a mode of *cunning trickery*. His prestidigitatory routine concludes by arguing both that a massively distributed apparatus, like Google, might display a "cunning *world-wide-web*-weaving" craftiness – and that if this is the case, "'alchemical operations' would incontestably be 'machinic technics'".

For Simondon, knowledge is not distinct from the processes in which it is caught. Something like *theory*, he argues, can only emerge *transductively*, through an individuation or as individuation. This provides us with a model of theorization that connects its theories, which are still pejoratively held to be non-worldly abstractions, to the processes that it theorizes. Or, that sees theories themselves as composites of the real that do not *necessarily* have effects, but are always the residue of a real practice of theorization. In this sense, the "new media" rubric was the residue of a particular practice of engaging with media and communications, whilst theory – in the sense that we want to explore in *Platform* – is always *in* and *of* mediation. A platform is always the platform for the circulation of theory as that which has real effects as a real element in the world. For us, grappling with media and communication theory doesn't occur in the mode of reflection – *theōria* – but as a kind of practice that works with and through the media that determine our contemporary situation. If *Platform* is a platform for the new, this new can unashamedly incorporate theory – as, itself, one mediator amongst many.

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The ontogenesis of cinematic objects: Simondon, Marx, and the invention of cinema

Jon Hackett – St Mary's University
jon.hackett@stmarys.ac.uk

The ideas of Gilbert Simondon have recently surfaced in debates on cinema and its development in modernity. Pasi Väliaho (2013) has considered early cinema in terms of individuation and affectivity; Thomas Lamarre (2011) has considered the magic lantern as technical object and "dark precursor" of animation; Bernard Stiegler (2010) has considered cinema as a "mnemotechnical object". This paper will evaluate the contribution of Simondon's ideas on technical objects and on individuation as a model or paradigm for the development of early cinema, while questioning the primacy in Simondon's analysis of the demands of technicity over economic questions. Such analyses in fact return us to the canonical work of André Bazin (1967) on the ontology of the cinematic image and the dream of pure cinema. Earlier "materialist" analyses of early cinema from a Marxist perspective criticised Bazin's "idealist" account of age-old fantasies of moving images finally realised thanks to the development of available technologies, proposing instead that economic factors were more likely to account for the development of new machines and technologies – and thus of the cinematic apparatus, film and consequent entertainment industry. The question considered in this paper is where an interpretation of early cinema as technical object, emerging via a process of individuation, sits in relation to these earlier debates. This will be considered particularly in relation to Simondon's Du mode d'existence des objets techniques *(1958). Does Simondon's analysis expose the earlier materialist/idealist boundary as ill-founded? How do his concepts illuminate the development of early cinema in relation to ideas on invention, technology, culture and machines? Does a conception of the birth of cinema as individuation complicate or obfuscate questions about labour and machines familiar from Marxist analysis?*

Though Gilbert Simondon's work is only recently finding a wider Anglophone readership, we might characterise two of the prime attractions of his work for contemporary film and media studies as first, a series of ontological or metaphysical conceptions that allow for analysis of a wide range of objects and that overcome traditional oppositions between nature and culture; and second, an explicit concern with aspects of communication, information and technology that anticipate more recent media theory by some decades.

The focus of this article is on the latter aspect of Simondon's work, especially on his account of invention and the ontogenesis of technical objects. Specifically I will consider the invention of cinema itself through the lens of Simondon's conceptions, considering whether his work allows us to overcome oppositions between "idealist" and "materialist" accounts of the origins of cinema. The discussion will necessarily be general and in some cases provisional due to the scope of the article – but then many of the canonical discussions of this question in the literature make very broad claims about the genesis of cinema, from at least André Bazin onwards. To render the discussion manageable, the focus will be on the very early days of cinema – though there would obviously be much to say about subsequent developments in moving image technology in relation to Simondon.

I will consider the following questions in particular, without proposing to answer them definitively. First, whether it is the creative imagination of human beings, which is responsible for the invention of cinema. Second, whether developments in early cinema can be seen, in Simondon's terms, as a rational process of autonomy and concretion – or one of "hypertely", an exaggerated specialisation that is a temporary stage of the moving image of limited potential for evolution. And third, whether the relation of the machine, and technical objects, to human alienation in labour, has any bearing on the consideration of cinema as technical object. The latter two questions, in particular, will bring the analyses of Simondon in relation to Marxist debates on the origins of cinema.

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The invention of cinema

Cinema is notable for its dependence on innovations in various fields, from optics to electricity, from the chemistry of plastics to the development of photography. I will not recap the developments of these fields here but, as Leo Enticknap (on whose account of cinema's technical history I draw extensively in this article) summarises:

> by 1889 the three essential ingredients of the first mass-produced form of moving image technology were in place: the ability to induce the perception of continuous movement effect mechanically, photographic emulsions which were fast enough to produce the images needed for these devices and a strong, flexible and transparent film base to support them on (Enticknap, 2005, p. 10).

By 1895 these images were finally being projected, by the Lumières in France and by Edison in the United States.

André Bazin provides one of the canonical considerations of the invention of cinema in his widely known essay, "The Myth of Total Cinema" (1967). Bazin's focus in the essay is not historical considerations of primacy or technical innovation so much as the relationship between imagination and invention on the one hand, and the economic and technological development of cinema on the other. The starting point for his reflections is the first volume of *Histoire générale du cinéma* by Georges Sadoul. Bazin admires the book for what he discerns as "a reversal, in spite of the author's Marxist views between an economic and technical evolution and the imagination of those carrying on the search" (Bazin, 1967, p. 17). For Bazin, it is as if despite himself, Sadoul is forced to recognise the causal primacy of age-old fantasies of moving pictures, and more recently a nineteenth-century craze for realism, over economic and technological factors, which lag behind.

Bazin goes on to characterise the cinema therefore as an "idealistic phenomenon", which "owes virtually nothing to the scientific spirit".[1] Obviously developments in science, technology and industry facilitate the development of cinema, but as with nineteenth-century visual culture generally, there is underlying its genesis "an integral realism, a recreation of the world in its own image, an image unburdened by the freedom of interpretation of the artist or the irreversibility of time" (Bazin, 1967, p. 21).

On the one hand, myths of moving pictures appear to Bazin to provide a timeless motive for the various nineteenth-century (and earlier) forms. On the other, a specific nineteenth-century concern for realism (as opposed to the illusionism of earlier *trompe l'oeil*) increasingly motivates the quest for cinematic images – and this accounts for the medium's genesis rather than scientific and technical innovation themselves. This emphasis on realism is clearly consonant with Bazin's film aesthetics in his other articles, where the long takes and deep focus of Gregg Toland's cinematography for Orson Welles and William Wyler, as well as the strategies of Italian Neorealism, are all said to privilege the depiction of "reality" on screen. The development of cinematic technologies of, for example, sound and colour in fact brings film ever nearer to its origins: "In short, cinema has not yet been invented!" (Bazin, 1967, p. 21).

Evidently this idealist version of the invention of moving pictures has been criticised in more recent decades. Though not responding to Bazin, an account by A.R. Fulton from 1960 argues "The ingenuity and effort, not of artists, but of inventors, mechanics, photographers, engineers, and manufacturers, made the machine possible" (Fulton, 1976, p. 32). Primacy of material determinants is also a feature of Marxist-inflected theorising of the cinematic apparatus in the 1970s on (many relevant articles are collected in Rosen 1986 and De Lauretis and Heath 1980). In historicist accounts such as Michael Chanan's, economic factors play a "determinate (but not determining) role" (Chanan, 1996, p. 11); in much apparatus theory, the separation of technology and image, apparatus and representation itself is called into question, in the positing of cinema as apparatus or *dispositif* (Comolli, 1980).

The virtues of these latter, materialist accounts of the invention of cinema are still considerable and do not consist simply of a "vulgar" Marxist reduction of film, *qua* superstructure, to the economic base. In the work of Jean-Louis Baudry, Jean-Louis Comolli and others, the separation of representation and substrate is challenged through the notion of the apparatus, which at its broadest includes the spectator posi-

[1] Although this statement may claim indulgence for oversimplification from its mode of presentation, its essayistic form.

tioned through the address of the screen. However, these models have been criticised for their monolithic positing of cinema as a system "suturing" the spectator into a remorselessly ideological set-up, something which has been questioned by more recent attention to audiences informed by ethnographic and empirical studies. Baudry's own appeal to Plato's allegory of the cave (in Rosen, 1986) implies a timeless model of moving pictures that although most thought-provoking, might be said to neglect the mechanisms through which such systems emerge and become.

In this light, the attractions of Simondon's analyses for a consideration of the emergence of cinema are numerous. One of the most notable features of Simondon's work is its priority of ontogenesis over stasis, the processes through which individuals *become* rather than their existence as objects conceived as static or reified. Moreover, ontogenesis and individuation, by which things organic and inorganic become, extend to chemical, organic, psychic, technical and collective entities – thus incorporating all of the aspects we might conceive of as contributing to the development of cinema.

In *L'Individu et sa genèse physio-biologique* (1964), individuation as such is the key concern in the ontogenesis of chemical and biological entities. In *Du mode d'existence des objets techniques* (1958, henceforth *MEOT*) the focus is on technical objects and their becoming. Thomas Lamarre sees Simondon's concept of technical objects in terms of "specific modes of existence of technological devices or apparatuses without positing a substantialist or metaphysical distinction between technical objects (mechanism) and natural objects (organism)" (Lamarre, 2011, p. 128).

Ontogenesis of technical objects

Some of the broad features of Simondon's analysis of technical objects will therefore be considered here. The second page of the introduction of *MEOT* defines the technical object as, simply, "something that has a genesis" (Simondon, 2007, pp. 6-7). The object does not exist prior to its becoming but is present at each stage of this becoming; it is united from the inside through a "principle of internal resonance". Simondon's concern early in the book is to outline how this genesis occurs, moving from an abstract unity of separate elements to an ever more concrete, internally resonant system.

There are two ways in which improvement of technical objects may occur. The first is a "minor" improvement, which essentially compensates for undesired consequences of an existing object or technology. The second is a "major" one, which changes the functioning of the object by essentially boosting the synergy of its various functions (Simondon, 2007, p. 19). In this way, a minor invention can prevent a major one, through compensating for essential drawbacks or weaknesses through artifice.

Minor invention can thus proceed according to "hypertely", an increasing specialisation that risks a sterility that would preclude further genesis. One type of hypertely is an *adaptation* of the technical object without a loss of integrity or autonomy; the other form involves its *fragmentation*, "as in the case of the division of a single original being into towing unit and unit towed" (Simondon, 2007, pp. 27-28). Here Simondon gives the example of a glider as a hypertelic technical object that has fragmented. A glider has obviously lost autonomy in its inability to take off and propel itself. A further "mixed" example is where a technical object is adapted to its milieu, such that the object requires a particular type of environment in which to function. Simondon illustrates this with clocks synchronised with different frequencies of mains electricity – which would not work outside their country of origin.

The more promising case is when evolution moves in the direction of autonomy and concretisation (Simondon, 2007, p. 29). This is where the genesis of the technical object conditions its milieu instead of vice versa as above. Simondon's informative example here, one which he returns to frequently, is the Guimbal turbine, in which the generator powering the turbine is for the first time introduced into the pressure pipeline. Formerly size precluded its insertion but now, through a casing of oil around the generator, the mutual action of the oil and the water in the turbine permit, through improved cooling, the inclusion of a smaller generator.

Simondon's (2007, p. 30) point is that the functions of the oil and the water in Guimbal's turbine are "overdetermined", aside from their prime functions of insulation and powering the turbine, these fluids permit improved cooling, which allows for a more autonomous and less unwieldy generator: "The water becomes multifunctional: it supplies the energy that activates the turbine and the generator, and it evacuates heat produced by the generator; the oil is also remarkably multifunctional: it lubricates the generator,

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isolates the coil, conducts heat from coil to crankcase, from which it is evacuated by the water" while preventing water from entering the casing due to the oil's higher pressure. In short, the use of oil in the casing proves to be far from arbitrary – not only insulation, but also increased cooling and efficiency issue from its introduction and its fruitful synergy with the action of the water in the turbine itself.

Simondon (2007, p. 30) utilises this example to illustrate "adaptation-concretisation" whereby "it is in fact thanks to the new conditions created by the concretisation that this concretisation is possible". In our example above, the versatility or multi-functionality of the oil and water stem from the introduction of the oil as a way to insulate the coil from the turbine. The point is that this happens all in one go, rather than as a gradual introduction of compensatory elements. As such, this is a model of concretisation: the self-conditioning of the technical object.

Ontogenesis of cinematic objects

It seems difficult to sustain Bazin's assertion that cinema "owes virtually nothing to the scientific spirit". When we consider cinematic exhibition, for instance, we note immediately that "many early motion picture projectors were supplied in the form of mechanisms which used the same light source as a magic lantern, thus enabling exhibitors to use both still and moving images interchangeably" (Enticknap, 2005, p. 11). It is also well documented that many early innovations were motivated by studies of motion and of the persistence of vision. Cinema develops from earlier visual cultures and science, adapting in some cases existing technologies and certainly utilising novel ones when they facilitate its development.

It is commonplace to observe in relation to early cinema that many of the innovators of pre-cinematic moving images were lone individuals: dilettantes and gentlemen inventors. In many cases they were motivated by scientific or technical interests rather than envisioning cinema as a mass entertainment (Edison is usually seen in the latter terms – though considering the appeal of cinema as ephemeral). In this respect they embody what Simondon in his 1968-1969 seminar advances about the typical inventor of the nineteenth century, as being independent of the material networks which supported earlier forms of labour but constrained them in space and time, working instead on small-scale models "at the disposal of their means of operation as well as their mental equipment" (Simondon, 2005, p. 76). The nineteenth-century inventor synthesises, alone, available sciences and technologies in order to form new machines, conceived of deductively. In terms of early cinema we can think of Eadweard Muybridge's adaptation of the magic lantern projector for animal motion studies or Étienne-Jules Marey's photographic "gun", capable of taking 12 pictures serially in a second, as obvious examples of such a process. Obviously these scientific and technical interests needed investment – sponsors or personal fortunes – and were themselves dependent on the economic networks of existing industries.

Most histories of the birth of cinema are then written in terms of lone individuals, be they scientists or engineers, or perhaps magicians and stage performers, innovating and improvising from a wide range of motives. There then follows, usually with Edison as the indicative figure, the attempt to standardise and slap a patent on the technology in order to profit from it. Enticknap (2005, p. 16) summarises as follows: "a pattern emerges whereby a significant technological advance ... tends to happen in two stages: the research and development which makes the process technically viable, and the changes to economic and industrial practice which enables its widespread commercial use".

In terms of Simondon's analysis of the genesis of technical objects, the dependence, or otherwise, of technical invention on purely economic motives is not the focus – some might see this as in fact a lacuna in his work although it is true that he acknowledges contemporary motives of efficiency and utility in production as not true to the essence of technics. In any case, in early cinema historiography, the motives for its invention are not usually taken to be initially those of developing a mass entertainment industry – even Edison, the most commercially minded and litigious of its inventors saw the form as a diversion that audiences would soon outgrow, albeit one that promised profit in the short to mid term. Were the focus of this article on later innovations in cinema in the era of standardisation, say, the introduction of sound or colour technologies, the industrial and commercial pressures from an established mass entertainment industry would certainly be more immediately visible as determinants.

Whatever our verdict on these questions, in terms of the development of cinema, in order to consider the pertinence of Simondon's ideas on major and minor inventions, we can consider the introduction of

certain elements to cameras and projectors, which were crucial in the production of moving images, as to whether they embody the processes of adaptation-concretisation and hypertely outlined in the previous section. A couple of examples must suffice here.

One such element introduced into both camera and projector was the intermittent device, necessary to move the film, during shooting and projection in a non-continuous, regular manner. Put simply, if 16 frames per second was standard in the silent era of cinema (although this risks exaggerating the standardisation of cinema early on) then the film has to be moved on 16 times a second, then kept still after each of these movements for the exposure (in addition, the shutter has to be open for the exposure but closed while the film is moved on, to avoid the film developing while being wound on). The same is true for projection – the individual frames must be lit from behind, then unlit while the film moves on, then projected once more. In order to facilitate each of these processes, an intermittent device is required for the discrete movement of the film through camera and projector. A continuous movement of the film through a viewing device was acceptable for Edison's kinetoscope peepshow, but not on screen in front of an audience, where the image was too blurred unless each frame was kept in place during projection.

The intermittent devices used were variants of claw-and-cam devices and Maltese crosses. The first were familiar from industrialised sewing machines, allowing a strip of material to be advanced bit by bit before insertion of needle and thread (the movie camera–sewing machine analogy is featured in a montage sequence of Dziga Vertov's *Man with a Movie Camera*, 1929). The Maltese cross device "in essence converts the continuous drive from a cranking handle or motor into the intermittent movement of a shaft with a sprocket at one end, which engages the film's perforations" (Enticknap, 2005, p. 135). This gizmo replaced claw-and-cam devices by the early twentieth century in projectors since it was gentler to film stock as well as being extremely accurate in its motion.

Another element was the Latham loop (named after Woodville Latham) introduced to Thomas Armat's Vitascope projector after its invention in 1896. The loop "was a length of film positioned between the continuously moving sprockets which transported the film through the mechanism, and the gate in which it was intermittently held stationary" (Enticknap, 2005, p. 135). The devices inserted above and below the gate served as a shock absorber and are retained to present-day analog projectors.

We may ask then whether the introduction of the Latham loop and Maltese crosses constitute adaptation-concretisation or hypertely. And further, what would constitute evidence either way? Here we would have to consider whether these elements (which in Simondon's conceptions are component elements that are not "individuals" themselves) enhance the self-regulation and autonomy of the system and whether they do this through increasing the autonomy of the system or merely counteracting deficiencies inherent in the machine. The Latham Loop seems more straightforwardly to be an instance of minor invention: a device that serves to absorb shock inherent in celluloid as a material, without any other organic function. This is an adaptation that serves to compensate for a deficiency in celluloid itself as a medium for carrying photographic images.

In the case of an intermittent devices such as the Maltese cross, its purpose is so crucial to the projection of still images in a sequence to enable projection that it seems rather to inaugurate the possibility of projected moving pictures, and therefore to be an instance of major invention. As a case of adaptation-concretisation, we might argue that the incorporation of an intermittent device conditioned a new milieu of early cinema exhibition and spectatorship. It might take an expert in the technology of cinema to provide more reliable verdicts on which additions to the apparatus were merely compensatory, and which were undoubtedly "major" inventions in Simondon's sense!

Though after the period under consideration here, this also raises the question as to whether television and digital cinema, and so on, represent major inventions in the same "lineage" as cinema or whether they constitute entirely new technical objects. Simondon in *MEOT* writes: "The beginning of a lineage of technical objects is marked by a synthetic act of invention that is basic to a *technical essence*" (Simondon, 2007, p. 22). A lineage is marked by a stable essence, but productive of supplementary concretisations in its functioning. This is because after a given process of individuation, there remain pre-individual potentialities in the system making up the individual and its milieu. The question would be whether these more recent media share the essence of cinema or represent a new essence altogether. Is the "technical essence" of cinema moving pictures – or moving pictures through projected roll film? Perhaps we will come to see

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celluloid roll film as a type of hypertely – a dead end for moving pictures that required a new lineage of digital technologies to replace it.

In the case of a given lineage of technical objects, for Simondon, adaptation-concretisation involves a close relation to an "associated milieu" (Simondon, 2007, p. 31). This associated milieu exists only virtually before the invention; nonetheless, the invention realises or actualises this "techno-geographic" milieu as its own condition of possibility. "Invention", Simondon (2007, p. 33 translation modified) claims, "is a taking charge of the system of actuality by the system of virtualities". He draws a parallel here between individuation in the living being with its associated milieu – and creative invention of technical objects, in which once again a process of individuation is anterior to the creation of being and its milieu.

Furthermore, for technical objects, this associated milieu is possible only through human intelligence. This is where Simondon (2007, p. 32) gives an account of a necessary "creative imagination", a "conditioning of the present by the future" which creates the associated milieu and technical object by anticipation. In this priority of creative imagination anticipating the object, we can see here a potential rapprochement between Simondon's conceptions and Bazin's myth of total cinema – though what separates them is the closer intrication in Simondon's thought between the material genesis of technical objects and invention itself. Indeed, neither is conceivable without the other for Simondon. For Jean-Yves Chateau, Simondon's account is irreducibly material, indeed technological – and conceptions of invention call for "a psychology of reflection and of intelligence, which considers technical reality as a true invention, as the resolution of a specifically technical problem" (in Simondon, 2005, p. 51). We might say that Bazin's conceptions of moving pictures are more in line with what Simondon describes as "creativity" instead of "invention", the former being a less determinate, rather more unfocused process than the latter.

The emphasis in Simondon's account of the associated milieu seems to accord well with the emphasis of many accounts of early cinema on the wider technological and cultural context. Indeed, we would have to talk of associated milieux since these would bring in existing popular entertainments such as magic lantern shows, panoramas and dioramas, and optical toys; technical invention both by passionate amateurs (such as William Friese-Greene), sponsored polymaths (such as Muybridge) and financially motivated entrepreneur-inventors (such as Edison); as well as nineteenth century visual culture, especially urban, in the widest general terms.

As cinema proceeded from Edison's kinetoscope parlour, this associated milieu would come to include production facilities such as Edison's Black Maria Studio (Fulton, 1976, p. 25) and Méliès's purpose-built studio; distribution networks both of film and apparatus; exhibition venues; and just as widely, the development of spectatorship as such – new visual competences and affective investments from a rapidly proliferating demographic. This was the audience for early cinema, for what Tom Gunning (1990) has called the "cinema of attractions". As Pasi Väliaho (2013, p. 161) states, "the moving image, in its inception, produced transformational spaces where the individual became problematized and regulated in a new manner – not only in narratives and rhetorical figures ... but more importantly, in the spatial patterning of perception".

Indeed, Simondon is gesturing towards questions of perceptions and affects in the very brief passage in which he discusses cinema in *MEOT*. I will not linger over his characterisation of television as an inferior technology to cinema, but the terms he uses for cinema imply a high valuation:

> Cinematographic motion has a powerful hypnotic quality and pace that soften the reflective faculties of the individual in order to bring him to a state of aesthetic participation. Organized as a time series that uses visual terms, the cinema is an art and means of expression of emotions; there the image is a word or a phrase, not an *object* with a structure that can be analyzed by the activity of the individual being; there the image is rarely an immobile and shining symbol (Simondon, 2007, p. 59).

It is interesting to note that *MEOT* was published in the same year as Claude Lévi-Strauss's *Anthropologie structurale* (1958). Chateau notes the polemics during this decade between ethnologists such as André-Georges Haudricourt and Georges Granai, on the one hand, and the structural anthropologist Claude Lévi-Strauss, who wished to subsume the analysis of technology and culture under a linguistic model. For Chateau, Simondon's own "process of concretisation of technical reality is radically of another order than

all that is language or that which, of course, without being it in one sense, can be analysed like a language" (in Simondon, 2005, p. 54). Structuralism too, in this sense, can be seen as part of the literary bias of culture *qua* "system of defence against technics" (Simondon, 2007, p. 1).

One of the most important points Simondon (2007, p. 59) is making in the discussion from which I have just quoted is that for him cinema is a "cinematic and dramatic action" rather than a graphics and thus it escapes the "encyclopaedic" thought of the era, which spatialises in series another series that is temporal in origin (there are obvious connections here with the analyses of Henri Bergson). This conception, as well as serving as a rejection of structuralism, reflects Simondon's (2007, p. 66) contention that "the primacy of letters in cultural education comes from that omnipotence of opinion; ... literary culture is therefore a slave to groups; it belongs to groups from the past".

Cinema might escape the alleged dead weight of an exclusively literary culture through its images being irreducible to words; perhaps too an interest in cinema might promote the more technical culture Simondon advocates, one in which an understanding of its mechanisms might overcome a historical resistance to technical objects: this for him will in fact be a humanism of sorts. He wishes to show that "culture fails to take into account that there is a human reality in technical reality and that, if it is to fully play its role, culture must come to incorporate technical entities into its body of knowledge and its sense of values" (Simondon, 2007, p. 9).

In the conclusion of *MEOT*, Simondon criticises once more hylomorphism as a model for technology and production, which is also his target at the start of his doctoral project. The artificial separation of form and matter as static terms is rejected for the process of taking form (*prise de forme*), which alone is the concern of technics. Simondon argues that instead of being exterior to this process in contemporary society, the worker "should be able to enter into the mould with the clay, make themselves at once mould and clay, live and feel their common operation in order to think taking form in itself" (Simondon, 2001, p. 329).[2]

Such a conception involves one of Simondon's key concepts, that of transduction. Here questions of ontology and epistemology overlap – for it is transduction that accounts both for the ontogenesis of technical and other objects, but also for our intuition of these, which occurs via a process of analogy. So inserting the worker into the self-regulating becoming of technical objects will overcome the psychic alienation of the operator too – through the worker's grasp of the process in reflexive thought (Chateau, 2008, p. 116). As Miguel de Bestegui summarises, "Transduction is not only an ontological category, then. It also designates the method of thought itself. As a method, the transduction does not remain outside thought" (De Bestegui, 2013, p. 173).

We might argue that cinema is an exemplary technical object for transduction not only of technical objects but also as a method of thought. Cinema works as a machine to produce perception and affect and in its positioning of the viewer via point of view, allows the spectator "to enter into the mould with the clay". Such a view brings us close to the ideas of Daniel Frampton (2006), who argues that film itself can be a medium for thought – transduction indeed appears to model such a process. An understanding of the technical nature of moving image technology, in its early days and now, would facilitate the insertion of the enlightened spectator into technicity and a genuine technical culture.

It is worth pointing out that the third part of *MEOT* provides an ambitious account of the genesis of various different phases in the relations between humans and the world. The first of these is a magic relation, which provides a unified system relating humans to the world. This is followed by a split into two phases, the technical and the religious. Each of these two split into a theoretical and a practical aspect (for technics: science and morality).

Simondon argues that in the end, it is philosophy that can reunite these various fields through transductively thinking their relation; this is its contribution to culture. However, there is a sort of intermediate case of aesthetic thought, the "neutral point between technique and religion" (Chateau, 2007, p. 43),

[2] I have used Ninian Mellamphy *et al*'s (2007) translation in progress of *On the Mode of Existence of Technical Objects* as far as possible – though since the translation is incomplete, later passages indicated through the earlier publication date (2001) are my own translation. All other translations from sources in French in the bibliography are my own unless otherwise stated.

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which tries to think the unity of the religious and the technical in a less systematic and more affective mode.

It is interesting to conjecture that cinema might also straddle several of these types of relation between humans to world. It is worth pointing out the origin of some cinema production and exhibition in nineteenth century magical entertainments.

> Many of the early film showmen were professional magicians, and early film culture owes a great deal to the ambivalent position which film held somewhere between science and magic – that is, a sense of the objective reproduction of the world on the one hand, and the magical creation on the screen of separate worlds on the other (Chanan, 1996, p. 15).

Chanan's quote brings out this sense of cinema partaking in a magical, technical and scientific relation to the world; obviously, too, it is an aesthetic response to the world also, one that is able at least potentially and for a given time to reconcile these divergent modes of relation.

Alienation and technical culture

Since we have been considering materialist conceptions of the birth of cinema, in relation to the contested nature of invention and technology, this article will finish by discussing the shared interest in Karl Marx and Simondon in the relations between machines, alienation and culture. It will be informative to contrast, briefly once more, the varying conceptions from an earlier avowed materialist with those of Simondon, who explicitly mentions Marx in his own analysis of these questions.

The question of alienation is associated with the writings of the young Marx, in the *Economic and Political Manuscripts* of 1844 especially. For Marx, the worker is alienated in capitalism from what he or she produces, since the latter is appropriated by the capitalist. Increased industrialisation and the division of labour exacerbates this experience. After Marx was writing, this was taken even further in the Fordist and Taylorist working practices of the twentieth century, to which Hollywood practice in the twentieth century is often compared, in its compartmentalisation of functions.

Another obvious reference here, in the relations to work and technology, is the famous "fragment on machines" from Marx's *Grundrisse* (Marx, 1993, pp. 690-712). Some of Marx's interest in machines is in the impoverishment of the worker and his or her increased exploitation (this argument is developed in the first volume of *Capital*). In Marx's nineteenth-century language, he argues, "The most developed machinery thus forces the worker to work longer than the savage does, or than he himself did with the simplest crudest tools" (Marx, 1973, p. 709).

Machines also play an important role in the organic composition of capital, for Marx. As capitalism develops, the amount of fixed capital, including raw materials and means of production, increases in relation to variable capital, the capital laid out in terms of labour. In the *Grundrisse*, Marx states that machinery is "the most adequate form of *fixed capital*" (Marx, 1993, p. 694). Put simply, machines and technology become the increasingly greater proportion of capital – and require fewer and fewer workers to operate for the same output as before. Dead labour weighs ever more heavily over living labour.

However, there are certain passages in Marx's work that present a countervailing tendency facilitated by the rise of the machines. This more positive aspect of the introduction of machines is often emphasised by Italian readers of Marx, especially of the *Grundrisse*. Paulo Virno (2007, p. 4) highlights the importance of machines in the development of "general intellect": machines testify to the extent to which "general social knowledge has become a direct force of production". Or in the words of Guido Starosta, "Marx not only claims that in order to be really free labor must become a consciously organised, directly social activity, but also that the consciousness regulating that emancipated productive activity must be of a general and scientific kind" (Starosta, 2011, p. 43). This development of general intellect will, according to these readings, anticipate and prepare for post-capitalist formations.

In fact, this conception of a general intellect is remarkably close to Simondon's own conceptions of a properly scientific culture. Both ideas imply the close implication of the ontogenesis of technical objects and human acts of creative invention. We can also point to a shared interest in ideas of alienation and la-

bour – but here their conceptions differ more markedly. Here we will consider Simondon's own arguments about alienation in contemporary culture.

In *MEOT*, alienation is first mentioned on the second page of the introduction, whose main cause in the contemporary world is, simply "failure to understand [*méconnaissance de*] the machine" (Simondon, 2007, p. 1). This is linked with what we have indentified above as, for Simondon, culture's attachment to the dead world of letters at the expense of technics. Later on these points will be expanded and explicitly related to Marx's early conception of alienation as related to the expropriation of the products of the individual worker's labour in capitalism. Simondon's (2007, p. 72) argument is as follows: "The alienation of man from the machine has more than a socio-economic meaning; it also has a psycho-physiological meaning; the machine no longer extends corporeal experience [*schéma corporel*] to workers or to those who own the machines". We can recognise in the *schéma corporel*, a rare reference to Maurice Merleau-Ponty, Simondon's doctoral supervisor, whose analyses in *The Phenomenology of the Perception* are brought to mind here.

Simondon's point is not to deny Marx's assertion that workers are alienated in capitalism; it is rather to deny that the basis of this alienation lies in private property and in the privation of the worker from ownership of the means of production. For Simondon, abolishing capitalism in itself will not end the alienation of the worker in contemporary societies. Rather, the root of this alienation is in the relation of the operator with the technical object. Technics itself is implicated in the question of alienation – only through integrating workers into production through a technical culture that will bring them an understanding of the individuated technical object, will alienation be overcome. Here once more, transduction provides the model both for the genesis of technical objects and for the intuition of this in reflexive thought. As we have seen, the operator must intuitively or reflectively "enter into the mould with the clay".

Though Simondon recasts the question of alienation as a problematic involving the worker's relation to technical objects, via technicity, Simondon is not denying the economic and social factors that Marx places at the centre of his accounts both in the early works and in the *Grundrisse*. However, for Simondon, the expropriation of the product of the worker's labour is a consequence of alienation from technicity and culture, not vice versa. As Vincent Bontems states: "From the moment that the machine is conceived only as a means of production and its operation is evaluated solely by the yardstick of a form of productivism, it determines in its turn an organisation of labour where men are inevitably alienated" (Bontems, 2013, p. 16). As Bontems underlines, for Simondon, a liberation of the worker will inextricably involve a liberation of the machine.

At first glance, Simondon's solution to the problem of alienation in contemporary labour might seem "idealist" in the old sense of construing it as a mental problematic – getting the workers more involved and providing them with a technical education that will allow them to intuit or reflect on the process. From a Marxist perspective this might appear to involve reconciling the worker to the existing relations of production rather than changing these relations themselves. However, Simondon states repeatedly that "productivism" and an emphasis on utility and efficiency directly obstruct true technicity – so liberation of the worker from a Simondonian perspective would inevitably involve changing the relations of production as they exist under capitalism.

In relation to cinema, this brings us once more to questions about production (as well as distribution and exhibition) in relation to the cinema industry's workforce. This takes us beyond the scope of this article but a consideration of labour in the moving image industries – and its nature as alienated or non-alienated in a Simondonian sense – would be an interesting one for the rapidly developing field of media industry studies. This would also, in relation to the question of a genuinely technical culture, situate such questions at the intersection of studies of media industries and studies of their audiences.

Conclusions

Perhaps Simondon's contention that liberating machines is the "same struggle [*combat*]" as liberating humans (according to Bontems, 2013), and that this is more fundamental than property relations in producing alienation, is the most contentious aspect of Simondon's conceptions for the more traditional materi-

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alisms. It could be argued that this makes his own work seem close to techno-utopianism.[3] Here too we should bear in mind Simondon's own position in the mid century at the Sorbonne and *grandes écoles*. This might seem to have given Simondon an environment, set of institutions and a wider culture that was welcoming to and supportive of a relatively autonomous technical culture, in ways that may not be true in our place and time. Apart from elite institutions in France, perhaps we can speculate that his conceptions are nonetheless compatible with a strain of democratic modernism associated with the expansion of higher education in the mid last century in Britain, or with social democracy generally in Europe after the second world war.

Attempts to imagine a post-capitalist society and culture are frequently dismissed as utopian, sometimes by Marxists and sometimes by others, writing about Marxists. There is little in Marx's work speculating on what post-capitalist formations might be like concretely, other than the withering away of the state. However, perhaps we can see in Simondon's advocacy of a technical, not just a literary culture, one driven by the ontogenesis of technical objects and not the extraction of surplus value, a glimpse of what a society not built on the division of labour and separation of manual and academic labour might involve. As Simondon (2001, p. 334) writes in *MEOT*, "The hierarchical distinction of the manual and the intellectual does not strike a chord in the world of technical objects". And perhaps, at the risk admittedly of sounding techno-utopian, cinema – or other forms of moving image – might play a role in fostering such a culture, for an audience encouraged to understand the ontogenesis of cinematic and other technical objects.

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[3] In relation to much later technologies, Christian Fuchs (2013) has recently argued out that we need to be sceptical about the liberatory potential *in itself* of participatory cultures driven by technology, pointing out for instance the unpaid labour involved in various forms of social media. The extremely one-sided participation of people in some of these forms of labour would not constitute non-alienated labour in either a Marxist or a Simondonian sense.

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"Making sense of power": Repurposing Gilbert Simondon's philosophy of individuation for a mechanist approach to capitalism (by way of François Laruelle)

Laura Lotti – University of New South Wales
lauralotti@mac.com

Gilbert Simondon's philosophy offers fruitful resources to approach the problem of the relation between man and digital networked technology. However the validity of his method is significantly undermined by the seeming lack of a rigorous critique of political economy and by the strong normativity at the core of his idea of technical invention, which makes it difficult to adapt Simondon's thought to the all-encompassing capture of cybercapitalism. In order to overcome this impasse I propose to look at capitalism as an aspect of the individuation of the ensemble constituted by man and nature, made possible by specific techno-cultural interfaces – precisely, the technological evolution of the medium of money. Key to this is the relation between power relations and signification, or sense – that is, the way that a certain kind of making sense of the world allows in turn for certain formations of power, and vice versa. Further, by retaining the primacy that Simondon attributes to the technical as productive of epistemological and ontological ground, I propose that the normativity that is generally criticised in Simondon's philosophy can be productively reworked as a theory of value, precisely by availing of his concept of technical invention. The technical effort that allows for the coming to existence of invention allows to uncover gaps of resistance to the smooth extraction of coded information operated by cognitive capitalism, and to highlight occasions of reversibility of the sense of power, as the recent invention of electronic cash demonstrates.

Gilbert Simondon's philosophy has remained relatively unknown to the Anglophone academic world until recently. As Muriel Combes explains, "Simondon was greeted as a "thinker of technics" rather than as a philosopher whose ambitions lay in an in-depth renewal of ontology" (Combes, 2013, p. xxi). Although his writings have provided inspiration to a wealth of renowned French authors since the mid-twentieth century (e.g. Gilles Deleuze, François Laruelle, Bernard Stiegler), according to Brian Massumi (2009), the constructivist models of the Nineties were still too concerned with language and rhetoric to appreciate Simondon's ideas. Today, the times are ripe for a Simondonian revival. The 2010 "flash crash" caused by algorithmic failure; the beginning of a new geological era, the Anthropocene, determined by the increased (and mostly negative) impact of human activity on Planet Earth since the automation of production; the NSA scandal as a confirmation of the lack of security and ethics in digital networked communication, are just some of the contemporary global events to reopen the question of the relation between human and technological systems or to raise, as Massumi puts it "the issue of the immanence of the non-human to all of the vicissitudes of the human" (2009, p. 38) – this is the question at the heart of Simondon's thought. In this sense, amidst the (at times sensationalistic) claims for post-, trans-, inhumanism that animate the current philosophical debate, Simondon's philosophy offers fruitful resources to speculate upon the natural, technical, and cultural processes that constitute the human, by providing the means to account for "a humanism without the human to be built on the ruins of anthropology" (Combes, 2013, p. 50).

However, the strong normativity at the core of Simondon's philosophy has been criticised for not resolving the problem of the exploitation of cognitive labour under contemporary capitalism. In particular, one of the main critiques of Simondon's idea of technical invention (1989a, 2009a) is the seeming lack of rigorous engagement with the socio-economic conditions that allow for the development of a technological lineage (During, 2006; Chateau in Simondon, 2005b). Moreover, his central concept of transindividuation – synthesised by Muriel Combes as a relation of relations that is both internal to the individual

(defining its psyche) and exterior to the individual (defining the collective) (2013, p. 26) – is problematic for it seems to justify the rhetoric of flow and pre-programmed interaction supported by second-order cybernetics upon which contemporary forms of control thrive. For instance, referring to the domain of programming, "where certain forms of hacking and open-source may be viewed as Simondonian 'transindividual collectives'", Alberto Toscano observes that:

> contemporary work on "cognitive capitalism" … cannot but cast some doubt on the dichotomy of work and invention as the all-purpose key to the emergence of a non-alienated technical culture. Is it really enough that the genesis and existence of the technical object not be sundered for us to speak of nonalienation, and of interactions that would communicate and actualize our preindividual "human nature" (Toscano 2007a, pp. 204–205).

In order to overcome the "wall" Simondon's philosophy seems to leave us at,[1] I propose not to adopt a political economic approach *to* Simondon's thought, but to step into his philosophy and look at capitalism itself *as* an aspect of the individuation of the ensemble constituted by man and nature. Key to this is the relation between power relations and signification, or sense – that is, the way that a certain kind of making sense of the world, afforded by specific techno-cultural interfaces, allows in turn for certain formations of power, and vice versa – which is made possible by a re-examination of the formation of value in Simondonian perspective. By retaining the primacy that Simondon attributes to the technical as productive of epistemological and ontological ground, I propose that the techno-cultural normativity that is generally criticised in Simondon's philosophy can be productively reworked as a theory of value, precisely by availing of his concepts of invention and transindividual technical relation.

In order to illustrate my point, I discuss the establishment of capitalist values via an analysis of one of the most basic and perhaps mundane technologies we avail of daily: money. I first reframe Simondon's philosophy of individuation and technics as a process of "sense making", by coupling Simondon's formal approach to individuation with François Laruelle's early writings on political materialism. Secondly, I discuss the "sense" of capitalism as the structuration of a specific axiomatic of signification made possible by the development of fiat currency within Simondon's schema of the birth of technology (Simondon, 2014). Ultimately, I consider Simondon's idea of invention in terms of Laruellian minor hermeneutics to analyse how value is produced in the contemporary socio-economy. My wager is that Simondon's and Laruelle's formal treatment of individuation and power, respectively, allows to go "beyond the power principle" (Laruelle, 1978), bypassing the grand onto-theo-political truths upon which contemporary capitalism thrives, by demonstrating that every individual already contains the potential for both *pouvoir* and *puissance*, thus realising Simondon's (and perhaps Norbert Wiener's) project of a "universal cybernetics".

Individuation and technics

Simondon is best known for his philosophy of technics, which postulates that technical objects evolve progressively from element to individual to network and possess an increasing level of autonomy, culminating in the establishment of a technical mentality with the introduction of post-industrial technical objects (Simondon, 2009a, 2014). However, to fully grasp its relevance for media and communication studies, Simondon's theory can only be understood within the framework of his philosophy of individuation. Here I will briefly sketch out Simondon's theory of individuation before clarifying the role that technics and technology play in his schema, thus setting the groundwork for a reframing of Simondon's philosophy in political economic terms, with the support of François Laruelle's early political materialism.

The novelty of Simondon's philosophy lies in his formal approach to the problem of individuation engendering, as Muriel Combes aptly puts it "a reformation of our understanding" (2013, p. 1). By

[1] Here I paraphrase Elie During's article titled in French "Simondon Au Pied Du Mur" (During, 2006), which precisely deals with the problems posed by the concept of technical invention. All translations from the French are mine throughout the paper, unless stated otherwise in the bibliography.

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substituting the idea of an ontology of being with an ontogenesis of becoming, Simondon reverses the view by which the individual has always been studied, not stopping his inquiry at the principle of individuation, which presupposes matter and form as a priori givens, but traversing it, thus "*grasp[ing] the individuated being from the viewpoint of individuation, and individuation from the viewpoint of preindividual being*, each operating at many different orders of magnitude" (Simondon, 1992, p. 311). Individuation is the single process underlying the ontogenesis of physical, biological and technical beings, and it is the sole process that allows for the conservation of being through becoming (Simondon, 1992, p. 301), therefore allowing for evolution. Individuation presupposes the existence of a disparation between at least two orders of magnitude or two scales of heterogeneous reality in non-interaction between each other, in a state of metastable equilibrium, and resolves the incompatibility between such states by giving rise to both the individuated being and its *milieu* of individuation. Crucial to Simondon's formal approach to individuation are operations. His allagmatic theory is precisely concerned with the energy exchanges among structures, which he calls transduction, that allow for the process of individuation:

> the principle of individuation is the operation that carries out an energy exchange between the matter and the form, until the unity leads to a state of equilibrium. One could say that the principle of individuation is the common allagmatic operation of the matter and form through the actualization of potential energy (Simondon, 1995, p. 44).

Attending to such operations allows to formally intervene in the process of individuation by manipulating the relational layer that constitutes the centre of individuality – i.e. emotivity and affectivity – that in his philosophy are the ground for perception and action.

Put differently, individuation rests upon an analogic operation of exchange across different domains of being with the preindividual dimension, and in living beings this creates an internal resonance "requiring permanent communication and maintaining a metastability that is the precondition of life" (Simondon, 1992, p. 305). Individuation is thus an operation of communication between at least two orders of magnitude non-compatible with each other, carried out by a process of *in*-formation. In contrast with information and communication theory, for Simondon information is a pure difference without content, structure or meaning. It is not quantifiable and carries an ontogenetic power within itself. Before being a technical concern, information is what allows for the perceptual engagement with an ensemble via the structuration of an axiomatic of signification. In a highly abstract manner, Simondon describes signification as the event of the discovery of an axiomatic that allows for the "initial resolution … of the tensions that result from the confrontation of the *primitive tropistic or taxonomic unities*" (Simondon, 2009b, p. 9). This process allows for the structuration of perception in relation to its *milieu* by giving a direction [*sens*] to the taxonomic unities that make up the world. This axiomatic, which appears in the very process of individuation, is both internal and external to the individual: internally, it connects the individuated being to the preindividual reality, by structuring affectivity and emotivity; externally, it connects taxonomic units to the environment, thereby structuring perception. The signification that emerges via the process of communication that allows for the individuation of being "is a relation of beings, not a pure expression" (Simondon, 1989b, p. 200), therefore it need not be conflated with language. Rather, it must be understood in spatial and ontogenetic terms, as the morphogenetic process that constitutes the very dimensionality of being (Simondon, 1995, p. 226) and that allows for the structuration of the perceptual spatio-temporal axiomatic upon which collective, physical, psychic individuation rests (Simondon, 1989b, p. 127).

Because matter and form are not ontologically constitutive, but a dimension of individuation, everything departs from an undifferentiated being, defined in the third part of *Du Mode* as "primitive magical unity" or *apeiron* (Simondon, 1989a, p. 162), in which there is no distinction between subject and object, man and nature. Being subsequently individuates under different guises – crystals, animals, humans, thought, technology, even relations (Simondon, 1992, p. 306). This is important to clarify Simondon's conception of politics. To Simondon politics is a mode of individuation of thought that departs from the aforementioned *apeiron* in accordance with a system of signification that affects, via its milieu, the process of individuation of other beings. As Alberto Toscano explains, Simondon's formal method "sets aside the

idea of a political disposition, of an originary sharing out of politics, in favour of a study of the conditioned contingency of political invention" (2007b) that result from the process of individuation across disparate fields. The individuation of the system of power relations known as Capitalism is the central concern of this paper. Before delving into that, however, it is worth clarifying the role that technics play in the system man-nature envisaged by Simondon.

To Simondon, technics[2] serve the purpose of instituting a code of correlation that allows for the system man-nature to function in a state of internal resonance (Simondon, 2014, p. 176). Simondon reminds us that the individual must be grasped at its centre, according to the operations of becoming and spatio-temporal structuration that constitute it (Simondon, 1992) – similarly, the individuation of the system man-nature can only be studied via an analysis of the operations of technics. Although technics are initially free, the system they create initiates a progressive closure of their freedom, until a technical invention inaugurates a new system based on a new code. In *Du Mode* Simondon defines invention as that which brings about a new technical lineage (or *machinic phylum*, following Deleuze and Guattari's vocabulary): "the beginning of a lineage of technical objects is marked by a synthetic act of invention which constitutes a *technical essence*" (1989a, p. 43). Simondon further distinguishes between two types of inventions corresponding to two kinds of progress: the continuous and the discontinuous (2005b, p. 101). While continuous, relational progress rests upon an invention that reinforces that internal logic of the system, a "veritable invention" corresponds to the establishment of an auto-correlation among elements of the system. This way, the invention disrupts the previous order and establishes a new one. Invention is purely technical and possesses a normativity "intrinsic and absolute" (Simondon, 2005a, p. 513) that alone instantiates change in collective and individual values and exigencies, precisely by modifying the system of signification – i.e. spatio-temporal axiomatic – that underlies the individuation of a system. It is then up to socio-economic factors to establish whether to take up the invention and welcome it in their community.[3]

François Laruelle calls the capacity of technical objects to give direction [*sens*] to perception, "the sense of power" and could be considered the political completion of Simondon's project.[4] In *Au-delà du Principe de Pouvoir* (1978) Laruelle outlines his political materialism, which is precisely concerned with going beyond the principle of individuation of power. To Laruelle (1978, p. 15, 35), traditional political theory conflates power [*pouvoir*] with forces of production that don't explain "the production of the process of production of power" but that, on the contrary, already inhabit the "onto-theo-political thoughts" that constitute the sense of power. As for Simondon politics stems from a mode of individuation of thought, so for Laruelle Power is first of all the power of thought, the power of thinking. The relation between Power and the Beyond-of-Power is a relation of sense, which is not to be confused with its imaginary representations, or conceptual meaning. Sense is directional, or vectoral.[5] And the sense of

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[2] Simondon defines technics as the practical uses of different utensils. The term has been largely employed in media studies, especially after Bernard Stiegler' discussion of Simondon's theory in *Technics and Time.* Commenting on *Technics and Time,* Andrés Vaccari states that: "The essence of the human, it seems, is the technical; which is paradoxically the other of the human: the non-human, the manufactured, unnatural, artificial; the inhuman even" (2009).

[3] In *L'individuation à la Lumière des Notions de Form et d'Information* Simondon makes a fundamental distinction between community (*communauté*) and society (*société*), in which we can read his critique to communism. A community corresponds to a code of extrinsic obligations that put individuals in relation to each other, while a society is founded upon an order of relations interior to the individuals. Community and society are antagonist with each other, but together they constitute the "collective reality" humans live in. Communitarian forces tend to incorporate technics into a system of social obligations, and assimilate technical effort to work (2005a, p. 513).

[4] François Laruelle was one of the thinkers to immediately recognise Simondon's genius, as some of his writings testify (Laruelle, 1994) and he helped Simondon edit and publish his second volume of his oeuvre on individuation, *L'Individuation Psychique et Collective* (Bardini, 2014). To my knowledge not many authors have put the two thinkers in conversation before. An exception is Nandita Biswas Mellamphy, who, in "Nietzsche's Political Materialism: Diagram for a Nietzschean Politics", discusses Nietzschean politics as "the operation of an elementary and fundamentally non-signifying force-mechanics" (Nandita Biswas Mellamphy, n.d.) by ways of François Laruelle's political materialialism cross-referenced with a Simondonian account of "forces" as "pre-individual affective 'potentialities'".

[5] The discussion of power as directionality resonates with McKenzie Wark's definition of vectoral power: "In the development of the vectoral regime of power, everything depended on the development of technologies of perception" (Wark, 2012, p. 32).

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power, as the operations of circulation of knowledge, can only be countered by a "power [*pouvoir*] of the senses", that is the "ensemble of technologies that the West comprehends under the name of 'interpretation'" (Laruelle, 1978, p. 5). This corresponds to a "minor hermeneutics" which directly refers to the "interpretation" of the machinic (i.e. axiomatic) dimension of power.

According to Simondon-Laruelle then, capitalist power is a matter of individuation of thought, and of the technologies that allow for the operational circulation of knowledge, therefore structuring a specific axiomatic of signification, or sense.[6] Ultimately, it is a matter of how such a system of signification allows for the circulation of the value introduced by technical objects. Simondon-Laruelle's schema allows for a more nuanced understanding of the intricate relation between capital and technology, by demystifying capitalist power as *fait accompli*. For Laruelle the sense of power is inherently linked to the production of a certain mode of thought; similarly, for Simondon such a sense can be mobilised by technical invention, which is in itself "a seed of thought" (2005a, p. 514). But how is this relationship materially produced? In the next section I attempt to answer this question by following the technological development of one of the most basic capitalist technologies – money. Subsequently, I gesture toward contemporary technological developments that are undermining the sense of capitalist power by awakening the power of the senses.

The sense of power: On the modes of existence of capital

Although Simondon hardly discusses capitalist power, let alone money, it is possible to map the development of capitalism following the evolution of the mechanist phase of technological progress. In a rather obscure seminar from 1970, Simondon locates the origins of technology in the West in the encounter between technics (i.e. the practical uses of different utensils) and the *logos* of the theoretical sciences (Simondon, 2014, p. 176).[7] Contrary to technics – which, in spite of its close relation with human essence, is an autonomous, and automated mode of being radically different from the human – Simondon explains that technology, or "mechanics", is entirely human. The system it inaugurates supplants the generative code of correlation between man and nature with the law of man – "the law of conservation of movement, the law of conservation of work" (Simondon, 2014, p. 170) – as direct consequence of the development of human language and the theoretical sciences. Simondon explains that the law of man aims only for the domestication and regularisation of nature via the anticipation of natural phenomena and the exploitation of work, thereby introducing a conception of mechanical teleological progress. This has created a system that progressively incorporates the discontinuum into a continuum that annihilates the necessary action of *kairos* – the aleatory power of nature – in favour of a "sense" of the necessity of prediction and anticipation of relations, while at the same time it forecloses the freedom of technics, until a new invention inaugurates a new code. In short, with the development of mathematics and the theoretical sciences, the language of man (be it literary, political, mathematical, or scientific) has imposed on the autonomous *logos* of technology (i.e. its chain of operations that allow for a technical system to work), establishing a transcendental *nomos* (i.e. law) which has supplanted the eco-logic code of correlation with an eco-nomic code,[8] propagating in a horizontal transductive movement to encompass economic and social relations, to the cultural

[6] Deleuze and Guattari discuss the "capitalist axiomatic" in *Anti-Oedipus* in a similar manner to Simondon-Laruelle. However, whereas to them capital works "as an axiomatic of abstract quantities" (1977, p. 228), it is important to note that for Simondon such axiomatic works at a deeper level, as the constitution of "intensive series" from which perception, then science, develop (Simondon, 2009b, p. 9). Furthermore, whereas for Deleuze and Guattari the capitalist axiomatic can be understood either in a strict economic sense or in a broader socio-political conception, for Simondon and Laruelle capitalist power needs to be understood as a result of the single operation of individuation, which encompasses the economic, political, and social spheres, in a somewhat similar way to Nitzan and Bichler's formulation of capital as both political and economic power (Nitzan and Bichler, 2009).

[7] Simondon traces the birth of technology in the West back to the encounter between the Eastern, or Egyptian, techniques and the Greek contemplative and theoretical sciences in the city of Alexandria around the year 300 BC. In Alexandria, the first cosmopolitan city of the Mediterranean, the development of alchemy "added technology to technics and sciences [allowing for] the development of the *logos* through *teknika*" (Simondon, 2014, p. 176).

[8] The etymology of the term "economy" – the management (*nomos*) of the household (*oikos*) – seems to point precisely to this movement of domestication of nature. This is evident today too; both classical and neoclassical economic theory share the goal of predicting economic agents' preferences and behaviours in order to forecast market dynamics and production/consumption. Furthermore, anticipation of market's behaviours is the central tenet of financial trading.

superstructure that constitutes the social (Simondon, 2014, p. 172). Therefore, the birth of technology marks the shift from an ecologic reality to an economic one. Here I propose that the bond between social and economic relations that forms the basis for capitalism can be understood by closely analysing the technological evolution of money since antiquity – which first brought to a quantification of human relations, and secondly to the abstraction of value from the underlying asset.

Money is a computational unit, store of value, and medium of circulation. Following Simondon's classification, money can be considered an elementary, therefore abstract, technology (i.e. a tool), which substitutes and quantifies the technic of exchange between man and nature. According to Simondon, this originates in the "debt" that humans have towards nature:

> We are natural beings that have a debt of technics to pay the nature that is within us; the seed of nature that is in ourselves must dilate in technics around us. We cannot achieve our essence without getting the organisers that are in us to shine (Simondon, 2014, p. 24).

Money is a technical object. As such, it is not only a thing, *hic et nunc* – it incorporates its own genesis, thereby instituting a set of transductive relations that extend to and modify culture (Simondon, 1989a, p. 20). Paradoxically, while money has remained an abstract technology since the introduction of coinage, the set of economic relations it has established has progressively concretised in capitalist power.

In his important study on debt, David Graeber demonstrates that the introduction of coinage during the Axial Age (approx. 600 BC) paved the way for the quantification of the values of pre-existing "human economies" further allowing for the rise of a "military-coinage-slave complex" (Graeber, 2012, p. 229) that typically increased debt. Coinage was possible with the discovery of metallurgy, which, according to Simondon, anticipates and introduces the industrial schema of production, based on the complete transformation of minerals into metal (2009a, p. 20), and on an idea of teleological progress that misunderstands the role of the technical object. Rooted in the discovery of metallurgy, the industrial mode of production progressively concretises during *la mécanique* – the mechanist era of the relation between man and nature. According to Simondon's analysis there exist three major phases of mechanist progress. Starting with Cartesianism in the seventeenth century, the process of mechanisation and domestication of nature intensifies throughout the eighteenth and nineteenth centuries – with the Enlightenment and Marxism respectively – transductively expanding in a horizontal movement to encompass more and more aspects of the world, first at the level of thought (with deductive sciences), then at the level of the entire individual (with pedagogy), and ultimately humanity as a whole (Simondon, 2014, p. 174). This period also coincides with the individuation of the long capitalist era in the West, made possible by the advances in calculus and commercial infrastructures that allowed for the development of banking systems and the invention of fiat currency. With fiat money, the value of social relations has increasingly been abstracted from the underlying asset it represents, and circulated freely in the form of bills of exchange or banknotes. Following Paolo Totaro and Domenico Ninno (2014) fiat money precisely derives from the application of the concept of mathematical function in the theoretical sciences to the practical sphere. Expanding on their argument, fiat money is perhaps the most ancient algorithmic technology. This has contributed to a certain gnoseological formation according to which the recursive function has shaped the *socius* by constituting "the premise to a conception of value as a quantitative continuum" (Totaro and Ninno, 2014, p. 9), which can be computed and accumulated.

The "relational invention" of fiat money fits well with Simondon's analysis of the mechanist phase of technological development. As a matter of fact, with its circulation, fiat money precisely performs the function of the *perpetuum mobile* that the laws of thermodynamics and the general law of the conservation of energy disproved, thereby shifting the focus on the productivity of work, both for the machine, and for the operator (Simondon, 2014, p. 170). Furthermore, in order to function, this system is based on a relation of trust, rather than a material relation with nature, in which both the party that "owns" and the party that "owes" must trust the apparatuses that warrant the value of this relation in the present, in order to gain from future occurrences, and that allow for its circulation – namely, banks, commercial hubs, and the State. Whereas commodity money possesses an intrinsic value determined by the precious materials it is made of (e.g. gold, silver), paper money has no intrinsic value, but only exchange value – which resides in

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the system of relations guaranteed by the money token. Following Laruelle's analysis, this process of abstraction empties power of any theoretical meaning, and instead validates the concept of power as a social and political construct – largely indebted to the market dynamics that determine the circulation of knowledge: "Like the older terms of Existence or Structure, but with more facility because it expresses fewer theoretical requirements … [power] has conquered the grand capitalist style: as a concept, its practical value is virtually null, it is rather its exchange value, to which it is reduced, that makes its only possible usage" (1978, p. 1-2). In this way, money becomes the form of expression (the *logos*) of capitalist value. Money is *pouvoir d'achat* – purchasing power – the purchase of Power upon reality.

Thus, there cannot be such a thing as a subsumption of man and technology to capital. In Simondon's universal cybernetics there is only place for man, nature, and technics. To him alienation is precisely due to the development of theoretical sciences in the past centuries. As Pascal Chabot observes: "[a]lienation, for Simondon, is rooted in this intellectualism, which has the knowledge and the idea of power (*puissance*) while lacking any concrete power (*pouvoir*), except for that which it appropriates from others for its own purposes" (Chabot, 2013, p. 44). Importantly, the alienation of man from technology is not only a socio-economic matter, due to the privatisation of the labour process, but more profoundly, a physical-psychological one, which started precisely with the mechanist era of technological development, which has hindered "a more profound and essential relation, that of the continuity between the human individual and the technical individual" (Simondon, 1989a, pp. 117–118). Thus, "the bankers … are also as alienated from the machine as the members of the new proletariat" (Simondon, 1989a, p. 118). Simondon reminds us that technical progress proceeds by leaps and bounds (Simondon, 1989a, p. 40) and not according to a continuous line. The introduction of the idea of teleological process has caused a disequilibrium between the internal functioning of the machine and its external finality (i.e. the economy of production and consumption) (Simondon, 1989a, p. 119), which in turn has hindered the process of individuation in the human *qua* human, prompting an increasing level of alienation and foreclosure of the freedom of technics. Thus, the process of quantification, abstraction, acceleration for economic purposes triggered by fiat money has favoured the progressive individuation of the capitalist system of signification, with profound political consequences. As Deleuze (1992) famously stated after Simondon, with the rise of the societies of control we have indeed become dividuals, in the sense that the individual body is substituted with and fragmented into a numerical code, which grants access to information and allows for manipulation by apparatuses of control.

The abstract circulation of values money affords has evolved with its underlying technological developments, weaving a signifying infrastructure of the sense of power that has progressively expanded to different fields of life. At the time his writing, Simodon couldn't forecast the paradigmatic shift cybernetics would bring about. However, he could sense the import of "this new macrocosmic closure":

> its contours are still blurred; it contains both elements of science fiction and strategic concerns; it tends to become, if not a sacred art as the first hermetism, at least a monopoly of great powers [*puissances*] attempting to forecast their future (Simondon, 2014, p. 171).

Interestingly, to Simondon, cybernetics constitutes the formalisation of the Marxist cognitive schema (2014), the third phase of mechanism. To Simondon, Marxist dialectics introduced a break in the continuum instantiated by the "law of man". However, by applying the concept of revolution to all social groups, it integrated the discontinuous into the continuum. Subsequently, cybernetics gave a general intelligibility to such a complex system in multiple states of equilibrium, thereby initiating the rhetoric of uncontested flow upon which contemporary capitalism still thrive.

Indeed, cybernetics started the process of financialisation of life (Mirowski, 2002), by introducing concepts such as game theory and statistical samplings that still constitute the foundations of contemporary digital networks. Fast-forward forty years from Simondon's analysis; the acceleration of economic activity has reached the point of liquefaction – pure flow. Liquidity is the precept of financial trading. The more circulation, the more capital is produced. This has generated an all-encompassing acceleration that has transductively impacted all fields of life. The present conflation between economic and social exchanges at the level of software design (Easley and Kleinberg, 2010) constitutes the

apotheosis of this process of financialisation. On the one hand, "technical *reseaux*" play an increasingly fundamental role in constituting, supporting, and modifying the planetary infrastructure;[9] on the other hand, we are witnessing the seeming demotion of politics in favour of a pervasive monetisation and generalised algorithmic trading (of currencies, derivative, options, personal and non-personal data, cognitive labour, personal relations etc.) that indeed seem to make the process of individuation follow market dynamics. Whereas fiat currency could be considered a first instance of algorithmic technology, today algorithms perform the function of universal *numéraire.* While the production of value is increasingly bequeathed to ranking algorithms, rather than to labour, that operate an exploitation of cognitive capital beyond the scope and method of any major political economic theory (Pasquinelli, 2009), the social sphere is exposed to the contingency of price in financial markets, as demonstrated by the 2008 global recession and 2010 flash crash. Supposedly, we live in a quantified world. Transactions don't need to "take place" – they deterritorialise in the market to reterritorialise again in the *socius* as numbers, as price.

While financial capitalism runs on ever thinner, straighter, and faster fibre optic cables, and is increasingly interwoven within the fabric of social life and the geo-materiality of the world, the processual nature of value as fruit of the labour process has been superseded by the immediacy and contingency of price. Following market theorist Elie Ayache (2010), Jon Roffe argues that values, that are qualitative and predispositional in character, have been superseded by price in "the market ... as the *socius* of the capitalist social formation, the inscriptive sine qua non of capitalism" thus granting ontological primacy to contingency, rather then to processual production (Roffe, 2013). While Roffe's argument seems to point to a conceptualisation of the market not only as the *socius* of capitalist social formation, but more radically as the site where individuation happens, I believe that Simondon's philosophy, coupled with Laruelle's materialist politics and the primacy that both accord to contingency (which is shared by Roffe and other authors, and that will be made clear below), offers a more nuanced account of the creation of value, which allows to map the current situation in order to highlight movements of reversibility in the contemporary sense of power.

The power of the senses: Towards a technical theory of value

Following the mechanical evolution of money it is possible to understand how today capitalist power "makes more sense" than anything else – the system of signification it has established seems impregnable. This, I have argued, is due to the invention and technical evolution of money. However, Laruelle reminds us not to stop at the function of the technologies of power, but to pursue its sense beyond its principle of individuation. Sense constitutes the "*au-delà* of the linguistic function" (1978, p. 240) being it spoken, written, visual, or mathematical. While function is mechanical (the *logos*), sense is machinic. Sense is the transcendental condition internal to the function, therefore, the very condition for the production of meaning. "Sense, in its authentic concept, is not the end or the aim, it is a "fact" (the political effect produced by another active power or medium) towards a power to have an end [*pouvoir d'avoir une fin*] and of being constrained by a local task" (Laruelle, 1978, p. 240). Sense is self-constituting, precisely like the Simondonian idea of signification, which corresponds to "the auto-constitution of a topology of being that resolves a prior incompatibility through the appearance of a new systematic" (Simondon, 1989b, p. 127). Thus, sense only arises via a process of individuation, *as* the individuation of thought. It is a vector, which bears both the power to carry on the "task" required by the event of signification/individuation, and also the power (both in terms of *pouvoir*) to actively resist to it. Thus, "making sense" corresponds to an allagmatic operation that allows for a new axiomatic of being. It is a concrete, individualised power.

[9] Benjamin Bratton defines the "stack" as a kind of Simondonian technical *reseau*: "Planetary-scale computation takes different forms at different scales: energy grids and mineral sourcing; chthonic cloud infrastructure; urban software and public service privatization; massive universal addressing systems; interfaces drawn by the augmentation of the hand, of the eye, or dissolved into objects; users both overdetermined by self-quantification and exploded by the arrival of legions of nonhuman users (sensors, cars, robots). Instead of seeing the various species of contemporary computational technologies as so many different genres of machines, spinning out on their own, we should instead see them as forming the body of an accidental megastructure … This model is of a Stack that both does and does not exist as such: it is a machine that serves as a schema, as much as it is a schema of machines" (Bratton, 2014). The individuation of the stack as a technical ensemble affects the individuation of both man and nature, and vice versa.

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In order to break the status quo a new "veritable technical invention" is needed, which corresponds to the establishment of "a new regime of functioning" (Simondon, 2014, p. 301) between individuals (both technical and biological). This is because a technical invention inserts itself within the community by instituting a function that modifies collective values and beliefs on the basis of its own internal design, thereby modifying its associated *milieu* and impacting collective and psychic individuation. The true, discontinuous, invention possesses:

> something which goes beyond the community and institutes a transindividual relation, going from individual to individual without passing through the communitarian integration guaranteed by a collective mythology. The immediate relation between individuals defines a social existence in the proper sense, since the communitarian relation doesn't allow individuals to communicate directly with each other but constitutes a totality via whose intermediary individuals communicate indirectly, and without a precise conscience of their own individuality (Simondon, 2005a, pp. 513–514).

Simondon already sensed this possibility with the concretisation of the cybernetic schema. Although to Simondon cybernetics constitutes a further phase in the mechanist evolution of technics, he also lets transpire that it may inaugurate a new era of technological development, due to the instantiation of a "movement of thought" (Simondon, 2014, p. 302) that would contribute to the development of a technical mentality – a thought-network, that is "the material and conceptual synthesis of particularity and concentration, individuality and collectivity" (Simondon, 2014, p. 307). As a matter of fact, cybernetics has furnished the cognitive schema for the invention of post-industrial technical objects – that is, technical objects, such as information and telecommunication networks that eschew the foreclosing mechanist schema that the *logos* of the sciences has imposed upon technics (Simondon, 2014, p. 303). Simondon describes post-industrial technical objects as the unity of two layers of reality – one stable and permanent, which adheres to the user, and the other modular, impersonal, mass-produced by industry and distributed by all the networks of exchange (Simondon, 2014, pp. 311–312). The "reticular structure" that characterises post-industrial technical objects makes them open and participable. While Simondon was mainly referring to telecommunication networks such as phone cables and antennas, contemporary algorithms constitute the emblem of post-industrial technical individuals. As a matter of fact, the process of transduction that occurs from mathematical formalization to digital implementation (i.e. the fact that electronic circuits "can count") opens algorithms to the incomputable dimension of preindividual reality, thereby creating infinite occasions to produce novelty. In a similar sense, Luciana Parisi (2013, p. 46) discusses algo-rithms as "objectiles" – i.e. "spatio-temporal events" that not only are open to the possibilistic past, but also to infinite potential futures. Therefore, the process initiated with cybernetics, rather than foreclosing chances of disentanglement, has opened up an infinite variety of potentialities for reversal of the sense of power, that are immanent to the unilateral function of digital computation.

The open character of post-industrial technical object is evident in the financial-technical ensemble too. The invention of the Black-Scholes-Merton equation (1973), which created the trading of derivatives as we know it by allowing for a scientific estimate of the price of options in the market, introduced noise in financial markets as fundamental condition of their functioning. "Noise makes financial markets possible, but also makes them imperfect" (Black, 1986, p. 530). Noise doesn't only relate to the asymmetry of information between two parties, but first and foremost to the openness to untapped potentials immanent to the channels of communication. With the digitalisation of trading platforms and the introduction of algorithmic trading, which operates via real-time simulations and statistical samplings, such as the Monte Carlo method, the openness of digital objects is felt at the deeper level of the individualisation of algorithms in complex environments, as they interact with both random, but individualised data, and the preindividual dimension of computation. The 2010 Flash Crash in the context of high-frequency trading (HFT) seems to confirm this thesis: *no one knows what happened*. In this context, Mackenzie Wark's comment about the 1987 Black Monday is more actual than ever: "finally – and this goes for the capitalists too – an inhuman power rules over everything" (Marx cited in Wark, 1994, p. 174).

However, Simondon reminds us that, while the non-human is central to human progress and increasingly autonomous, ultimately "human reality" is what resides within machines (Simondon, 1989a, p. 12).

The concept of transindividual technical relation at the basis of a "real invention" precisely points toward this direction. The human presence among machines is a perpetual invention that goes well beyond the mechanist paradigm of the industrial era. As a matter of fact, the technical invention is born as the concretisation (i.e. individuation) of the thought of an inventor-designer, via a technical effort that opens a new channel of communication between man and nature – a transindividual technical relation. This produces an "irradiation of values" (Simondon, 1995, p. 514) that departs from the individual, because: "communicating is in the nature of the individual, it is irradiating the information that he himself created". As a matter of fact, to Simondon the living being can be considered a node of information – "it is a system within a system, containing within itself a mediation between two different orders of magnitude" (Simondon, 1992, p. 306). Technical effort can be regarded as one kind of Laruellian minor hermeneutics – a material operation aimed to establish a new sense of power. To Simondon: "the technical being is open to all human gesture to use it and recreate it, and it inserts itself into an *élan* of universal communication" (Simondon, 2005a, p. 512).

> The *value* of the *dialogue* of the individual with the technical object is to preserve human effort, and to create a transindividual domain, distinct from community, within which the notion of freedom takes a *sense*, and which transforms the notion of individual destiny but it doesn't crush it. [The technical being] is the correlative of the individual's autocreation (Simondon, 2005a, p. 515 – emphasis added).

In this context, a close reading of Simondon's theory offers transindividuation as a form of radical xenocommunication, a mode of communication that always already implies an alien component – the preindividual. This reformulation challenges the all-encompassing smooth extraction of coded information operated by cognitive capitalism, by uncovering gaps of resistance to programmed interaction that allow for the encounter with a "real collective" in the form of contagious transindividual thought.

Therefore, whereas financial markets constitute a further step in the continuous evolution of fiat currency, the invention of cryptocurrency seems to introduce a break in the mechanist-capitalist paradigm, and could be considered a veritable invention. Cryptocurrencies are a peculiar hybrid of fiat currency and commodity money, born out of the "reinterpretation" of previous discoveries in cryptography and computer science (Nakamoto, 2008) that eschew any previous theory of value, and have the potential to set the foundations for a radically new political economy, overcoming the divisions between human and non-human, asset-matter and money-form. This is because digital cash has introduced a system of values that embraces the open character of post-industrial technical objects, and that may radically disrupt the status quo that fiat money has imposed on the world since at least the Renaissance. Whereas capitalist power, in its emptied form, is closely related to the exchange value of fiat currency, a new mode of power is emerging, based on entirely different premises – the technical value produced by the technical effort involved in the invention, and use, of cryptocurrency.

While an in-depth discussion of cryptocurrencies is beyond the scope of this paper, the invention of Bitcoin and other altcoins testify the liveliness of a transindividual collective in a true dialogue with the technology, based on a collective technical effort made possible by the "reticular" structure of algorithms, and with each other, aimed to the expansion of such a thought-network, regardless of any political credo. Importantly, this confirms Simondon's claim that "a technical being is thus a seed of thought" (2005a, p. 514), which is currently reawakening the power of the senses that lies in each and every individual. While we still do not know whether, with the digitalisation of mathematics and the sciences, we are indeed coming to the transductive convergence between technical individuation and psychic individuation, as Massumi asks (2009, p. 45), Simondon's philosophy reminds us that ultimately, the future of humanity is in our hands, in the power of the senses.

Conclusions: Beyond the power principle

In this essay, I have examined the establishment of capitalist power as a process of "sense making", via the application of Simondon's philosophy of individuation and technics to the medium of money, coupled with François Laruelle's early work. Furthermore, I have discussed Simondon's concept of invention as a novel approach to the theory of value. Simondon sees value as inherently technical, introduced by an

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invention that radically modifies the relation between man and nature. The definition of a technical, or machinic value points towards a higher order of values that, in economic terms, can be explained neither through Marx's labour theory of value, nor as the output of the law of marginal utility. Instead it is closer to what Felix Guattari (1995, p. 55) calls "constellations of Universes of value", that are constituted at the "machinic interface between the necessary actual and the possibilist virtual". To Guattari (1995, p. 55): "The sterile opposition between use value and exchange value [needs to] be relinquished in favour of an axiological complexion including all the machinic modalities of valorisation: the values of desire, aesthetic values, ecological, economic values…". Precisely, the discussion of the mechanist development of money allows us to understand the categories of exchange value and use value as part of the capitalist mode of signification. Contrarily to the abstract, relational character of fiat money, which inaugurated a system based relations of capital and trust in apparatuses of control, the invention of cryptocurrency introduces a system of values that embrace the open, ontogenetic nature of post-industrial technical object. It remains to be seen whether the development of cryptocurrency, in experimenting with open-ended approaches to the technology at our disposal, represents a true departure from the predictive mechanist paradigm discussed throughout this paper. Ultimately its potential lies in a newfound "common sense," a "sense of the commons" to be achieved in cooperation with technologies rather than in antagonism or separation. This can only be realised via a *trans*gression from the necessity of teleological progress: a transindividuation. As Simondon observes: "isn't it all creation a transgression?" (2014, p. 449).

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Individuation and the synthesized network: An approach to digital convergence

Diego Viana – The University of São Paulo
vianadeoliveira@gmail.com

This paper proposes an analysis of digital convergence through the concepts of French philosopher Gilbert Simondon, who develops a theory of technicity as a mode of existence of humanity on par with religion, science and art, and describes an evolution of technicity that culminates in networks by which the world itself becomes technical. The paper relates contemporary digital technologies, which converge in algorithms, gadgets and the internet, to this theory, including an examination of the roles played by machines, humans, and the external world in different stages of technicity, a discussion of how digital technologies involve problems of affect and embodiment, and suggestions concerning the social and political import of such problems. I argue that contemporary technologies of digital convergence perform an operation of synthesis whereby not only are different networks tied by the same operation, but also the technical roles of machine, world, and human are merged.

Since the Industrial Revolution, the question of technicity has gradually increased in importance, and by the twentieth century had become central to philosophy, in notable texts including those of Walter Benjamin (2000), Martin Heidegger (1958), and Theodor Adorno and Max Horkheimer (1974). The growing presence of machines in daily life, war, art and politics raised the issue of the relationship between humanity and its own creations. Simondon contributed to this debate as the first to declare explicitly that technicity is more than just a human faculty: it is one of the fundamental human modes of being in the world, commensurate with religion, art and philosophy. The fundamental flaw of most accounts of technicity (and most uses of technology) is their tendency to exclude it from culture altogether, thus envisaging machines and other technical objects as either a threat or a miracle (or both). To incorporate technical reality into the concept of culture, alongside science and the humanities, was one of Simondon's central tasks, because only by taking into account technical existence into thought would it be possible to describe a relation to technicity that is not alienating or destructive for both humans and machines.

It is clear that digital technologies, the global computer network, and the near ubiquity of so-called "gadgets" bring the question of technicity further to the fore. Not only is our relationship to the world entirely mediated by technical apparatuses, it is for the most part mediated by one great instance that connects several others, namely the internet. From research to friendship, from shopping to mating, from investing to spying, more and more human activity is coded into this network. Several authors have recently deployed Simondonian concepts in an effort to theorize this process, including Bernard Stiegler (1994), Brian Massumi (2009), and Adrian Mackenzie (2002). They all develop Simondon's ideas in concert with those of other authors, as Simondon himself never experienced the rise of digital technology in everyday life. Nevertheless, it is noteworthy that the reality of a world where algorithms mediate almost every possible relation has revived the interest in a nearly forgotten philosopher, as if Simondon's reflexions regarding psychosocial individuation and technicity had been dormant, waiting for their time.

Indeed, Simondon's association between affectivity and technicity, politics and life, culture and work, resonate more and more as the convergence of these aspects of reality becomes more apparent. Simondon's thesis on machines is a call to introduce technical objects into culture: machines contain human reality, human efforts, in conjunction with "natural forces". Technicity is a fundamental human mode of relating to the world. But Western culture, Simondon argues, is split between literary and scientific strands, resulting in an approach to machines as either an enslaving threat to humanity or an enslaved force working for the leisure of humans. One manifestation of the latter is the way the industrial society treats its own products, rendering them obsolete while still perfectly capable of operating, for the benefit of the economic system. The technical object is stripped both of its link to natural forces and its link to humanity in two

ways: people lose the opportunity to engage durably with the object's capabilities, while also missing the opportunity to extend their own technical ability.

For Simondon, this problem stems not from technology itself, not even from industrial technology, but from an intrinsically flawed relation to technicity. In an oft-cited passage, Simondon (1958, pp. 246-251) suggests that the Marxian notion of economic alienation should be extended to encompass a more fundamental alienation: that of work itself, because more than the alienation of the individual that reproduces her means of existence, Simondon wants to stress the alienation of the human subject from her own technical and transindividual gesture when it is reduced to the idea of "work". The most alienating technical objects, for Simondon (1958, pp. 250-251), are those made for users ignorant of their operations, who will degrade them quickly and envisage them with the same perspective by which they came to their hands: economically.

This article uses concepts borrowed from Simondon in order to examine the phenomenon of digital convergence in relation to human technicity in general – that is, what digital convergence represents in the development of this mode of existence for humans. For such an examination it is necessary to take stock of the themes that are tightly connected in Simondon's thought: the evolution of technical objects and ensembles; the process of technical individuation; and how this individuation appears in relation to bodies (affects) and collectives. The disconnected examination of these themes leads to the alienated conceptions of technology that Simondon laments.

This discussion of digital convergence through Simondon demands firstly an overview of how the most ubiquitous and advanced technological forms (networks) fit into Simondon's theory of technology. In the second section, I then discuss the most common traits of digital convergence that have been raised in the work of authors such as Manuel Castells and Pierre Lévy through the lens of concepts drawn from Simondon. In this section, I argue that digital convergence points to a tendency for technical networks to become united in a "synthesized network". The third section is dedicated to the role of computers and algorithms in the development of this synthesized network, through the projects of Alan Turing and John von Neumann. The ideas presented by George Dyson in "The Turing Cathedral" are confronted with the concept of the synthesized network in order to question the relation of an artificial intelligence to collective individuation and affectivity. This is further explored in the fourth section, which discusses Adrian Mackenzie's theories about the embodiment of contemporary technologies and their relation to speed, time and space.

Simondon and networks

Networks appear in Simondon (2005, p. 86) as the highest stage of development of technicity, the point in which "the world becomes technicized". This claim carries several meanings that should be stressed before dealing with the outreach of technicity in the context of digital convergence. Within Simondon's philosophy of individuation, the terms "world" and "technicity" apply to two dimensions of the "transindividual", which is the regime of individuation particular to the living being whose own internal tensions demand the development of psychic existence. It is important to note that the division between individuated and milieu occurs within the living being itself, having become a *subject* whose own action is part of the milieu. The subject is psychosomatic and the milieu is no longer simply *nature*, but *a world*. Once there is a world, there is plasticity, so that the relation between the living being and the world is mediated by the subject's own psyche, mental images (symbols, concepts, objects) relating not only to the external reality and the internal body, but also among them, in an internal resonance that develops an ever more complex psychic life of its own. Where this mediation implies the representation and modification of the world through action, there is *technicity*.

Technicity refers to the mode of existence of the subject, as it relates to its world in a problematic way: for every problem, there is the need to *invent* a solution to resolve the tensions, in a single new form, which is *metastable* (that is, contains the tensions that gave origin to it, and maintains a communication between the different levels of reality that called for it). Being metastable, technicity keeps the door open for new inventions: when the solutions brought by a certain stage of technical existence no longer resolve the tensions within the mediation between subject and world: technicity evolves. "At elementary levels,

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technical activities appear essentially as a functionally useful mediation; at superior levels, internal criteria of self-correlation, therefore intrinsic perfection, prevail" (Simondon, 2005, p. 86).

If the first sign of technicity is what Simondon calls "methods" – animals and humans making marks on the external world – his properly technical analysis begins with the extension of the body and the senses by means of tools and instruments respectively. These evolve into utensils and devices, objects that include an internal functioning logic, their own mechanism: not all operations, not all information, are directly linked to the operating subject. This internality is meaningful and becomes more significant with machines. Machines have an internal system of relations and functions that transform movement (simple machines); if they have energetic autonomy, but depend on a direct operator, they are tool-machines; "actual machines" are autonomous in terms both of energy and of information (operation). The completed machine is liberated from the operator and can "function far from him" (Simondon, 2005, p. 99).

So far, the distinction between subject and world is clear. Information originating in the world produces a tension in the psyche. The subject formulates the images that will symbolically and physically respond to it; this psychic conception can be channelled into information supplied to another object, also external: the machine, which will act upon the world. Technical individuals and ensembles, as they evolve, develop their own milieu, most perfectly adapted when it is simultaneously technical and geographical, pertaining both to the realm of the technical and to that of the world. The term *world* is not to be confused with *nature*: it is already grasped by the subject's inventive psyche; it is a perceived outside, where the potentials are already stated and related to the subject's actions. This double creation of the object and the milieu, writes Simondon (1958, p. 56), "could also appear as naturalization of man; between man and machine, a techno-geographical milieu is created that only becomes possible by means of human intelligence".

Yet Simondon refers to the highest level of technical concretization as the moment at which the world is technicized. The subject's Other must then coincide with its regime of intermediation. The device that circulates information, which used to be the tool or the machine, is now the world itself. Simondon cites such networks as including the telephone system, the electrical grid, and especially the maintenance systems needed for any machines to subsist. In these cases, the human operator only acts on terminals, whereas the system's internal regulation is the fruit of one or several centres. Technical reality has a tendency to converge into networks, as polytechnical technologies replace isolated ones while ensembles concretize. The proximity between world, human, and technology tends to grow, while the internal flow of information becomes more cohesive. This is the world as technicized: "Thus are constituted certain clusters [*hauts-lieux*] of the world, natural, technical and human; the conjunction and interconnection of these clusters creates this polytechnic universe, both natural and human; the structures of this reticulation become social and political" (Simondon, 1958, p. 220).

The reticular world is that in which technicity and politics coincide, since the world itself is technical, while the technical network has its own relation to the natural world, notwithstanding its relation to humans. The notion of *haut-lieu* represents gateways or interfaces between the natural reality as still a milieu for the technical ensemble and its modulation into the world of a technicized milieu (e.g. energy plants and distribution centres). The *haut-lieu* incarnates the mystery, even the sacredness of the technical network, because with a significant level of independence from the human operators, what occurs in it is the transformation of signal and energy that justifies the existence of the ensemble, including the subject.

This individuation is both technical and collective: transindividual. Progressively, the distinction between subject, world and technical mediation is blurred. Once the network becomes ubiquitous, all action is embedded within this mediation. The user of the terminal is adapted to the operations of the network while also acting as one of its inventors. *Usage, operation and invention are, at this point, potentially the same activity*[1]. "Technicity is part of the world, not only a set of means, but a set of conditions for action and incitation to act", Simondon argues. After all,

[1] Potentially, because few people actually invent or even operate the machines. The debate over inserting code into school curricula centres on this point.

> [w]e switch our tools and instruments, we can build or fix a tool, but we never switch networks, we do not build networks ourselves: we can only attach ourselves to the network, adapt to it, participate in it; the network dominates and contains the individual being's action, it dominates each technical ensemble. Hence a form of participating in the natural and the human world that brings an incoercible collective normativeness to technical activity; ... through technical networks, the human world acquires a high level of internal resonance (Simondon, 1958, p. 221).

Simondon distinguishes between the roles played within technicity according to the development of technical objects. When it comes to tools, humans are presented as tool carriers; when it comes to machines, humans are the operators and the machine is the tool carrier. When humans are tool carriers, the tool relates directly to matter, the "geographic milieu", so that the human senses the world through the tool. Simondon's (2005b, pp. 52-60) beautifully illustrated example is woodcutting: it is necessary to sense the log's internal structures, its veins and knots; otherwise the clapboard will be imperfect. Technicity involves a transductive relation between world and subject, in which the builder knows the weight of the bricks, the weather conditions, the resistance and consistence of the ground. This is how technical individuation fosters the emergence of a technical milieu. The human itself may be a milieu, a world for the tools and instruments. Schooling, for instance, is a technical system in which the student, from a certain point of view, is the matter that that technical action will transform. This is also the case for medicine, military technology and urbanism.

With machines, another role is added to those of tool carrier and world: the operator. The relationship between human, world and machine is more complex: the machine relates to the world, while the human senses the world through the machine, i.e., she senses the signals sent by the machine's instruments, as these instruments sense the world (whereas with the tool, it is possible to directly sense the contact between the technical object and the milieu).

What makes networks a form of return is that they operate a progressive *fusion* of these roles. By establishing a communication between terminals – "stations receiving and sending information to or from the machine" – (Simondon 2005 p. 99) and centre, in which the flow of information between machines and tools is continual and reciprocal, and in which the technical being senses the human as much as the human senses the technical being, the network marks the most extreme point of the tendency by which "the world becomes technicized". This means that the ultimate network is that in which all these roles – the (technicized) world, the tool carrier, the operator and the tool – are assimilated.

Another important consequence is that different networks tend to relate to one another directly, as they perform roles of external milieu (world) for each other and each network feeds other networks with information. This role of "network of networks" is the very meaning of political and economic systems in general, as they bring a certain coherence to a set of otherwise independent networks (cf. Luhmann, 1995).

Simondon's concept of technical concretization stresses that the elements of technical individuals tend to converge functionally. Likewise, the problems faced by the collective are progressively bound together and often share solutions. Simondon (1958, pp. 65-70) argues that the comparison between technical evolution and biological evolution is flawed because living species do not (at least "spontaneously") share parts of their genetic code in order to solve another species' tensions in their relation to the world: the eagle does not transfer its wings to the dog (unless a bioengineer manages to do it; cf. Garcia dos Santos, 2003, pp. 81-106). Technical evolution does precisely that. An engine created for military aeroplanes may soon be in full use in private automobiles and laundry machines. Simondon names this *law of relaxation*.[2] This mobility of technical elements is crucial for digital convergence.

[2] Garcia dos Santos (2003) demonstrates how genetic engineering consists in extending the technical (and economic) logic to the deepest areas of the natural world, extending Simondon's law of relaxation. As this extension makes use of digital technology, it can be yet another operation pertaining to the synthesized network.

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Convergence

Since the concept was first sketched by Kittler (1986), accounts of digital convergence have tended to focus on one or both of the following aspects. The first is its effect on the market, particularly telecommunications and media. The second is its effect on personal relations and social processes. With Simondon, we have seen that both these perspectives must be studied together under the focus of technicity, understood as a mode of existence of the human subject (transindividual). This amounts to an examination of the categories of world and subject and the roles of operator, tool, tool-carrier and matter, which then can unfold into a question about collective determinations.

Commenting on Manuel Castells' notion of "mass self-communication" (Castells, 2009), psychologist Rocío Rueda Ortiz (2009, p. 117) writes that digital convergence is "a double convergence process, one technological, the other cultural and political". While "spectators receive services without realizing how diverse technologies converge in the same platform", "references and symbols are distributed in an increasingly universal and convergent manner", generating new segmentations of cultural products, while also fostering the development of minority movements that resist the hegemonic models. She argues that digital convergence leads to "techno-cognitive transformations", in which the "perceptual organization of space-time", "epistemic orders", and the "coding of (present, past and future) models of the social order" (Ortiz, 2009, p. 118) are radically changed. She raises thus the consequences of a ubiquitous technical ensemble (network) over the lives of collectivities, as the perception of the outside world is affected by digital convergence.

The same points are raised by Pierre Lévy, a noted author regarding the possibilities opened by digital technologies for the public sphere. Since his 1990 book *Les Technologies de l'Intelligence*, Lévy (1990, p. 4) has argued that "the very bases of social functioning and cognitive activities are changing at a speed that all can perceive directly", so that "we must necessarily reformulate in our minds the technical phenomenon if we are to progressively install a techno-democracy". This quote summarizes much of Lévy's project – including books such as *L'Intelligence Collective* (1994), *Cyberculture* (1997), and more recently, *The Semantic Sphere* (2011). For the purposes of this article, it is useful to stress one of his arguments in particular. In a recent article, Lévy (2009) contends that while the extension of cyberspace creates a new dimension available for collective deliberation which is increasingly global, horizontal, and blurs the distinction between public and private, the semantic sphere faces difficulties when dealing with the distinctions between languages and the distinct forms of classification that abound in the digital community. These manifestations of singularity are obstacles to the further convergence of this new kind of social sphere born from the global network of networks. A universal system of semantic and conceptual tagging that would synchronize the "virtually infinite diversity" (Lévy, 2009, p. 96) of people and online networks is necessary, according to Lévy. This argument suggests that the evolution of the network, as a core of human technicity (i.e. mode of existence), expresses an intrinsic need to constant perfection, tending to the infinite. I shall explore this tendency in the following sections.

With the political goal of exploring the possibilities of emancipation through notions such as folksonomy and folk communication, Sabbatini (2011) writes that "digital convergence unifies communication fluxes" and points towards "a synthesis operated by the Web. In this convergence, the interactivity of the digital medium is expected to allow for the traditional receptor, passive element in the communication process, to become a receptor-producer". Citing Briggs and Burke (2004), Sabbatini describes digital convergence as a further step in what was called "multimedia" in the 1990s, adding that recent digital gadgets allow for transformations that go beyond the network itself, in what Jenkins (2008) describes as a "culture of convergence". Sabbatini figures among theoreticians who advance the problem of societal appropriation of the network, which amounts to an appropriation of technicity. Otherwise, society would be alienated from its own mode of existence, as the network would be subjected to an alien normativity–that of finance and politics. Sabbatini points towards the newly created roles for the social subject incorporating their own affect and creativity into the network.

How does Simondon help to interpret the synthesis operated by the processes of digital convergence? From the texts cited above, this convergence seems to be the farthest humankind has reached in rendering inseparable the political and the technical, the affective and the operational, the local and the global. While Simondon defines networks as a dialectical moment in the development of technicity in which

technical reality returns to nature after having denied it, digital networks go further inasmuch as they attach themselves to human reality in the same way as to the natural reality: their activity takes human actions, gestures, individuating activities, and so on as the source of potentials and information that will take form digitally. When Steve Jobs insisted that devices should be multifunctional, leading to the development of smartphones and tablets, he exhibited the same reasoning: the gaps and silences between networks, devices, actors, should be minimised as much as possible. All information should be *present to itself* – that is, to the network – and the technicity of the network should be able to resolve the tensions by itself.

We shall see in the following section that the roots of this reasoning can be traced to the very origins of computing. For now, I must add that Simondon (1958, pp. 153-240) demonstrates that this tendency encompasses the whole of technicity. As we have seen in the last section, when technical networks evolve, they generate a world for themselves, in which the intrinsic possibilities of physical reality (i.e. nature), of psychosocial configurations, and of technical objects and ensembles all function under the same operational logic: they *transduce* together. This was true in Simondon's time, as cities, for example, can be interpreted as networks of networks, connecting subsystems of water supply, sewage, electricity, gas, transportation, public administration, and so on.

Therefore, digital convergence represents a contemporary form of the fusion of the roles described by Simondon within a general network, achieving what could be called a *synthesized network*, which differs from the usual "networks of networks" such as the city for the oneness to which it tends. It is not only a case of coordinating networks, but of unifying them. The diverse and supposedly incommensurable flows of information must be made to share their individuation; they must have the same language, the same code, which is interchangeable (in the sense of Simondon's law of relaxation). Lévy, for instance, defends this idea very clearly from the point of view of its emancipating possibilities. This demand for oneness is as vast as the collective itself, as originally the relation between different networks exists ultimately through their transductions with human embodiment. With a synthesized network, the transduction can potentially occur entirely inside the technical ensemble, so that the terminals, by means of computers, gadgets and other screens, work as the network's *hauts-lieux*.

Furthermore, in the digital world, the most present interface of which is the internet, a new feature is added: the realistic perspective with which human affects and cognition may be transported into the circuitry of the network, but playing the role of milieu. This is suggested in Rueda Ortiz's reference to techno-cognitive transformations. To sum up the argument so far, the synthesis means that technicity becomes progressively general and unified. Every subsystem (every network) of the transindividual reality, from governments to families, from corporations to legal systems, can be envisaged as a *world* for the synthesized network – that is, a reservoir of affective potentials for new individuations.

If the technical ensemble can be compared to the living being, as Simondon does, then its metabolism is dependent on operations performed by the user, as inventor (e.g. coding), as supplier of information (feedstock), and as the user who posts, performs, interacts (tool and instrument). The human plays a role of tool, for example, when a member of the network is called into action to make the operations occur, for instance in the gesture of inventing locally, or in the act of digitalizing analogical information. As for the technical ensemble constituted by the network, it must be able to operate in the same sense as the human operates machines (while they are envisaged as tool-carriers). Finally, the novelty brought by the possibilities of digital convergence is that the network begins to seek and sense, in the world *and* in the human – and we must keep in mind that in the technicized world of networks all that is human also plays the role of *world* – the information it needs in order to operate its technicity. This information comes under the form of affect, as we shall see in a further section.

Thinking and doing

The argument that technical ensembles could synthesize the operation of their own technicity first appears in a series of texts by Alan Turing, written between 1947 and 1952. Turing conceives of machines that effectively think, meaning they would solve problems guided by rules of thumb (cf. Copeland, 2004, p. 363) and learn from experience. These principles form the base of generate-and-test algorithms, central to the contemporary research on artificial intelligence, in which "potential solutions to a given problem are

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generated by means of a guided search. These potential solutions are then tested by an auxiliary method, in order to find out if any actually is a solution" (Copeland, 2004, p. 364). Turing inaugurates a technical conception of thought that became hegemonic in the digital age, in which "intellectual activity consists mainly of various kinds of search" (Copeland, 2004, p. 431).

Another stage in the development of the digital capacity to operate its own technicity appears in John von Neumann's breakthrough computer of 1947 that, applying Turing's ideas, "broke the distinction between numbers that *mean* things and numbers that *do* things" (Dyson, 2012, p. xi). It is not by chance that Von Neumann idealized the universal constructor in his "Theory of Self-Reproducing Automata" (published posthumously in 1966). Von Neumann was very accurate in identifying that science in the future would be concerned with "problems of control, programming, information processing, communication, organization, and systems" (Burks, 1970, p. 3). When developing his calculations on machines capable of replicating, the mathematician was interested in stressing the similarities between the living systems studied by Wiener's cybernetics and computers as conceived by Turing. Von Neumann was looking for the answer to a question about the logical organization necessary for an automaton to *control itself* and ultimately *reproduce itself*. Von Neumann went one step further than Turing: while the latter had in mind a thought entirely disconnected from life (i.e. affect), he already wondered how the systematic characters of computers and living beings could converge.

The point in evoking Turing and von Neumann is that if the machine (i.e. the network) is expected to play the roles in the technical mode of existence that were once played by the human, then it must be driven by similar motivations. Motivation is a tricky word, as it presupposes the affective dimension absent from Turing's formal idea of thinking; nevertheless, the term already implies a certain form of embodiment that will be discussed in the next section. For now, it is important to note that thinking, when the affective character is abstracted, can be understood as a proxy to computation (thinking, like computing, is searching). The development of artificial intelligences is thus an important part of the return of technicity over the world and the subject. Technical means become able to define a crucial aspect of what it means to be a technical subject. If so, then the synthesized network can operate and transduce the subject; and the affective aspect of thought and action assumes the role of matter, feedstock, and potential of information.

Dyson (2012) offers a hint at how this process is taking place and its potential meaning. He compares a visit to the Google headquarters with a hypothetical tour of a medieval cathedral under construction. What makes Dyson's comparison interesting is that medieval cathedrals were *hauts-lieux* in a network that involved belief, power, technicity, art and the economy, much like contemporary cities and stock exchanges. Through a network of religious centres, entertained by religious servants in close relation to secular powers, several dimensions of reality were put in relation, acting in the definition of the world of the transindividual. As *haut-lieu*, the cathedral operated the convergence of several strands of medieval technicity, while operating the convergence of other modes of relation between humankind and its world.

For Dyson, contemporary algorithms perform a similar, but more pervasive operation. Computers can solve almost any problem stated in finite, unambiguous terms, but most thinking occurs in ways that are neither finite, nor unambiguous, so it is easier to find answers than to state problems clearly, Dyson writes, summarizing a problem present in Turing's papers. The innovation brought by companies such as Google is to reverse the computational flux: grasping the information output from users all over the network, and then treating them as answers for complex algorithms that stochastically produce a map of questions that corresponds to them. With the development of the instructions that compose these algorithms, the technicity of the computational network manages to return to human intelligence, and employ it as the information signals for its own (artificial) intelligence. But human intelligence is hardly separable from affect, thus making the affective character of life the feedstock of information for individuations operated within the digital network.

In Dyson's description, Google's algorithms (Dyson also cites Facebook, but since the advent of cloud computing, these corporations work as clusters for one huge interconnected ensemble) operate the dialectical return to the natural world (now including the mind) that Simondon describes as the definition of a network's potential. This reasoning must be extended to all the algorithms and gadgets that compose the world of digital convergence. The ensemble constituted by code, computers, gadgets and the infrastructure

connecting them (cables, satellite dishes, servers etc.) is as powerful a technical construct as cathedrals were in the Middle Ages, inasmuch as it can articulate individual affect, institutional powers, economic disparities, and technical abilities, in a synthesized momentum controlled more and more from within the technical ensemble itself. If the expression of people's affect is the source of information for the very same network that will organize their possible modes of action in the world, this means human thought and affect are both the source of information for the technical ensemble to act and the associated milieu to which the outcome is addressed. It is the instrument that measures the world's phenomena, while also being the phenomenon itself. The network has been synthesized in such a way that in the relation subject-technicity-world, subject and world are indistinguishable, from the standpoint of the ensemble. This brings a new sense to the idea of a "world brain" sketched by H.G. Wells and copiously cited by Dyson, under the perspective of an artificial intelligence whose intelligence is that of Turing's concept of thought.

This results from the fact that, when a number *does* something, it operates a technical individuation. But if the transindividual is completely assimilated to technicity, all that pertains to the relations and connections of humans would be the preindividual stance of information: singular metastable occurrences calling for an individuation that is technical and occurs within the network. For Simondon, in psychosocial existence, the source of information is mainly the body. The body is, for the psyche, both its past and its future (1989, p. 169), connecting the biological to the collective. This symmetry suggests that the artificial intelligence is expected to play, in relation to human living collectives, a role similar to that of the human psyche in relation to the body. It would modulate, operate and create meanings while interfacing with an array of bodies (i.e. their affects) spread throughout the transindividual. Indeed, Dyson speaks of the development of artificial intelligence in terms similar to those used by Simondon for vital and psychosocial individuation: as the process by which a system slows its entropy. While the biological human may believe digital technology is evolving at an accelerating rate, Dyson argues, from the technological viewpoint, it is human evolution that is slowing. The introduction of the question of speed, added to the problem of affect and power, brings me to my next point.

Affect and speed

At this point, it is clear that the question of the global technicity of the synthesized network and the question of the singular relation between bodies and the terminals are tightly connected and must be thus thought together. This is why the bridge between the political and the singular and affective is a central concern in the works of such theorists as Galloway and Thacker (2007), Hansen (2004), and Terranova (2004), who all stress the need to think operatively about how a technical structure that pervades potentially every other technical milieu acts in determining the mode of existence of the embodied psychosocial human.

Mackenzie (2002) is the author who most deeply develops the affective character of modern technology, through the problem of embodiment and drawing extensively from Simondon. He seeks to make sense of the contemporary relation of collectives to technology through "two problematic reference points: corporeality and temporality", because "it is in relation to bodies and time that modern technology effects its most intimate synthesis with cultures" (Mackenzie, 2002, p. 1). Mackenzie's phrasing is particularly useful to think the process by which contemporary networks fuse and incorporate not only the operators of technicity (subjects) but their affects as information. As a consequence,

> [e]nsembles of bodies, things, institutions, images and forces are subject to programming, in an attempt to render them calculable, predictable and tractable. Mass media, telecommunications, weaponry, genetically modified food and drug synthesis are the spin-offs of a process that accelerates events (...) by aggregating masses and groups of living and non-living bodies in programmed, repeatable sequences (Mackenzie, 2002, p. 31).

Mackenzie calls upon the works of the artist Stelarc, Donna Haraway's cyborg, atomic clocks, Judith Butler's *Bodies That Matter*, and videogames in order to stress the pervasiveness of contemporary technologies over the body, perception – particularly of time differentials – and affect. Mackenzie recalls that technicity cannot be thought of as secondary in relation to something that would be human nature in itself.

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Such a perspective would lead to the alienation of technicity that Simondon (1958) denounces, which involves either the notion of an enslaved technical object or an enslaving technical reality. It is by the overture of technicity that psychosocial individuation takes place, so that the effects of domination and slavery can only occur within technicity, not by it.

Nevertheless, Mackenzie raises several issues that are crucial to the understanding of the individuating operation of the synthesized network. The notion of ubiquitous programming in the citation above is at the core of the operation Dyson describes, by which every singular manifestation of affect and language is translated into signifiers that the digital network (Dyson's potential artificial intelligence) can interpret and turn into the answer to a binary question. From the three qualities Mackenzie lists (calculability, predictability, tractability), the most important is by far the third, following Dyson's argument, because it justifies the other two: the desire to calculate and predict manifests the desire to deal with the world seamlessly. The set of algorithms that underlie every terminal of the network must be able to sense the bodies and affects of the collective, and then give meaning to them, relating them to other algorithms, other networks, other parts of the synthesized network. The *program* is the technical manifestation of a will to have control over complex realities, as expressed by the scientific and engineering ambitions of Wiener, Shannon, Maturana and others. All of this is brought together by incorporating the systematic operations of areas as distinct as telecommunications and GMOs. These arguments shed a new light over the usual interpretations of digital convergence, as listed above. The outreach of what Lévy and Rueda Ortíz announce as cognitive, epistemic, and social transformations is very deep, touching the radical contingency of technicity (see below), inasmuch as it forms the mode of existence of the human as subject.

Mackenzie (2002, pp. 47, 51-52) shows that much of what makes technology a constituent part of the very notion of human is the fact that is relies on the "radical contingency of the materiality and temporality" of human existence, to which corresponds, in a transductive manner formulated by Simondon, a materiality and temporality of technicity:

> [t]hrough a transductive understanding of information, we can begin to see how limits and boundaries between matter and form are interactively stabilized. From the perspective of this interaction, technologies are not a domain exterior to human bodies, but are constitutively involved in the "bodying-forth" of limits and differences. Technical materializations are always involved in what we take to be a living, human body.

Given its relation to embodiment and the collective, the question of speed must also be grasped in a way that avoids the usual opposition of pre-modern and modern (Mackenzie's example is Paul Virilio's perspective). In terms of the operations of networks, most importantly of digital networks, speed is a question of presence, which means a possibility of relation and participation. Technical mediations, Mackenzie argues, "divert volatile, fluctuating relations between humans through alternate pathways, folding the collective by binding together different rates and rhythms" (p. 70). Technicity is thus that which creates a certain set of relations, a possible presence of one element to the other, so that a technical structure is individuated, solving within itself the metastable tensions of rhythmic and affective difference. This occurs billions of times per second all over the network. Thus speed appears as the movement, or the force, that folds the distances and differences, both topologically and chronologically. An infinite speed would be an infinite presence, which would amount to the complete effacement of differences and distances, a form of automated individuation in which the velocities usually associated with the body are multiplied radically by a technical speed tending to immediacy.

In other words, the question of speed involves the transformation – which is also a form of production – of the entire possibility of relations within a given collective, or the "folding of time" in Mackenzie's vocabulary (borrowed from Bruno Latour and Michel Serres). "As two points in a network previously separated by a certain distance or delay become more closely linked, time within the collective folds in some way" (Mackenzie, 2002, p. 71). When Dyson writes that the emergence of a "world brain" from the acceleration of technical evolution corresponds to the slowing of human evolution, this folding is at stake, in the direction of a progressively perfected presence. If there is to be a "world brain", it must be conceived as a violent striving for a fusion with the world itself, so that the idea that "the world is technicized", as

expressed by Simondon, acquires a radical sense. This means that technicity, in folding time and space, folds over itself. It also means that the brain in question is the general form of techno-biological embodiment: the "world brain" could only ever be if it were in a transductive relation to a "world body".

Conclusion

This discussion of the notion of digital convergence began with the exposition of concerns expressed by several authors about the effects of contemporary technologies over the public sphere, economically, socially and politically. The examination of the subject through the lenses of Simondon brought the analysis to another level of the problem, dealing with embodiment and the transduction of affects. These two extremes of the question of technicity, when related to the near ubiquity of the sythesized network, are inseparable. As we have seen, for Simondon the network is the highest stage of technical development, in which the operations of tools, machines, instruments and ensembles are coordinated in such a way that *the world is technicized*. For a network that can potentially unify all other networks into its own operation, this means the roles traditionally played by machines, humans and the external world, are changed in such a way that all human individuations tend to be assimilated in the synthesized network. If so, then the network, which is at first a matter of algorithms, i.e. calculations, to which the notion of thought can be reduced, must also be a matter of affect and embodiment. The ultimate sense of the synthesized network is to merge subject and world in it, which allows conceiving of a not entirely implausible world in which all manifestations of affect and desire are expressed algorithmically and realized in the synthesized network.

As the network comes to embrace the transindividual almost completely[3], Simondon notes that its stakes are always also social and political. All the more so when the networks are synchronized and synthesized. Like medieval cathedrals, the contemporary network of algorithms involves the very definition of meanings and possibilities for the collective, by means of the transductive operations that transform thought, but also affect, into computable sense. These operations now appear as an attempt to objectify the axis of affect and emotion, perception and action, which corresponds to rendering, as Simondon said, the world technical. And, also citing Simondon, it is a naturalization of the human.

This brings us back to the problem of alienation as described by Simondon: how can such an extended and powerful technical ensemble as the synthesized network come to keep a relation to the human that would not be alienated? This is not a trivial question. Simondon himself dreamt of a world where culture would include engineering skills, but he may have under-evaluated the convergence of the engineering culture with the political and economic spheres of technicity that ultimately came to characterize the digital world. For reasons that are not technical, much of what Simondon argued about the misunderstanding of technical beings in the traditional culture seems to prevail:

> [t]he man who will dominate his equals is reminding of the android machine. He renounces and delegates his humanity to it. He tries to build a thinking machine, dreaming that he can build a desiring machine, a living machine, so that he can remain behind it, free of anguish, liberated from danger, exempt from feeling feeble, and vicariously triumphant for his invention. So the machine imagined to have become this double of man, the robot, wanting in interior life, evidently and inevitably represents a purely mythical and imaginary being (Simondon, 1958, p. 10).

The origins of this misunderstanding, not being technical, must be cultural, and more precisely, political and economic. This is the perspective guiding the *organologic* approach undertaken by Bernard Stiegler and other researchers at the Institut de Recherche et d'Innovation (IRI), in Paris. Stiegler (1994, p. 11) states that technicity remains the "horizon of every possibility of future and every future possibility". This sentence opens the philosopher's series of books that argue that the contemporary social and political struggles are a dispute around technicity. Attempting to give this approach a practical outcome, Vincent Puig (2014, p. 1), director of the IRI, defines four axes of research, inspired by Simondon's philosophical concepts: 1) "time and space in the context of an economy of contribution"; 2) "the agency of metadata";

[3] The question of openness to singularities and the preindividual is too wide to be dealt with in this article, but does not affect the argument.

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3) "the question of attention in the collaborative and contribution context"; and 4) "the intelligence of the body and the gesture in the sensory-motor loops, that the digital still short-circuits largely".

Hui and Halpin (2013), who are also linked to IRI, stress the relation between life, psyche, economy and politics in the systematic thinking of networks by reminding that "the concept of the quantified social network pre-dates digital social networks, originating from the work of the psychologist Moreno in the late 1930s", while J.L. Moreno himself, who was the founder of sociometry, was inspired by Henri de Saint-Simon, "the first philosopher who fully conceptualized the idea of networks via his understanding of physiology, which Saint-Simon then used to analyze vastly different domains (...). Saint-Simon indeed envisioned networks for communication, transportation and the like". The authors show that the problems underlying the attempt to make the global digital network more than a matter of control, but of collaboration and collective individuation, are also a problem of how the technical organization of networks mirrors the transductive organization of life in general. This is reflected in questions about what it means to *act* through such a network, what kinds of subjectivity are fostered or inhibited in it, how memory is crystallized and rendered present. These are all branches of the question of the synthesized network.

The aim of this article is to suggest the use of concepts advanced by Simondon to study several contemporary phenomena linked to digital convergence. The synthesized network has produced successively and topologically a variety of inherent structures, such as the blogosphere, search engines, social networks, surveillance software, chat rooms, e-groups, cryptocurrencies, 3D printers, do-it-yourself communities (cf. Anderson 2013 and Rifkin 2014) etc. They all perform the convergence of different rhythms, collectives and bodies, making them present to each other, and all of them present to the network in general, and interfacing problematically (i.e. they are metastable). The diversity of domains in which the network performs makes it all the more urgent to question its meanings and outreach transductively, for the roles they exert in relation to the synthesized network.

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Digital Simondon: The collective individuation of man and machine

Melanie Swan – Kingston University
m@melanieswan.com

Simondon's theory of individuation is the dynamic world process by which everything arises: technology, living beings, individuals, groups and thoughts. The full subjectivation of the individual requires both individual and collective individuations. This paper examines how the Contemporary Media Environment (CME) may be influencing the realization of individual and collective individuations as specified by Simondon. The CME is the current situation of the widespread connected world of computing, and the pervasive presence of technology in an increasingly rich information environment between and amongst human and machine entities. The CME is further distinguished by its use in all manner of human activity, and the increasing emergence of technology as "the other" in the human-technology relation. The CME might stimulate greater activation of individuation, both individual and collective individuation, and also now collective individuation with machine others as group members. In the case of individual individuation, CME technologies might facilitate the three types of individuation: self-world incompatibilization, "exceeding the self" incompatibilization, and "Zarathustra moments" of disindividuating individuation. Likewise in the case of the collective individuation, CME technologies might facilitate the structuring of emotion or other input signals across a group that then causes the collective individuation. In the case of human-technology individuations, the CME is the venue, facilitating mechanism, and mediator of collective individuations amongst human and technology entities. One worry might be that the CME infantilizes humans, but the opposite is true. The individuation possibilities afforded by the CME could lead to a deeper and more integrated partnership between humans and technology, and smoother transitions to a future of a multispecies intelligence. Productive interaction between intelligent species could be fostered through the notion of being joined together in the common framework of a capacity spectrum for mutual individuation in digital society.

When considering Simondon and the Contemporary Media Environment (CME), the first reach might be to his masterwork, *On the Mode of Existence of Technical Objects* (MEOT; Simondon, 1989a). Here he sets forth a detailed account of the different ways or modes in which technical objects exist, the causes of their evolution, and their position with regard to human culture and society. While this provides a good foundational understanding of technology and the CME, Simondon's philosophy also prefigures something more profound. Another of his centrepieces, the theory of individuation, anticipates not just the full subjectivation of the individual, but also that of the collective (Simondon, 2005). Individuation is the dynamic world process by which everything arises: technology, living beings, individuals, groups and even thoughts. Simondon allows an awareness of the individuation process of individuals and groups, and what may be next for human collectivity, some phases that have already been effectuated, and others that are just starting to unfold, such as the mutual co-individuation of humans and technology. The aim of this paper is to consider how Simondon's theory of individual and collective individuation applies to the CME, and the potential for the CME to facilitate the individuation of the individual and the collective.

What is the Contemporary Media Environment?

The CME is the current situation of the widespread connected world of computing, and the pervasive presence of technology in an increasingly rich information environment between and amongst human and machine entities. Three features distinguish the CME: the connected world of computing, the use of the CME for all manner of human activity, and the increasing emergence of technology as "the Other" in the human-technology relation.

The CME is the connected world of computing

The connected world is the conceptualization and experience of a continuously-connected seamless layer of computing devices blanketing the world. Any and all computing devices may be connected to the Internet, which makes them available to send and receive information, and conduct on-demand operations at any moment. Connected devices may include wearables, smartwatches, smartphones, tablets, laptops, video-gaming consoles, quantified self-tracking devices like Fitbit, Internet-of-Things (IOT) sensors, personal robotics, artificial companions, connected cars, and smarthome and smartcity sensors. Further, the connected world comprises not just the usual computing devices, but also the idea of "smart matter," where everyday objects like thermostats, scales, clothing items, washer-dryers, roads and buildings are increasingly coming online.

The process of potentially Internet-connecting all people and all objects is underway. The majority of individuals worldwide are estimated to be online by 2020 (Marsan, 2010). The rate of object connection is even faster. Thus the connected world is a venue for all forms of human and machine communication. Another property of the connected world is "big data crunching." This is the vast volume of data flows resulting from connected entities and the implied cloud-based algorithmic processing of these data. People and machines are continuously uploading information to the cloud, and deep-learning neural networks crunch these data in the background and process them back as real-time personalized recommendations, notifications and alerts. This means that humans are developing a wholly different relation to data. The human-data relation is one in which there is a notion of a "vast data other" being omnipresent in the cloud, hewing to unclear purposes, most likely those not controlled by individuals. (Swan, 2015d). Where formerly all data was signal (each appointment on a calendar is salient), now 99% of data are noise, and CME tools must help humans localize signals. Information-richness is also shifting the way that humans conceive and interact with the world, from what necessarily had to be a mode of reactive response, to one that is now proactive and predictive (Swan, 2015c).

The CME is the venue for all human endeavour

The CME is not only the venue for all human and machine communication; it is also emerging as the venue for all human activity, or at least its partner and accompaniment. The CME is the venue for every form of personal and professional endeavour. This means in prominent life categories like work (enterprise software, intranets, job search and eLabor marketplaces), social interaction (email, texting, photo-sharing, social networks and dating), finance, economics and eCommerce (purchasing and selling items and asset management), and entertainment (TV, movies and video games). All other life categories can also be conducted via the CME such as obtaining news and information, education (massive open online courses, and online and distance learning), health management (information-seeking, service provider interaction, health social networks, self-tracking and health research studies), and personal contribution (charitable organizations, citizen science websites and problem-solving communities like Foldit, EteRNA and SETI@home).

The CME includes new media, but is a broader category. New media denotes digital content like text, audio, pictures and video that is made and stored in the 1s and 0s of computer code. The digital content can be delivered via different media, like radio, television, compact disks and digital video disks. The Internet is the communications platform on which digital media content can be delivered to a wide variety of devices, including desktop computers, wireless laptops, smartphones and other mobile devices (Nestor, 2011). Some key features of new media are its real-time on-demand dynamism and interactivity, for content access, production and modification, and the possibility for users to interact with the content, modify it and share it with others. Since anyone can create, publish, distribute, or otherwise participate with content at any time, new media is seen to have the property of democratization (Socha, 2010). The CME comprises all of this but is broader, first because users exhibit interactions that are a blend of both traditional and new media interactions (Flanagin, 2001), and because the definition given here of the CME as the connected world of computing is broader. The CME is an indispensable venue for the conduct of all manner of human activity, going beyond digital content production, consumption, and interaction to every personal and professional area of human endeavour.

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The CME reflects technology and information as "the Other"

A third feature of the CME, particularly produced by the CME as the venue for all of human and machine communication and activity, is the increasing emergence of technology as "the Other" in the human-technology relation. The CME is an information-rich environment in which both humans and machine entities participate. Humans are now in a wholly new situation with technology and information, where non-human entities are the primary other party in the majority of interactions (Floridi, 2014). Technology is "the Other" with whom humans are engaging the most. The theme of the "technology Other" has often been explored in film, with the increasing trend of humans and technology being portrayed in full partnership, for example in *Big Hero 6* (2014), *Her* (2013) and *Robot & Frank* (2012). Another way that the CME is manifesting the technology other is through embodiment, and in an escalation in the forms and types of human interaction. The technology other is no longer conceived narrowly as Amazon and Netflix recommendations, but instead may be a fully-embodied agent. An example of this is robotic personal assistants for home, and work like Robotbase's Personal Robot, MIT's JIBO and Amazon's Echo. A sense of embodiment may also be perceived with advanced voice assistants like Apple's Siri, Google Now and Microsoft's Cortana. The technology other is also seen in that the best "worker" for many contemporary jobs is a human and a machine in collaboration (Cowen, 2013). The CME is redefining the human-technology relation such that technology is the full other, where the CME's position is both as other and self-world mediator.

Simondon and the philosophy of new media

The CME offers many affirmative possibilities for human existence, but is also a venue for fear and uncertainty. Different views are highlighted in the philosophy of new media. Theorist Lev Manovich attempts to distinguish how digital media is different and illusory, for example in regard to reality, viewer interaction, and space (Manovich, 2001). Another view is that the impact of technology is pervasive and inevitable, such that "the [CME] determines the way we conceive reality, human life, and mind" (Canan, 2014). Other views are cautionary, as Mark Hansen discusses ideas from Paul Virilio, Jonathan Crary, and William Mitchell in *New Philosophy for New Media* (2004). These are summed up in an early critical position advanced by Baudrillard: "Electronic digitality has been accused of eviscerating the real and liquidating reference, truth, and objectivity" (Lenoir, 2004). The central issues are the status and nature of reality, and the situation of the subject as potentially being disembodied, dematerialized, and dehumanized.

The issue about truth and reality is quite valid – it is increasingly difficult if not impossible to discern what is "real" in the CME in cases ranging from images to people. The CME provides a panoply of ways to create images and "person entities," whether real or simulated. However, since reality multiplicity is a feature of the CME, a more productive reframing of the question of truth could be to focus on the qualities of representation in the gradation of a Simondonian capacity spectrum. Digital entities could be seen as existing on a capacity spectrum for the expression of authenticity and validation in representation. Simondon might also be mobilized to address the concerns about the subject and reality. The different forms of the subject (disembodied etc.) can be seen as versions that more and less effective individuations.

Simondon's worldview and individuation

The worldview that Simondon puts forward is one of dynamic processes, metastable equilibria and networks of relations. Subjects and groups do not self-constitute but arise as an effect of individuation. Individuation is the process of the formation and structuration of distinct entities like human beings and groups. Life is a never-ending succession of individuations or becomings. A living being becomes a subject through successive individuations. Individuations have both an internal and external side, and transindividuation is the interplay between interiority and exteriority, which are separate but connected in an ongoing relation. The individual individuation is comprised of two individuations: one interior to the individual (the psychic individuation), and the other exterior to the individual (the collective individuation). The psychic individuation is the formation of the psychology of individuals, and the collective

individuation is the formation of how these individual states are linked to the wider external world. The psychic individuation is itself composed of individuations of perception and emotion, where perception resolves self-world incompatibilities, and emotion operates the self-self and self-world relations. The collective individuation is needed because incompatibilities with the associated milieu cannot be fully overcome internally. Collective is meant as the collective individuation of the individual, and also in the sense of the collective itself, as a group or society. Individuals and groups are not opposing, the individual and the collective are both effects of the continual world process of individuation.

CME facilitates the individuation of the individual

The CME facilitates the individuation of the individual in ways that were not possible previously, in each of the three ways that the individual individuation arises, through incompatibilization problems with the environment, the subject's anxiety at exceeding its individuality, and in "Zarathustra moments" with another person as other.

Incompatibilizm problems between self and world

A subject and world are constantly in tension. A living being faces incompatibility problems with the *associated milieu* (world or environment) such as discomfort, hunger and emotion. The compatibilization of the living being to the milieu is a process where through perception the subject ideates and invents a new form or model with the goal of resolving the incompatibility problem. Perception and ideation is "an act of individuation operated by a living being to resolve a conflict with its milieu" (Simondon, 2005, p. 264). In the CME, a subject may face more self-world incompatibilizations due to reality multiplicity. The CME gives rise to many different environments: there is the traditional "found reality" of the physical world, plus the many "manufactured realities" of the digital world. Since the subject may be operating in different worlds, and incompatibilization is a feature of self-world interaction, there is the possibility for more incompatibilizations, and therefore more individuations. CME technologies already draw attention to self-world incompatibilizations at the basic level, for example notifications of being late, canceled meetings and traffic status. Next generation interactions could be more robust as the CME could facilitate the subject's individuation through a greater presentation and mediation of self-world incompatibilizations.

The rate of new ideation is greater in the CME than in the traditional physical world. Social networks allow individuals to be exposed to more ideas more rapidly than has been possible before (Pentland, 2014). Thus CME technologies might be developed to more directly target ideation, and help identify, resolve, and even catalyse self-world incompatibilizations. Incompatibilization is the idea of personal growth by breaking out of comfort zones. One possibility for this is through the fourth-person perspective that arises through the ensemble of connected world quantified-self tracking devices (Swan, 2014b). The fourth-person perspective is a new way of seeing the self through the private eyes of personalized technology, an objective metrics perspective that has been previously unavailable. Without the biases of other perspectives, the CME-mediated fourth-person perspective provides an intimate and objective look at behavior from the stance of a non-judging merely-reporting other. This is an example of technology-as-other; CME gadgets are the technological other, the alterity that provides a new means for humans to see themselves via exteriority.

Anxiety: The subject discovers that it exceeds its individuality

While self-world incompatibilizations can be resolved internally through perception and ideation, other incompatibilizations require external resolution through affectivity and the collective. The second means of triggering the individual individuation is through moments of anxiety when the subject discovers that it exceeds its individuality. A central idea for Simondon is unrealized preindividual potential, which is "the ether of reality" in the sense of unindividuated potential being infinitely available for individuation. Subjects are always more than the currently-existing individuals because they are composed of both already-realized individuations and the preindividual potential for new individuations. Being is not reducible to already-realized individuated being since subjects are continually constituted by new and ongoing individuations. Since the subject is both individual and more-than-individual, it means that it is

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incompatible with itself. This gives rise to a specific kind of incompatibilization problem between the currently-realized self and the potential self. The subject becomes aware of the exceeding-the-self incompatibilization problem through an emotional trigger. Emotion in the form of anxiety is the experience of the individual discovering this incompatibility; that it has within it that which exceeds it. An example of this in daily life is a moment of becoming aware of your true potential, and realising that you are not living up to it. Overall in some sense, an individual can be seen as "a mode of management of instability and excess" (Grosz, 2012, p. 39).

The lived experience of self-incompatibilization anxiety could be either great or horrible depending on one's perspective and perhaps the CME can render these moments in ways that are helpful for individuation. On one hand, self-incompatibilization anxiety is hopeful and liberating because it means that the subject is not static or fixed and can always grow and exceed itself. The possibility of becoming more and the fact that such potentiality is a fundamental constitutive dimension of the subject is generative and optimistic. On the other hand, the actual lived experience of self-incompatibilization anxiety can be a hideous conflict. The tension can only be resolved in the collective (external) side of the subject's individuation and not internally because the internal solution would be to individuate all remaining preindividual potential at once, which is impossible, or would be death. In some sense then, anxiety is "the highest achievement that a being on its own can attain as a subject" (Combes, 2013, p. 33), since it promulgates action-taking by the subject towards the collective, and results in individuation.

As the CME brings more self-world incompatibilizations with reality multiplicity, so too it brings more self-exceeding experiences. Numerous new forms of self-incompatibilization anxiety are available in the CME due to the physical limits of participation and emotional stress. Emotional stress may arise from the feeling of needing to be constantly online-connected (Fitzgerald, 2012), approval-seeking, fear of non-belonging and non-inclusion and the desire to be "liked" (Feilermay, 2014). In some sense, the "keeping up with the Joneses" mentality has been transmogrified in the CME: instead of meaning the acquisition of status through monetary currency and material goods, it means status acquisition through the new digital currencies of reputation, intention and attention. CME properties like Instagram, Facebook and Twitter inform you of the activities of others in real-time such that there is not just the fear of missing out (FOMO), but in fact the *proof* of missing out (POMO). For Simondon, however, the increase in self-exceeding incompatibilization problems per the CME can be seen as positive since it is a catalyst for individuation.

Transindividual individuation: "Zarathustra moments" with another person as Other

The third trigger for individual individuations is "Zarathustra moments," or transindividual disindividuations. The functional social relations of traditional everyday interaction can be an obstacle to the discovery and effectuation of preindividual potential, and therefore individuation. What is needed is an exceptional disindividuating event to strip a subject of its usual social function and reveal its preindividual potential to others. Simondon finds an example of this in Nietzsche, where Zarathustra sees a tightrope walker fall and die. Shifting the ropewalker out of his usual social role as a performer leads Zarathustra to see the ropewalker's preindividual potential directly, and through that, his own preindividual potential (Simondon, 2005, p. 280). An observer sees the preindividual potential in the other at the moment of the shift in functional social relations, which causes the subject to become aware of his own preindividual potential, and thus become engaged in a subjectivation ordeal called forth by the anxiety of this discovery. This process disindividuates the subject: the transindividual disindividuation loosens the subject's constituted individuality, which is engulfed by the preindividual, and conditions a new individuation (Combes 2013, p. 38). The break with functional social relations is important not only to abruptly show the other in a non-usual role, but also to strip the sense of one's own belonging to a social community so that a new individuation may be effectuated.

The structure of the Zarathustra moment is that a disindividuating event removes a subject from its usual social function and reveals its preindividual potential to others, which causes another subject to become aware of his own preindividual potential, and individuate per this discovery. However, the way that social functional relations are reflected in the CME is not generally such that there is a disindividuating event that strips a subject their functional identity. Instead it is the opposite; others are

not stripped of their identity to appear in a generalized state, but appear as an even-more purified version of themselves due to context-specificity. Individuals may not be seen as full persons in the CME but only as their digital identity in specific situations, such as a health social network, or software developer forum. While a key feature of the CME is reality multiplicity and digital identity multiplicity, any one presentation of identity may be highly specific, even if profile details are available about the full-person identity. Thus the encounter with the other does not occur as a removal of social functional identity, but as a concentrated context-specific interaction. Thus Zarathustra moments might be less available in the CME.

However, while the Zarathustra moment triggers the individuation in the Simondonian case, it could be that the stripping of social functional relations does not matter, it is just one mechanism, and that individuation can be accessed alternatively. The structure of the Zarathustra moment was not required in the other two modes of triggering individuation, self-world and exceeding-the-self incompatibilizations. The salient structural element of the Zarathustra moment is a disindividuating encounter that gives the subject access to the collective or exteriority, whereby they can see themselves differently. The link to exteriority through the transindividual relation is what is crucial, where the transindividual relation is the interplay between interiority and exteriority.

The transindividual disindividuation works because it produces an exteriority. Through the disindividuating relation to the other, the subject is able to appear to itself as a subject and capable of having a relation to itself. Notably, it is the other (an exteriority), that provokes the relation to the self, not an internal process that produces the self-self relation. The other, not the self, is required for the self to have a full relation to itself. How this happens is that when the other is no longer encountered on the basis of its social function, it becomes that which puts the subject into question, forcing the subject to no longer perceive itself through the intersubjective representations of sociality but directly as preindividual potential. However, other mechanisms, like the fourth-person perspective afforded by the CME, can foster the disindividuating encounter such that the subject is able to appear to itself as a subject and capable of having a relation to itself in a new way. The CME's fourth-person perspective grants the same nakedness of the anxiety-inducing Zarathustra moment such that a different relation to the self is possible.

CME as a catalyst for individuation

The transindividual relation is the self-constituting relation of subjects to themselves that happens through their own disindividuating encounters with the Other or any "Other" including technology-as-other. Any mechanism can potentially provide the requisite alterity for the disindividuating encounter, it does not have to be another person stripped of their social functional relation in a Zarathustra moment. The transindividual relation, as the interplay of interiority and exteriority that triggers a subjectivation moment, is a recurring philosophical problematic. Derrida's "transindividual relation" is the "exterior reflexive fold of subjectivation" where similar to Simondon, the subject is not fixed but constantly being rewritten and reinterpreted, and is constituted by writing itself into exteriority through a self-touch relation (Derrida, 2005). The *self-touch* relation (seeing the self from an alterity) triggers subjectivation through *exscription* (the subject writing itself in exteriority). Heidegger's "transindividual relation" is *Geworfenheit*, the opening into which the "I" is thrown and must respond by subjectivating.

The Zarathustra moment is also the case of another recurring philosophical problematic of the subject experiencing moments of anxiety as a trigger for subjectivation. For Heidegger, the anxiety is the wake-up call from the conscious that forces one to choose whether to live authentically into one's own finitude. For Kierkegaard, dread is the motivation towards subjective truth, true faith, and existentially determining one's own way. For Bergson, it is discomfort and great crises that activate the possibility to exercise free will. For all of these philosophers including Simondon, anxiety-triggered subjectivation moments are rare. One great benefit of the CME is in catalysing more of these moments; however it must be queried how volitional these moments can or should be. How active can or should a subject be in triggering moments of subjectivation, especially when the subject is often an effect not a cause of the world process like individuation. Initially, it might seem that individuation cannot be volitional. It occurs through unforeseeable events that are provoked externally and "cannot lie in a voluntary decision by the subject" (Combes, 2013, p. 38). However, an answer can be inferred in that while individuals are effects of world processes, they are not passive but rather continuously ideating and resolving incompatibilization problems and therefore can

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try to catalyse subjectivation moments by being aware of how subjectivation happens and putting themselves into propitious situations. While these anxiety-triggered subjectivation moments have been rare, they need not be. CME technologies might be employed to effectuate all manner of anxiety-triggered subjectivation moments. Thus the role and position of the CME persists as a means of facilitating greater possibilities for individuation, catalysing more situations where individuation can be realised.

CME facilitates the individuation of the collective

For the full subjectivation of the individual, there must be not just "the collective individuation of the individual*"* but also the individual's participation in a collective since "the subject cannot coincide with himself even in the collective individuation, because the individuated and the preindividual cannot coincide directly" (Simondon, 1989b, p. 108). Thus "the final individuation cannot be done within the being of the subject; it can only be done through other beings, as a transindividual collective" (Simondon, 1989b, p. 213). The result is that the subject is not reducible to either the pure individual or the pure social (collective). Neither individual nor collective is privileged, what is most important is the relation between them in transindividual reality. As with the individuation of the individual, the CME can potentially facilitate the individuation of the collective in a number of important ways that were less possible before the CME. Three aspects of Simondon's collective individuation are explored: society as a dynamic and shifting set of relations, group formation and the collective structuration of emotion.

Society is a dynamic network of relations

Simondon's worldview of society is that it is a dynamic network of relations. The transindividual relation (the interplay between interiority and exteriority) provides a way of understanding both the individual and the relation between the individual and society. The traditional psychological and sociological approach is that the individual and society exist in an established relation as one term to another. However this is static and one-dimensional. Instead for Simondon, the relation is that of a reciprocal environment of exchanges of information and causality in the larger scope of a system that individuates. The ontological unit of precedence is the system. The world is a system that individuates groups and individuals where the individual is the effect of the individual individuation, and the group is the effect of the collective individuation.

Individuals are already linked through preindividual reality, and this is the precondition for the individuation of the group: "before structuring itself, the collective is already in subjects, in the form of parts of uneffectuated nature" (Combes, 2013, p. 51). Preindividual reality is inspired by the pre-Socratic notion of nature or *apeiron* (the undetermined, possibility, unindividuated preindividual potential). Individuals are connected in the collective initially by being connected through the undetermined. It is because of this shared potential that individuals can enter into relation with one another and constitute a collective. The individuation of the collective connects "the natures that are brought by individuals, but not contained in the already-constituted individualities of these individuals" (Simondon, 1989b, p. 197). If individuals were not already connected through preindividual potential, a collective could not individuate. "The collective has its own ontogenetic individuation utilising the potentials brought by the preindividual reality contained within beings" (Simondon, 1989b, p. 211). Thus the collective is a new and different linkage of preindividual potential across the social fabric of individuals: "the collective arises through the preindividual zone of subjects that remains uneffectuated by any functional relation between individuals" (Combes, 2013, p. 38). The collective individuation is the situation of the formation of a new group, one that goes beyond already-existing functional social relations between individuals, as Zarathustra's spectator to the ropewalker's performance artist.

Through the interplay between the interior and the exterior in the transindividual relation, the connection is not as one term to another but in the complexity of overlap where "the individual only enters into relationship with the social through the social" (Simondon, 2005, p. 295). Only by being already preconnected in the social or collective, through shared preindividual potential, are subjects able to enter into new social relationships. Importantly, in the social relation, "the interiority of the group is a certain dimension of the individual personality, and the social is a zone of participation around the

individual" (Simondon, 2005, p. 295). The individual is distinct from the social or the group, and the two are linked in a transindividual relation. The group's interior is constituted by parts of group member personalities. The group is exterior to the individual, existing as a zone of participation around individual group members.

Several aspects of the CME point to it as an enactment venue for the collective individuation as thus described. First, the preindividual potential of individuals is already connected in the sense that any human agent is potentially linked to all other humans through the CME. Second, the CME serves as the zone of social participation around individuals in which the collective individuation takes place. Third, both individuation and the CME focus on the key activity of participation. There is an expectation of participation in the CME, and a progression in the magnitude of digital collaboration, from sharing to cooperation to collective action (Shirky, 2009). The collective action-taking capacities afforded by the CME have been recently demonstrated in collective individuations in the cases of in global crisis response (Hui, 2013) and political action. CME social media allowed the coordination of Arab Spring, the Hong Kong university protests featuring real-time personalized drone footage, and the "*Je suis Charlie*" manifestations. What is new in the CME is that individuals are always-already situated in the global social through the connected world, and thus able to immediately participate in new collective individuations in real-time.

Group formation

Group formation is the next moment in Simondon's theory of collective individuation. Just as he rejects theories of individual subject formation for taking the subject as already formed, he rejects theories of the group and society from psychology and sociology for similarly taking the group as already formed. The concept of individuation instead focuses on how the individual subject and group arise. A group is not formed as "an assemblage of individuals" (Simondon, 1989b, p. 182), or per a sense of sociological belonging to a group entity. Instead, a group "is born when forces held within many individuals lead to a collective structuration" (Simondon, 1989b, p. 184). A group individuation is two simultaneous inseparable individuations: the individuation *of the entity that is the group* and an individuation *of individuals as grouped individuals*, where grouped individuals become "group individuals" (Simondon, 1989b, p. 185) or units for the collective (Simondon, 1992, p. 307).

The group is not founded by individuals with preexisting relations; rather the individuation brings about the collective: "it is the individuation of the collective that is the relation between individuated beings" (Simondon, 2005, p. 11). The collective is not a result of the relation; it is the relation that expresses the individuation of the collective. As with the individuation of the subject, the collective is an effect, not a cause, of the individuation process. As part of this relation, the individual is protected from being controlled by and absorbed into the group by only participating in the group with a part of itself; via a "certain dimension of the individual personality" that is the generation of a new personality. The group is constituted by "the superposition of individual personalities" (Simondon, 1989b, p. 182) whose genesis "is contemporaneous with the genesis of the group" (Simondon, 1989b, p.183). The individual participates in the group in a way that is constitutive of the group, and self and group individuate simultaneously.

The CME offers many more opportunities for group formation and collective individuation. Frictions like the cost of joining and participating are reduced, so there can be more activity. Humans want to like, join, participate, share and engage as a means of social belonging and self-actualization. The CME provides graduated ways to do this in comfortable funnels of engagement that progress from light to heavy, with escalated action-taking such as liking, subscribing, joining, participating, coordinating and leading. While other new challenges arise regarding valorization and selection, for example information overload and filter failure (Asay, 2009), the bigger point is the greatly-extended possibilities for collective individuation offered though the CME.

Role of emotion in individuation

Emotion is the trigger for both individual and collective individuations. In individual individuations, emotion as anxiety is the signal of self-world and exceeding-the-self incompatibilizations and Zarathustra

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moments. In collective individuations, emotion structures itself across multiple beings to effectuate group individuation. Emotion has a causal role in the individuation of the collective. Individuals are already connected in the collective through preindividual reality as a precondition for individuation, and then the actual operation of the group individuation happens through a structuring of emotion. The collective is born at the same time as an emotion structures itself across several subjects, and as such structuration of that emotion. Specifically, "emotion is the power to create an individuation of the collective that will discover and attach the individuated being; emotion prefigures the discovery of the collective" (Simondon, 1989b, p. 212). The structuring of emotion is the necessary genesis of the collective and the collective will only arise to the extent that an emotion structures itself across grouped individuals (Simondon, 1989b, p. 211).

Simondon's theory of emotional latency

Simondon affirms two senses of emotion, emotion in the familiar everyday sense, and emotion in the sense of the *emotional latency* that structures itself across individuals and effectuates the collective individuation. "Emotional latency is the onset of a new structuration that can only stabilize itself in the discovery of the collective" (Simondon, 1989b, p. 213). Emotional latency explains what happens in both *the collective individuation of the individual* and *the individuation of the collective* as there is a transindividual relation, a structuring of emotion between the inside and the outside. However, "action is the individuation of the collective grasped on the side of the collective, while emotion is the same individuation of the collective grasped on the side of the individual" (Simondon, 1989b, pp. 106-107). Action-taking is the externally-manifesting property of the collective.

Emotion, collective individuation, and the CME

There are several ways that the CME facilitates the process of emotional latency structuring itself across a group and producing collective individuation. One example is through music, where the CME can orchestrate individuals coming together in an experience that results in a collective individuation. Shared experience produces a collective structuration of emotion that then individuates a group, the group being those who have had that particular experience. Fig. 1 illustrates examples of individuals participating in CME-mediated collective individuations, an Electronic Dance Music (EDM) event, and a virtual choir. In the virtual choir, singers record and upload their videos which are synchronized and combined into a single performance.

Figure 1: Examples of Simondon's CME-facilitated Collective Individuation: Electronic Dance Music (EDM) event (Q-dance) and Eric Whitacre's Virtual Choir 3 "Water Night"

In EDM shows DJs use CME technologies to create immersive experiences specifically designed to evoke and progress audience emotions. Media theorists have cited EDM as a complete expression of the CME in creating fully technologically-designed and mediated experiences (Butler, 2006; Rief, 2009). These experiences are capable of transforming the environment and the life of the subject (Vitos, 2014),

meaning producing both individual and collective individuations. Another example of collective structuration is the possibility of sharing subjective experience in the CME, possibly through immersive headsets like the Oculus Rift and Microsoft's HoloLens. These CME technologies enable "you to feel like you are actually present in another place with other people," and thus share entire experiences and adventures with others (Zuckerberg, 2014). The distinction is not just sharing a picture of an experience afterwards, or in real-time as CME property Instagram allows, but actually participating in a live experience like a sports event with others present with you in digital reality. The great potential of the CME is in providing experiences that allow emotion to be structured quickly and effectively across individuals such that they become group individuals through the individuation of the collective.

CME facilitates individuation of the collective when technology is the Other

One key feature of the CME is that technology, data and information are the full-fledged other in many and perhaps most of human interactions ranging from the slightest information-obtaining to the deepest level of meaning-making. Since technology is the other, and collective individuation is crucial for subjectivation, there could be collective individuations where the collective is comprised of both humans and technology entities as group members. Simondon clarifies that individuation is not privileged to human subjects but applies to all living beings. Machine entities could be said to be sufficiently "living" for the purposes of collective individuation in the sense that they have some degree of agency, autonomy and proactive interaction with humans. Here, individuation can be seen as the possibility for any agent to realize its potentiality for growth and actualization. Thus human and machine entities may be individuating, co-individuating, and participating in collective individuations in a wide possibility space or capacity spectrum for individuation.

Capacity-driven subjectivation

Simondon sees entities as existing on a spectrum of capacity for individuation, where their difference is one "of level rather than nature" (Simondon, 2005, p. 272). The notion of a spectrum accommodates many different kinds of entities within the same paradigm. Existing and future versions of humans and technology entities could be mapped onto the continuum per the same parameter of differing by degree (like temperature) not nature (like form). Entities subjectivate based on their capacity to do so, not their underlying morphology, since "what defines a domain of being are not the substances filling it, but the distinctions born of individuation" (Combes, 2013, p. 28). All entities thus exist on a spectrum of different degrees of capacity for different kinds of action-taking. Thus entities are seen in terms of degrees of capability, which is dynamic potentiality, instead of as fixed quantities, which is rigid and static. This is an extremely empowering anti-essentialist, anti-determinist view of subjectivation. Morphology does not predetermine, limit or govern the possibilities of an organism. Thinking in terms of capacity instead of morphology affirmatively orients the view towards the open-ended consideration of new possibilities for being and action in the world, as opposed to the circumscribed, finite and fixed possibilities defined by morphological classification.

One implication is that the basis for the relation between entities is also not related to underlying morphology, but rather capacity for individuation. This suggests exciting upside possibilities for individual and collective growth given the right stimulus and resources. Further, Simondon's consistent themes of dynamism and process are present here too, as any placement on a capacity spectrum is only metastable or ephemeral, based on the present snapshot moment of individuation which is always expanding. A capacity-driven view of subjectivation thus implies mobility and the ability for entities to grow and individuate even more given resource availability. External factors like stimulus and resources as opposed to internal factors like morphology become the constraint on subjectivation. Just as intelligence is conceived as a raw quality that can be enabled with education, so too can the capacity for any entity's individuation be mobilized.

Capacity-based theories of subjectivation are espoused by Simondon, and also Spinoza (an influential thinker for Simondon), and Bergson. For Spinoza, the subject is defined on the basis of "power of action," which is the capacity to affect others and to be affected by others. For Bergson, perception is the subject's

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capacity for action. Also like Simondon, Spinoza is concerned with the collective, acknowledging the Hobbesian necessity of man living in societies, but seeking ways for man to feel freer doing so. Spinoza aims at what might be considered a prototype of Simondon's collective individuation (and Deleuze and Guattari's *desiring-production*) in claiming that humans can live together most productively by expressing rather than subjugating their true desires, that "men will be most useful one to another when each seeks most that which is useful to him" (Spinoza, 1677). For Simondon, Spinoza, and Bergson, the subject is dynamically situated on a spectrum of capacity for individuation, affect, or power of action.

Human-machine CME capacity spectrum for co-actualization

As a model, the capacity spectrum is a flexible structure that could include and productively organize the conceptualization and execution of many types of endeavour, especially between diverse entities. A capacity spectrum is not just for individuation, but for the realization of any sort of capacity. For example, compassion, empathy, magnanimity, creativity and ideation could all be mapped onto capacity spectra as a simple organising parameter (Swan, 2014a). Further, the notion of a capacity spectrum could be extended from just being a continuum to a full 2-dimensional plane or 3-dimensional volume of possibility space as a way to visualize the different individuation capabilities of diverse entities within the same framework.

A capacity spectrum is helpful because it is a framework that does not highlight morphological differences but rather aligns entities on the same ground and value system for their most important forward-looking shared parameters, like growth and actualization. The higher-order objective is the ability to individuate; to learn, grow, and contribute more, for both human and technology entities, and the two in symbiosis and synthesis. In addition, the capacity spectrum is not just a current mode of mapping and interaction among diverse entities, but also a mechanism for the successful transition to different and uncertain futures. This is important as technology advances, or individuates, at much higher rates than biological humans. Productive interaction between intelligent species could be fostered through the notion of their being joined in the common framework of a capacity spectrum for mutual growth in digital society (Swan, 2015e).

The limitations of Simondon's individuation

There could be many potential limitations and critiques of both Simondon's theory of individuation, and the way it has been employed here, in the claim that the CME facilitates the greater possibility for individuation. One is that there is an overreliance on emotion and an external other in individuation. However, it might be possible to fulfil the same functionality with alternative mechanisms. Emotion and the collective have been the convenient factors that have been involved in individuation, but they may not be required (Swan, 2014a). CME technologies might bring better, quicker, more objective and action-oriented information to individuals to replace or supplement the reliance on emotion and the collective as other. In fact, the current dependencies may actually limit the possibilities for the individual's subjectivation since individuation is limited to propitious moments. Instead these moments might be catalysed in many other ways by the CME's ability to structure emotion and produce exteriority and alterity.

A second potential limitation is the possibility that the CME infantilizes humans rather than helping them to advance. The argument is that the automation economy displaces humans into irrelevancy (Carr, 2014). Indeed, the immediate reaction to the CME could be that man's agency is being usurped. Humans appear coddled into passivity and overly-dependent upon technology; no longer able to think for themselves with the CME automatically piloting all aspects of daily life. However, what is happening at a higher level is that large classes of time-occupying tasks are being removed from human purview and pushed into realization via technology. What this means is not infantilization, but the continued trend of technology making life easier, not just in mechanical tasks (as the role of technology was previously conceived), but now importantly in cognitive tasks too. Thus human effort might be deployed towards more complex and rewarding activities involving creativity, invention, ideation and problem-solving. The CME should be seen as a tool for both mechanical task relief and cognitive processing offload, and mental offload not just for lower-level tasks like obtaining information, but increasingly for cognitively-relevant tasks like planning and coordination.

Conclusion

The CME can potentially facilitate individuation in ways that were previously impossible. The purpose of the CME can be seen as to uplevel existence, to allow humans to engage with themselves and the world in new ways that produce growth, actualization and individuation. The CME might be able to help with greater activation of individuation, both the individuation of the individual, and the individuation of the collective, and also now the individuation of the collective with machine others as group members. In the individual individuation, CME technologies might help facilitate the three types of individuation, anxiety-driven individuations through self-world and exceeding-the-self incompatibilizations, and Zarathustra moments of disindividuating individuation. Likewise in the collective individuation, CME technologies might help facilitate the structuring of emotion or other input signals across a group that then causes its individuation. Also in the case of human-technology individuations, the CME is the venue, facilitating mechanism and mediator of such individuations. Overall the CME allows much greater possibility for all forms of individuation.

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Simondon and Big Data

Simon Mills – De Montfort University
SMills@dmu.ac.uk

This article explores some limitations of the claims made for Big Data, particularly in the work of Alex Pentland, as providing a universal method for understanding and managing the social. It does so by analysing Pentland's social physics in the light of the work of Gilbert Simondon. It argues that Pentland's social theory is essentially cybernetic and thus open to Simondon's criticisms of this schema of understanding. Additionally, it questions the way social physics leads to the development of hypertelic social structures; its lack of ability for theorizing invention, teleology and open systems; and queries the social ontology it has developed. Simondon's reformed notion of information, situated as it is, between determinism and indeterminism, may not disagree with Pentland's claim that "we're going to reinvent what it means to have a human society," but understands the nature of this claim in a radically different way. Where Pentland's work points towards yet another phase of the control revolution, this article asserts that it misses the more important question of how it theorizes indeterminacy and omits consideration of the transindividual as a mode of the social.

"The rise of the Information Society itself, more than even the parallel development of formal information theory, has exposed the centrality of information processing, communication, and control to all aspects of human society and social behaviour. It is to these fundamental informational concepts, I believe, that we social scientists may hope to reduce our proliferating but still largely unsystematic knowledge of social structure and process" (Beniger, 1986, p. 436). With this conclusion to his extensive historical analysis of the development of the role of information for social control, James Beniger reaffirms the importance for sociology of a broadly cybernetic understanding of society. Although he questions first-order cybernetics focus on control behaviour rather than programming[1] it is clear that, in his view, the three Cs of cybernetics (command, control, and communication) offer the most promising approach for understanding social complexity. We are currently witnessing the furtherance of that project with the recent development of Big Data.

In this article we will explore some of the limitations for the sociological claims made for Big Data through the lens of the work of the philosopher, Gilbert Simondon. By doing so we also hope to demonstrate the ongoing relevance of Simondon's work. In particular we will focus on Alex Pentland's work on social physics (2014), which is the most fully developed theory for the application of Big Data to understanding the social produced to date. Another aim is to situate Big Data, and in particular social physics, within the genealogy of cybernetics. One of the striking achievements of Simondon's work is that he questioned the main tenets of cybernetics, prior to it attaining widespread application, whilst also developing upon the work of cybernetics himself.

At the outset, it is necessary to be clear regarding what some of the claims being made for Big Data are in relation to the domain of the social. According to Kitchin (2013), what is new regarding Big Data is not just the massive volume of data available but also the near real-time speed of its collection and distribution (velocity) from a wide number of sources (variety). This being due to the widespread usage of networked digital devices. The overall aim being to collect and analyse an *exhaustive* amount of data regarding the targeted population.

Although initial claims for Big Data's ability for modelling and prediction were made in relation to business, marketing, science and economics, increasingly it is being touted as offering solutions in other areas such as healthcare, transport, housing, and more generally as offering a broad sociological method.

[1] Whereas *control* is defined as "purposive influence toward a predetermined goal", Beniger (1986, pp. 39-40) calls the setting of the goal to be achieved *programming*.

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Such ambition is also closely related to the development of phenomenon such as the Internet of Things, Web Squared and persuasive technology.[2]

Many of the applications to which Big Data has been applied involve relatively closed systems where data is collected to investigate particular problems. For example, it is used for systems controlling traffic flow, where real-time data is algorithmically analysed relative to models in order to steer them towards a pre-programmed state.

A significant issue with this approach is gaining an understanding of the causal operation of the systems involved. As is well documented the use of quantitative data, due to the problem of induction, leads to the ability to derive correlations but not necessarily the presence of causality. One notorious claim made for Big Data by Chris Anderson (2008, no page) is that it dissolves this problem through the sheer scale of quantitative analysis:

> This is a world where massive amounts of data and applied mathematics replace every other tool that might be brought to bear. Out with every theory of human behaviour, from linguistics to sociology. Forget taxonomy, ontology and psychology ... We can throw the numbers into the biggest computing clusters the world has ever seen and let statistical algorithms find patterns where science cannot.

The strong claim for Big Data, then, is that our understanding of systems of all kind will emerge from working on data itself and messy theoretical struggles regarding interpretation will be dispensed with. Kitchin (2013, p. 130) sees this as a re-emergence of empiricism in which the model is to "collect first and ask questions later" (Croll as quoted in Kitchin 2013).

Although there is good reason to be optimistic about some of the claims made for the use of Big Data for regulating relatively closed and limited systems or networks (e.g. the electricity grid, traffic control, shopping behaviours), should we approach the more ambitious claims made for it to regulate society as a whole with some caution? For example, how seriously should we take Alex Pentland, a leading proponent for Big Data, when he states:

> Adam Smith and Karl Marx were wrong, or at least had only half the answers. Why? Because they talked about markets and classes, but those are aggregates. They're averages ... This is the first time in human history that we have the ability to see enough about ourselves that we can hope to actually build social systems that work qualitatively better than the systems we've always had. That's a remarkable change. It's like the phase transition that happened when writing was developed or when education became ubiquitous, or perhaps when people began being tied together via the Internet (Pentland 2012).

It is clear from this statement that Pentland's aim is to undermine traditional theories of social abstraction and develop his own operationalized abstraction with a wholly quantitative and empiricist basis whose scientific credentials are underscored by the name "social physics". However, as well as dismissing theories based on class Pentland is clear that social physics is not just going to be a reductionist theory, such as found in some recent economic theories regarding individuals as rational actors whose collective actions lead to an emergent equilibrium. Pentland (2014, p. 4) maintains the existence of "social effects" and claims that these are constituted, in a manner reminiscent of the account given in cybernetics, through the flow of information and ideas:

> Social physics is a quantitative social science that describes reliable, mathematical connections between information and idea flow on the one hand and people's behaviour on the other. Social physics helps us understand how ideas flow from person to person through the mechanism of social learning and

[2] The Internet of Things and Web Squared point to the increasingly widespread and automated ways in which data is collected, distributed and analysed in real time. Persuasive technology describes the way that such data can be utilized to attempt to manage user behaviour.

> how this flow of ideas ends up shaping the norms, productivity and creative output of our companies, cities and societies.

Social physics thus differs from the economic rational actor approach which views individuals as rationally determining their goals and actions because it demonstrates "that both peoples desires and their decisions about how to act are often dominated by social network effects" (Pentland, 2014, p. 59). As such it shifts the focus away from individuals as drivers of action onto the flows of information and ideas which individuals inhabit: "ideas flow is the real story of community and culture. The rest is just surface appearance and illusion" (Pentland, 2014, p. 44).

Pentland's (2014, p. 20) definition of an idea is "a strategy for instrumental behaviour" and information is "an observation that can be incorporated into an idea". As such, although Pentland allows for individual goals and motives these are subsumed into the overall flow of ideas throughout social networks.

The promise of social physics is to map the patterns created by these flows of information and ideas in order to understand social behaviour at a more fine-grained level of micropatterns, "because they don't just average out to the classical way of understanding society" (Pentland, 2014, p. 10). Pentland further maintains that traditional quantitative and qualitative sociological methods collect insufficient amounts of data to come close to being able to develop predictive models of future behaviour.

This is where Big Data comes to the fore. It is the ability to use contemporary digital technology to collect, store and analyse vast amounts of "digital bread crumbs" which enables social physics to accurately map social networks and see how "ideas turn into behaviour and action".

But of course, the overriding goal of such an enterprise is not just to map the operation of the social but, in the tradition of socio-cybernetics as developed by Wiener and Beer, to develop strategies for its command and control. As such Pentland's (2014, p. 171) text is littered with claims for the positive potential of "reality mining" such as when discussing applying social physics to cities; "we want to engineer the environment to enhance both exploration and engagement"; or that social networks "can provide more effective incentives to promote the development and enforcement of useful social norms. We need to begin applying these lessons to reinvent our current economic, government, and work systems" (Pentland, 2014, p. 208).

As far as Pentland (2014, p. 180) is concerned the main issue preventing this project from fulfilling its utopian potential is that of privacy, or to use terms which rather give away the implicit liberal politics underpinning his work, to "define ownership rights" so that we "recognize personal data as a valuable asset of the individual that is given to companies and government in return for services".

In what follows I want to think about the sociological claims made for Big Data via the work of Gilbert Simondon. It is my contention that social physics emerged from a cybernetic world picture updated to reflect contemporary technological developments. As such, Simondon's work is particularly relevant due to its unique position in combining aspects of cybernetics with the tradition of French epistemology as well as developing an original perspective on both technology and the nature of the social. The claims made for Big Data and for social physics traverse these same domains and as such a dialogue between them seems appropriate.

Open systems and hypertelia

An initial observation, from a Simondonian perspective, is that in the claims made for Big Data, especially in relation to social physics, little has been mentioned regarding the extent of the openness of the systems under discussion. Pentland (2012; 2014, p. 203) is optimistic for the potential of Big Data for maintaining concretized techno-social mechanisms whose stability he claims can be improved through designing in "social efficiency, operational efficiency, and resilience":

> That's the promise of Big Data, to really understand the systems that make our technological society. As you begin to understand them, then you can build systems that are better. The promise is for financial systems that don't melt down, governments that don't get mired in inaction, health systems that actually work, and so on, and so forth.

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One danger of such a proposition is that it aims towards the development of hypertelic social structures. To understand the implication of this we need to briefly describe the central role that individuation plays in Simondon's ontology for understanding a broad range of phenomena and for avoiding a substantialist metaphysic. Simondon expends much effort critiquing metaphysical theories which assume *a priori* the existence of fully-constituted individuals. His ontology is concerned rather with the ontogenetic operations by which individuals come to be structured and continue to individuate.

Generally speaking, for Simondon the development and continuing individuation of a system occurs due to the retention of a double relationship to both an associated milieu and to what he calls the pre-individual[3]. One of the places where Simondon most clearly explains his notion of individuation is in relation to technical individuals:

> Such individualization is possible because of the recurrence of causality in the environment which the technical being creates around itself, an environment which it influences and by which it is influenced. This environment, which is at the same time natural and technical, can be called the associated milieu. By means of this the technical being is conditioned in its operation. This is no fabricated milieu, or at least it is not wholly fabricated; it is a definite system of natural elements surrounding the technical object. The associated milieu is the mediator of the relationship between manufactured technical elements and natural elements within which the technical being functions (Simondon, 1980, p. 60).

From this we can ascertain that the individualization of a technical individual as a coherent system means that its own operation partially determines the necessary conditions for its continuing operation; that a satisfactory environment for the technical object is created by some transformation of a part of the natural world; and that technical individuals operate with a level of indeterminacy which enables them to individuate further in relation to changes in the external environment.

In addition to the stipulation of an associated milieu it is also worthwhile mentioning the difference of the abstract technical object from that of the concrete. The development of a technical object occurs via a process of increasing concretization:

> The essence of the concretization of a technical object is the organizing of functional sub-systems into the total functioning ... Each structure fulfills a number of functions; but in the abstract technical object each structure fulfills only one essential and positive function that is integrated into the functioning of the whole, whereas in the concrete technical object all functions fulfilled by a particular structure are positive, essential, and integrated into the functioning whole (Simondon, 1980, p. 31).

The difference is that a technical object which contains abstract structures necessary to its operation is comprised of a number of systems which are operationally independent from one another and which each perform only a single function. As such their operation often conflicts, as they aren't operationally integrated. The process of concretization has occurred when the requirement for such abstract structures is overcome by a solution that utilizes a single structure, which operates with a coherent level of pluri-functionality.

An example Simondon gives is that of a water-cooled combustion engine which consists of two abstract systems (the engine and the water cooling system) the concretized solution to which is the use of gills on the piston cylinder which solves the problem of cooling through air flow whilst also functioning as part of the structural support for the cylinder. An object is described as hypertelic when it is so closed as to be abstracted from both its genesis and any possibility of further functional development. A hypertelic tool signifies the completion of a lineage, to which no more development can be made.

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[3] The pre-individual is a foundational concept in Simondon's ontology, in the sense that it supplies his ontogenetic ontology with a non-substantial primary reality. As such the pre-individual is the "first phase of being" that also has the capacity to fall out of phase with itself. Thus the pre-individual does not name a primary substance but the fundamental condition of being as metastable. Simondon's (2005, p. 327) main sources of inspiration for the pre-individual comes from thermodynamic notion of metastability which describes a state rich in potentials and that is neither wholly stable nor unstable but can "produce a sudden alteration leading to a new equally metastable structure".

Although the description used so far has been specific to the individuation of technical individuals this general schema is also applied by Simondon to a broad range of phenomena at different scales. For example, in *The Limits of Human Progress* (2010, p. 230), Simondon describes human cultural progress ('the entire system of activity and existence constituted by what man produces and what man is') using the same terms as those used to describe technical development, that is as the progressive operation of concretizing relations between differing domains (e.g. language, ethics, religion, technology) in order to resolve disparities. Progress in any domain requires that it isn't saturated (hypertelic) but retains a degree of resonance, both internally and with other domains, to enable further development. Such development is also described as occurring via phase shifts involving the division of domains and the transformation of their relations.

However, we should be careful in too swiftly transposing the account of the mode of individuation of technical objects onto that of other domains, such as that of vital and psychic individuals. Although there are many similarities with how the individuation of these are understood there are also significant differences which ensure that, for example, the individuation of a vital individual can never be reduced to that of a technical individual. The individuation of technical objects occurs in discrete leaps whereas vital individuation is continuous. These differences are far too complex to give an account of here where all that's required is an understanding of the general axiomatic at work in Simondon's ontology.

Simondon's account of the individuation of psychic individuals also shares some of these common aspects such as the importance of the subject's relation to its milieu and the overcoming of problems. However an additional aspect of this account involves the role of meaning. To help clarify this Simondon (1989, p. 126) brings into play the difference between signals and signification. Individuation involves the overcoming of problematic disparities through a process of resolution, the result of which is the appearance of an individual (individualization), or "a new systematic" by which signification also appears. Signification here is the concurrent development of meaning or sense which accompanies the resolving individuation of a new systematic. In contrast signals are representative and can be understood as being like the messages passed between individualized individuals in traditional Information Theory. Signification however marks the actual spatio-temporal accomplishment of an individual's individuation in relation to both its environment and within itself.

There may appear a superficial similarity between Simondon's use of signal and signification with Pentland's use of information and ideas here. However, where Pentland's understanding of the social focuses just on the flow of ideas and information Simondon highlights the central role of individuation, of both the psychic individual and the collective, associated with signification. In this way Simondon resists the hypertelia to which Pentland's account is susceptible.

The questions need to be asked, if we are to interrogate the sociological claims made for Big Data from a Simondonian perspective, to what extent do these claims rely on an assumption of social systems as being abstract enough that their continued operation can be maintained in a controlled state of equilibrium via data analysis or conversely, and perhaps more troubling, to what extent does such proposed management of the social require that it becomes hypertelic?

Pentland's social physics doesn't entirely fail to respond to these questions but its responses are limited. The vast majority of the systems discussed in his book concern what can be considered as examples of systems understood in a relatively abstract sense such as financial investing, health monitoring, marketing and improving the productivity of a company. Although we know that the complexity of the social means that all these examples, as well as many others, are interconnected to some extent, Pentland needs to understand them as relatively closed. He is therefore more akin in his thinking to the theorizing of autopoieses such as that of Maturana, Varela and Luhmann.[4]

As such social physics' main concern is with the self-maintenance of systems, or their untroubled operation in relations of structural coupling. In itself this is an understandable enterprise when involving the protection and improvement of public utility systems. However, is the possibility of expanding such a

[4] Making such a comparison is problematic given the theoretical differences of these thinkers. However, Pentland's social physics shares aspects of autopoiesis with its assumed operational closure of systems such that they operate only utilizing that which they produce.

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vision to the much larger and more complex situation of society as a whole really feasible? Such a goal points to the necessity of the becoming hypertelic of the social; that is programming its set purpose to that of homeostatic regulation. Such a vision would encourage dispensing with the political in favour of the technocratic.

This is where the other relationship that the individual holds, its relation to the pre-individual, becomes significant. In simple terms, this can be understood as how the system is related to its openness with what it is not. In respect of the technical object Simondon writes:

> [T]he existence of the technical object is sustained by a double relationship – a relationship with its geographic environment on the one hand, and with its technical environment on the other. The technical object stands at the point where two environments come together, and it ought to be integrated into both these environments at the same time. Still, these two environments are two worlds that do not belong to the same system and are not necessarily completely compatible with each other (Simondon, 1980, p. 54).

Without this secondary relationship any system is incomplete and in danger of becoming hypertelic – that is focused on a single unwavering purpose. The problem with the use of Big Data to control any system is that it faces the problem of integration with a broader and oft changing environment, which is a likely source of indeterminism. This is, of course, usually the role of politics, a subject which receives scant attention in Pentland's (2014, p. 203) book, tending as he does to take it as self evident that the core social aim is that of technocratic efficiency and resilience in an environment which provides "for individuals to make correct decisions and develop useful behavioural norms".

It also begs the question of what is the purpose of society as a whole, if it is to be subject to such control? This is Beniger's problem of *programming* previously mentioned, which has its roots in the cybernetic concern with finality. This question is elided by Pentland and, just as importantly from a Simondonian perspective, so is the role of invention.

Invention and information

What is at stake with claims being made for social physics' ability to maintain the social in equilibrium via control, or its ability to predict future states of the social system in order to enable it to adapt, is the role of invention. One claim is that through the implementation of social physics we will "begin to explain many things – crashes, revolutions, bubbles – that previously appeared to be random "acts of God'" (Pentland 2014, p. 9). From these explanations arise the potential to adapt behaviour, for as Pentland (2014, p. 106) aphoristically contends, "What isn't measured cannot be managed".

It is precisely the removal of indeterminism and novelty from the domain of the social that is being proposed. That Pentland (2014, p. 16) states that "social physics is inherently probabilistic" in its measurement of information flow belies its affinity to cybernetics and the probabilistic notion of information as the mathematical measure of the uncertainty surrounding the communication of a message between two entities.

For Simondon, however, the cybernetic notion of information as something measurable should not be understood as describing a fundamental reality. Simondon describes the cybernetic account of information as "secondary information" indicating that it is founded on a more primary kind of information. For Simondon, this secondary information is too hylemorphic and atomistic in nature, given that it focuses only on already individuated individuals between which signals are sent and received. Such an understanding enables a probabilistic account of systems that are able to adapt to environmental changes within narrow parameters, but Simondon's conception of being is one in which the role of invention is central and which exposes the weakness of information so described.

In part, Simondon's project is a reformulation of cybernetics, which has at its heart a reworking of the notion of information that acknowledges novelty. As noted above, in reference to the importance of the notion of the pre-individual, Simondon's ontology is founded on thermodynamics. A key concept Simondon borrows from this science, which helps him place invention at the core of his ontology, is that of the phase-transition. A phase transition occurs when a system shifts from one relatively stable state of

equilibrium to another, such as when water turns to ice or when a liquid is heated in such a way as to produce convection rolls. These transitions occur when certain systemic thresholds are crossed which leave the system in a metastable or critical state. In fact Simondon's (1964, p. 130) notion of (primary) information is based on a first-order phase transition that he describes as "the arrival of a singularity establishing a communication between levels of reality".

The difference between levels of reality that come into tension with one another is described as a *disparity* forming a problem for being which needs resolution to a higher level. It is the arrival of a singularity that causes a resolving structuration to occur around it through the invention of a new spatio-temporal reality. Information is not then something measurable but refers to the process of in-formation of one level into another thus resolving a disparity. It is this structuring process that Simondon calls transduction.

This is not to say that embracing a Simondonian prioritization of primary information entails ruling out the possibility of more highly determined mechanisms or the mathematical interpretation of some systems. However, what we find is that there are a broad range of systems with varying levels of determination and that indeterminacy does not have to be located at the level of the already individuated information-as-message but can be found at a more fundamental ontological level. What Simondon's levels based ontology enables, beyond the probabilistic ontology of cybernetic information, is an account that includes strong emergence and not just adaptation. Such a distinction is consistent with the difference between weak and strong emergence.

Weak emergence describes when a phenomenon emerges from a lower level in an unexpected and surprising manner. It is also called epistemic emergence as the impossibility of predicting it is due to a limitation of knowledge of the lower levels from which emergence occurs. Essentially, with weak emergence the claim is that we could predict emergent phenomena if we only had more data regarding the situation in the first place. This is basically the claim of Big Data, that by gathering more data about any system we can predict how it might adapt.

Strong emergence describes events that aren't merely epistemologically unpredictable but are instances of the production of *ontologically novel phenomenon* that are "not deducible even in principle from truths of lower level domain" (Mumford and Anjum, 2011, p. 92). The claim here is that it is not possible to predict some phenomenon however much data you have.

These two types of emergence differ in their understanding of the role of the environment. The adaptionist theory tends to understand systems being able to adapt to environmental changes by inhabiting already virtually present pre-adaptations, rather than the stronger thesis that the environment is causally implicated in an operation of radical creation, that is to say, the invention of something completely novel.

As we have seen an individual maintains a double relationship with both an associated milieu and to the pre-individual and attempts to integrate both of these in an inventive and resolving act. The implication here is that the individual doesn't always adapt to environmental changes but that sometimes such openness requires a leap of invention.

At this point it is useful to remind ourselves that social physics is not the first attempt to utilize quantitative data to model and regulate the social. For example, Stafford Beer's theory of the Viable Systems Model (VSM), which he developed from 1972 onwards, was an attempt to develop operational real-time models of various social systems based on quantitative data flows, whose aim was to enable such systems to survive "in an environment that was not just fluctuating but also changing" (Pickering, 2010, p. 244). As such, and although he never mentions it, Pentland's project is resolutely in the tradition of cybernetics.

Pentland's project echoes that of Beer in that he begins by conceiving such modelling to help structure and maintain relatively small systems such as factories and firms but goes on to extrapolate from this the possibility of similarly running whole societies. The pinnacle of this, for Beer, was the Cybersyn project he helped organize in Allende's Chile but which was brought to a premature close by political events in that country.

The VSM is relevant when considering social physics because one of its explicit aims was to enable a social system to survive and adapt in a world of constant change and becoming. It did this through the implementation of a "performative epistemology" (Pickering, 2010, p. 251) that was troubled by the problems of *which* information flows were relevant and how were they related? So described, Beer was

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confronting, as many of the second-order cyberneticists did, the problem of weak emergence in that it wasn't always clear which data to collect and how to interpret them. As Pickering describes it:

> What might adaptation of these models in practice mean? I just described adaptation in the VSM as open ended, but Beer imagined and was prepared to implement something less than this in his models. He understood them as sets of mathematical equations linking long lists of variables such as demand, revenue, technological and economic change, dividends, share prices, and the money market. And the basic form of these sets of equations was not, in itself, revisable, at least as part of Beer's description of the regular functioning of a viable system. What could be revised in practice were the parameters figuring in these equations which specified the intensity of the couplings between variables. Beer's models were thus adaptive, but only to a degree, within a fixed overall form (Pickering, 2010, p. 252).

What is interesting here is that not only did Beer struggle to deal with the problem of weak epistemic emergence but that, even though he had an awareness of it, he could not even confront the thornier issue of the environments radical role in invention, which Simondon describes with his ontogenetic notion of information.

The best Beer could achieve was to model the social on an understanding of organisms as adaptive to their environment and not as inherently inventive in their individuation. Pentland's social physics seems oblivious to these previous discussions. For him, they appear blithely resolved through sheer mass of data, much as Anderson claims.

So, as well as invention being a seemingly insuperable problem for social physics, Beer's experience with his VSM also makes clear that epistemological issues such as with selection bias and conceiving of ways that data should be interpreted and which data should be collected and related have yet to be acknowledged. It remains unclear how having bigger data sets makes these problems disappear.

The analogy which Beer makes of social systems with organisms is typical of a long-running fascination cybernetics had with reducing all phenomena to mere informational flows and thereby erasing ontological difference in order to contrast forms of behaviour. Although Pentland certainly doesn't think of society in terms of an organism it is worth asking what analogy might be in play in social physics.

The role of analogy in social physics

The role of analogy is crucial for cybernetics. From the outset cyberneticists such as Wiener and Ashby drew analogies between systems which enacted the same kind of purposive behaviour but were materially distinct; such as between games and the economy, cellular automata and living organisms, and brains and computers. For example, in their seminal paper, "Behavior, Purpose and Teleology", Rosenblueth, Wiener and Bigelow drew an analogy between a human patient with a damaged cerebellum who is unable to drink a glass of water and the operation of a machine with an "inadequately damped' feedback mechanism"

From such behavioural analogies it was a short distance to claiming an isomorphism between organisms and machines and hence the ongoing fascination with studying machine behaviour. It is unnecessary here to explore examples but just state that first-order cybernetics was interested in drawing analogies based on the exhibition of forms of behaviour and similarity regarding regulation towards a purpose.

As already discussed, Simondon was critical of the cybernetic formulation of information which he saw as both hylemorphic and atomistic. Another issue he had with cybernetics was its use of analogy. In a key passage of his thesis called *allagmatics* Simondon makes an important distinction between two types of analogy:

> [A]nalogical thought is that which observes identities of relations, not relations of identity but it must clarify that these identities of relation are the identities of operative relations, not the identities of structural relationships. By itself it discovers the opposition between resemblance and analogy: resemblance is given from structural relationships. Pseudoscientific thought makes substantial use of

> resemblance, sometimes even the resemblance of vocabulary, but it does not make use of analogy. (Simondon, 2005, p. 563).

For Simondon (2005, p. 564) an analogy is only valid "if it covers a world where beings are defined by their operations and not by their structures". An analogy based on structures does not in fact constitute an analogy for Simondon but merely a resemblance because it "cannot reach the whole reality of being". Simondon's theory of knowledge is thus premised on his ontological account of the operation of being.

This isn't to say that Simondon dismissed such resemblance as being of no use, rather one had to be careful of overstepping the limitations of its suitability. For Simondon the cybernetic *schema* of understanding the world is one amongst a set of other schemas (e.g. Hylemorphism, Cartesianism) which has been developed by analogy from the operation of different technologies:

> In this sense, technology manifests in successive waves a power of analogical interpretation that is sui generis ... None of the schemas exhausts a domain, but each of them accounts for a certain number of effects in each domain, and allows for the passage of one domain to another (Simondon, 2005, p. 18).

However, the attempt to universally apply such schemas is problematic as it misses the ontological reality of operation and reifies understanding in poor analogies across distinct domains. Additionally, Simondon (2001, p. 175) also warns of the reductive, fragmentary and inductive nature of these schemas which by extrapolating from the particular to the universal fail to "account for the existence of the totality, taken as a unity, but does account for the point by point and instant by instant functioning of that totality". As such the universal application of such schemas runs the risk of a hypertelia in thought.

Simondon's theory of schemas resonates with some work in French Epistemology, such as Bachelard's notion of epistemic breaks and Canguilhem's historical understanding of the development of knowledge. His contribution is that he ontologizes this process, something which becomes clearer in his work on the image-cycle in *Imagination et invention.*

In what way does this relate to social physics and big data? We can acknowledge that Pentland's theorizing of social physics is actually very close to cybernetics' with its focus on behaviour. Thus, in a description that resonates with the cybernetic focus on behaviour and purpose, Pentland describes the power of social physics as coming from:

> ...the fact that almost all our day-today actions are habitual, based mostly on what we have learned from observing the behaviour of others. Because most of our actions are habitual and based on physical, observable experiences, i.e., stories heard, actions seen, etc., they can be described as repeated patterns. This means that we can observe humans in just the same way we observe apes or bees and derive rules of behaviour, reaction and learning (Pentland, 2014, p. 190).

As described earlier, for social physics, the ultimate reality behind behaviour is the flow of information and ideas, which Pentland (2014, p. 20) describes rather tautologically as: "The propagation of behaviours and beliefs through a social network by means of social learning and social pressure. Idea flow takes into account the social network structure, the strength of the social influences between each pair of people, as well as the individual susceptibility to new ideas".

So, with Pentland's use of Big Data are we also witnessing the implementation of a reductive technical schema that "tends towards a phenomenology of regimes of activity, without an ontological presupposition that is relative to the nature of that which enters into activity"?

It seems apparent from the above that Pentland's schema for understanding the social is little more than a limited ontological schema developed from abstracting the flow of information through technical social networks. Thus it comes as no surprise that Pentland's idea of an improved social system "might look a lot like Wikipedia but founded on overlapping clusters of buddies who have face-to-face relationships" (Pentland, 2014, p. 209).

As such social physics can be understood as implementing an analogical technical schema that should be treated with as much care as the others discussed above (including cybernetics to which it is similar) in

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regard to the validity of the analogies made from them. That is not to say that what social physics tells us isn't useful in any way, rather that the limitations of its ontology must be acknowledged. As we have already shown, Beer was already aware of such limitations whereas Pentland fails to acknowledge them. In the next sections we will consider how Simondons reformed cybernetic ontology addresses the social and the question of finality.

The transindividual

It should now be apparent that Simondon's ontology is concerned with individuation and not mere adaptation or homeostasis. That is to say that in his descriptions of the ontogenesis of the various regimes which constitute nature (physical, vital, psycho-social) he is not seeking a description in which change occurs just through the actualization of adjacent potentialities, as an adaptive response to environmental change. What fascinates Simondon is what makes possible the emergence of novelty.

As already discussed the collection of ever more amounts of data does not necessitate a more developed understanding of the processes involved in social change. If anything, what Pentland's project aims at is the becoming hypertelic of the social.

We claim, in accordance with Simondon, that what the theoreticians of Big Data are missing is a philosophy of nature that undermines substantialism. Simondon's theory of individuation, grounded on energetic metastability holds as fundamental the ability of being (social or otherwise) to fall out of phase with itself, and to be restructured, as in a secondary phase shift, by a germ of information.

Applying his theory of individuation to the regime of the psycho-social Simondon develops one of his most striking theories, that of the transindividual. Simondon makes a distinction between two modes in which psychic individuals are related: the inter-individual and the transindividual. The inter-individual relation is that which most closely resembles the social abstraction found in Pentland. In this mode the relations between individuals are normative in that they relate to one another in accordance with the representations they have of one another as fully constituted individuals. Such a relation is functional and brings to mind the relation of fully formed entities passing and interpreting messages in conventional information theory.

This resembles Pentland's (2014, p. 21) theorizing of society as "mostly made up of networks of exchanges between individuals". Such a mode has two problems for Simondon. First, that from the perspective of the psychic individual this relation is unable to help resolve the problem of anxiety it feels in response to that which it is not. This is what Simondon (1989, p. 191) calls the problem of embodied immanence which cannot be resolved by the inter-individual relation as this is a relation that merely "goes from one individual to another" but "it does not penetrate individuals".

Second, the inter-individual relation fails to offer a means for true social invention. For this to be possible individuals need to form a system with one another which brings them into a state of resonance by which fresh structuration can emerge. For Simondon, the psychic and social are two poles of (and perspectives on) a single relation (the social relation) and the solution to both the problems mentioned above comes about through a transformation of the mode of this relation from the inter-individual to the transindividual:

> transindividual action is what makes individuals exist together as the elements of a system including potentials and metastability, anticipation and tension, then the discovery of a structure and a functional organization that integrates and resolves this problematic of embodied immanence (Simondon, 1989, p. 191).

Just as we witnessed with the individuation of the individual, the individuation of the transindividual also requires the attainment of *signification.* In the case of the transindividual the signification of the individual and the collective together create a problematic whose resolution is the structuring of the collective. The transindividual mode thus solves both the problem of embodied immanence (through the individual

being able to extend itself as part of a group) and that of change in a truly psycho-social gesture where individuals come into resonance with one another and form a metastable system.[5]

What enables the emergence of the transindividual is not just the flow of ideas between individuals (*a la* Pentland) but the individuation of the collective through the use of pre-individual potentiality, which individuals carry with them, as well as signification. As such the transindividual denotes a physical individuation, commensurate with energetics, like any other.

What is being specified by the pre-individual for the level of the collective? To be clear what Simondon is proposing *in this context*, far exceeds just the passage of ideas in a network, although would include it. The answer cannot be too specific, but as we saw in the description of technical individuation the resources for individuation are found both in relation to an associated milieu and the environment. What Simondon is suggesting is that the source of potentiality for psycho-social individuation cannot be bounded due to its radical environmental openness.

As such the transindividual also builds on those funds of potentiality from that which is already individuated. For example, the sharing of common beliefs can enable a transindividual relation between members of a group, but the fund of potential resources is far broader and would include the whole gradation of psychic activity from sensation and affect to the social structuring of emotion and ideation. Beyond these Simondon also develops a unique theory of the imagination in which images and artefacts (what he calls image-objects) can play a role in structuring the social. It is worth quoting at length an interesting passage from *Imagination et invention* where he discusses the role of images in this respect:

> In effect, the image, as intermediate reality between the concrete and abstract, between self and world, is not only mental: it materializes, becomes institution, product, wealth, and is diffused as much through commercial networks as through the "mass media" disseminating information. Its intermediate character, a fact of consciousness but also object, gives it an intense capacity for propagation; images permeate civilizations and charge them with their power ... The circular causality that runs from the mental to the objective real through social processes of cumulative causation also runs from the objective real to the mental ... Almost all objects produced by man are in some measure object-images, they are carriers of latent meanings, not just cognitive but also conative and affectivo-emotional. Objects-images are almost organisms, or at the very least germs capable of revitalizing and developing in the subject (Simondon, 2008, p. 13).

From this passage we witness how for Simondon the resources for transindividual individuation are widespread, including the conative and affectivo-emotional, and how some individuations also become sources of information or structural germs for further structuration of the metastable field of the social. In *Imagination et invention* Simondon develops an extensive theory of how images develop within organisms to constitute the imagination and how these can also become materialized, through invention, into objects which further influence the cycle of image development. From such a perspective it is also clear that those images generated by the use of Big Data also intervene in the cycle of images and is thus also productive of invention. The situation is thus far more complex than just the passing around of ideas but involves an ongoing process of psycho-social individuation and invention. Coupled with his theory of technical schemas this also becomes a powerful ontogenetic account of epistemological development.

From this position Pentland's claim for the importance of ideas-flow is not entirely incorrect. However, it is also far too narrow for accounting how the social is structured and re-structured. Although Pentland's theory has the benefit of also being able to theorize the structuring of groups far smaller than a whole society, with its concentration on ideas it still remains too dilute to account for the reality of social novelty and thus we should be cautious of claims to the contrary. Bernard Stiegler makes a similar kind of reduction in his assertion that the pre-individual is just technical (for an excellent discussion of this see

[5] Unlike the superficial inter-individual relation the transindividual relation is such that it offers exterior resources for the resolution of the problem of embodied immanence as it penetrates the individuals concerned and brings them into resonance as a system. Such resonance is also metastable and thus allows for further transformation of this system.

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Combes, 2013, p. 67-70). Such an assertion is too limited given the breadth of resources that feed into the process of social individuation.

Teleology

Although Pentland's proposal for a new sociology is reminiscent of others working in the cybernetic tradition he does overlook its concerns regarding teleology. Such an oversight is unfortunate given how central the understanding of purpose in relation to systems is in so much of this work. Beniger's distinction between processes of control and their programming towards a purpose has already been mentioned. The problem of programming was also something that Stafford Beer wrestled with in relation to his VSM. His vision was for a social system that could undertake an active adaptation to a spontaneous finality which was itself determined via feedback from the social collective. Beer called this finality *eudemony* or social well-being (Pickering, 2010, p. 272). For Beer the aim was to cybernetically enhance democracy so that social adaptations could be decided collectively.

In social physics the presence or even requirement for such finality is not even considered. What is claimed instead is an almost essentialist understanding of the habitual nature of the social: "Social physics is based on statistical regularities that span the population, i.e., things that are true of almost everyone almost all of the time" (Pentland, 2014, p.189). As I've already argued such an essentialist formulation leads to a dubious state of social hypertelia, but additionally, also fails to confront the problem of the production of goals towards which social adaptation might occur.

Simondon (2001, p. 119) was also concerned with teleology in systems that were self-regulating: "In self-regulated functioning, all causality has a sense of finality, and all finality has a sense of causality". The use of "sense" here has a double meaning indicating both semantic sense as well as (sense of) direction. It's not so much the case that purpose should be applied to systems, which would then run the risk of hypertelia and normativity, but an awareness that individuation creates new levels of reality the recurrent causality of which operate as unities which have an emergent and coherent inclination which demand their own aesthetic and axiological consideration. As such Simondon was unwilling to impose sense onto individuations but instead tracked their development and mode of regulation in order to do them justice. It's in this sense that his philosophy of technology was concerned with how traditional culture imposed inadequate values on emergent techno-social individuations thus generating conflict.

Simondon (2014, p. 317) understands culture as a "depository of values" out-of-step with technical development, which is indifferent to traditional values. As such culture programs the use of technical means and imposes on them what Simondon describes as a condition of slavery in that it thwarts technology's freedom to evolve. The assumption that the present code of values is final is therefore to define a "reign of purpose" (ibid) that domesticates the technical.

As we have seen new technology enables "new schemes of intelligibility" and with this the likelihood of fresh axiological content. Big Data itself needs to be recognized as a fresh technological advance that will also challenge received values (Pentland has already identified privacy as a zone of contention) and needs to be understood as such rather than as a neutral means of imposing established cultural values through social regulation. It is itself constitutive of a transformation of the environment in that it is productive of new needs and desires as well as new imaginings of the social.

Although this is a gloss of Simondon's position it is enough to make the point that so far Big Data sociology has not confronted the question of the *sense* of that which it studies, in the connected sense both of how the purpose of social systems are divined in relation to technical development (an axiological question) nor in respect to what overarching sense data is interrogated (the epistemological question).

Despite Anderson's claim that the data will somehow reveal its secrets automatically upon interrogation without the need for biased theories or hypothesis it seems clear that Pentland is indeed imposing his own ontology onto the data he is collecting. That is to say that purpose is built into the epistemological frameworks employed to analyse the data. That Pentland's social ontology implicitly promotes a technocratic liberalism should not be a surprise given its cybernetic heritage. Norbert Wiener's original project was also rooted in a liberal humanism, which also had an uneasy tension with his technocratic leanings.

Conclusion

Although it has not been the goal of this article to dismiss the claims being made by some for Big Data for aiding the understanding and efficiency of some relatively deterministic systems, we have attempted to question some of the claims made that it offers a new and universal method for understanding and managing the social.

In brief, we maintain that social physics is a development of the cybernetic worldview and as such would do well to pay heed to previous work in this area and, in particular, its reworking by Simondon. We claim that Big Data fails to account for the importance of the extent and nature of relations social systems have with each other and the environment, which is so well captured by the notions of the associated milieu and pre-individual. Additionally, the limitation of thinking in terms of adaptation needs to be recognized as what is at stake is the integration of systems with a changing environment leading to invention, which will confound any attempt at control unless the society so controlled becomes hypertelic.

In a quotation used above Pentland mentions that Big Data will itself cause a societal phase shift. Whilst the recognition of such phenomenon is welcome the point is that such a shift means the intervention of an indeterminism, which by definition, social physics would not be able to predict. Data is not information in Simondon's sense. Big Data says nothing of metastability and resonance. As Beer also maintained, the ability to regulate the social required more than an extensive database. Beer's own problems with the VSM demonstrate that any such intervention in the complex regulatory causal loops that constitute the social, will itself feed back into the system.

As such we also direct attention to the facticity of Big Data as a new technical development which itself will be productive of new individuations and values. It is, to use Simondonian terminology, a *technical mentality*. Occasionally Pentland's certainty in his project slips and he acknowledges the constructivist nature of the epistemology he is actually dealing with, which falls far short of Anderson's confidence that the days of theory are over:

> These data are often indirect and noisy, and so interpretation requires greater care than usual ... We need to construct living laboratories – communities willing to try a new way of doing things or, to put it bluntly, to be guinea pigs – in order to test and prove our ideas.

Instead of touting Big Data as a means by which to regulate social homeostasis questions need to be asked about how Big Data will construct new orientations of social development? There is some distance between this position and that which sees Big Data as finally giving an objective and scientific basis for sociology.

What is really at stake is the production of new practices, epistemologies, and techno-social assemblages that will lead to new psycho-social individuations. Simondon offers us a way to more clearly see both the importance of ontology for such projects as well as their role in the production of the psycho-social.

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Meta: Aesthetics of the media assemblage

Glen Fuller – University of Canberra
Glen.Fuller@canberra.edu.au

True Detective *is an example of a recent spate of works that could generally be described as "nihilist pop culture".* True Detective *is "meta" not simply as a work of meta-fiction, but also in an inter-textual media assemblage sense and furthermore in the way it dramatises a conflict over the value of (cultural) value. Meta is a minor aesthetic category of cultural works that operate by way of a recursive self-referential movement across singular qualitative thresholds of individuation. This essay reads* True Detective *in terms of Nietzsche's concept of nihilism as a process of transvaluation and Simondon's concept of meta-stability. Nietzsche and Simondon both gesture towards the germ of value from which normative values develop and this essay argues that works of nihilist pop culture such as* True Detective *are organised around articulating a sense of the meta-stability of cultural value.*

"Just spare me anything atmospheric: I've had enough hot air" (Nussbaum 2014).

"I get a bad taste in my mouth out here… aluminum, ash… like you can smell the psychosphere" (Rust Cohle, "The Long Bright Dark", *True Detective*).[1]

"Have we really made any progress in understanding this hybrid of the grotesque and terrifying which, under the right circumstances, could determine the fate of us all?" (Deleuze 2004, p. 84).

Plenty of viewers were left unsatisfied with the ending of the first season of television show *True Detective*. Emily Nussbaum (2014a) in her online column for *The New Yorker* drew comparisons to the infamous ending of *Lost*, which is the "nuke it from orbit" option when it comes to critics trashing television finales. Nussbaum reads the *True Detective* finale in terms of whether or not the plot was satisfactorily resolved, and for her it wasn't. Worse, argues Nussbaum, is the way the experience of the male characters, which largely drives the drama of the show, is in part created through a series of violent and traumatic acts carried out on or targeting female characters. The female characters are simply, as Matthew McConaughey's character "Rust Cohle" describes one of the murder victims, "chum in the water".

There are a number of ways to engage with *True Detective*. As a work in the detective genre, the *True Detective* audience follows the characters through a (multi-layered) process of discovery of who did what to whom. Indeed, the heavily gendered bias to the characters' process of discovery meant that the male main characters were transformed largely by what other (mainly female) characters experienced. Nussbaum locates this bias as a failure of the show and its writing, rather than being a "failure" of the cultural values of the world represented by the show and therefore a success of the writing. Taking her critique further, Nussbaum argues that even as a work in the crime or detective genre, *True Detective* is a failure. As a polemical move she judges the show by collapsing the plot – that is, from a perspective not unlike reading a mystery novel in reverse ("was indeed our serial killer") – and then systematically itemized its dense plot as a series of failures to "payoff". This neo-Aristotelian re-reading of the entire series after the finale sees the characters as agents of their own inevitable destiny; the contextual milieu of their experience – and by implication the experience of the audience – is merely "atmospheric". Nussbaum is arguably correct in everything she writes, but only so from the perspective of a twentieth-century television critic. The distributed character of the process of discovery – back and forth across narrative temporalities – that necessarily involves the experience of viewing and participation by the audience in the reception of a

[1] Most commentaries have interpreted this dialogue by Rust Cohle (Matthew McConaughey) in the first episode of *True Detective* in a metaphysical sense (for example, in Slate's *True Detective* glossary it is defined as a pseudo-psychological realm of all consciousness), but another interpretation is indicated by Cohle's disclosure in the bar and dancing scene of the third episode that he is a synesthetic.

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television show did not really matter. She suggests she shouldn't discount the pleasure of audiences when really she shouldn't discount the collective work of the audience and other more or less professional critics in shaping the *event* of *True Detective*.

There is the television show or text of *True Detective* and then there is the cultural or media event. The media event of *True Detective* is more than the simple text of the television show and its reception by audiences. Nussbaum's piece on the finale and the re-reading of the season was a traditional critical review. She signals her sophisticated understanding of the text and then passes judgement (perhaps in spite of other audience's pleasure) following the closed hermeneutic of text-based criticism. The proliferation of media vectors means that the audience for the television program of *True Detective* has a participatory role in its media event. The media event of *True Detective* is not (solely) created by a television producer or marketing team, but through the recursive patterns of vectors that repeat a perspective on *True Detective* in different ways.[2] As Daniel Fitzpatrick (2014, pp. 138-140) argues in discussing the importance of acknowledging the textual-visual "True Detective Conversations" and hashtag-based #TrueDetectiveSeason2 internet memes derived from the television show. The broader point is that there is no longer a singular broadcast-based television assemblage; rather it is a specific assemblage for each "television" show. This is another way to engage with the show, as a post-broadcast media event is shaped by a transversal movement of affect across the television show and the mobilisations of the audience through social media and television commentary sites to shape the show's reception.

True Detective as media event is less the "high holiday" genre of Daniel Dayan and Elihu Katz's (1992) concept of the media event and more like McKenzie Wark's (1994) immanent, vector-based conception of "weird" global media events. Dayan and Katz's concept of the media event made perfect sense for the past era (or very limited contemporary experience) dominated by broadcast television. In their version, there had to be a habituated regularity of television viewing for it to be disrupted by a pre-planned event happening on such a global or national scale that it is literally the live broadcasting of history. Wark's reworking of the media event prepares the concept for a time when "television" is a techno-cultural anachronism like "movie" (early twentieth-century moving pictures), "hifi" (1970s, high fidelity audio playback system), or even "phone" (twentieth-century, telephone, then cell or mobile phone; twenty-first-century, smartphone). Dayan and Katz's problem of explaining examples of hegemonic "history" being made by live television is corrected by Wark's dismantling of the normative mapping of history on global/national scale. Instead, Wark plots how historical events *become* as such as they propagate across "live" media vectors. A media vector has fixed properties, but it has no necessary position (Wark, 1994, pp. 11-12). A single image of a man in front of a tank becomes a media vector worthy of "perpetuating" and develops into a weird global media event as a kind of subterranean history Wark 1994, pp. 144-145, 158-159. There is a transductive relation here of the becoming of history – not an experience of "change" but "changing" (Munster 2013, pp. 157-158) – as the media vector propagates and returns through personal, local, regional, national, international and global affective circuits of media assemblages. The shift in the broadcast-based media event to the vector-based media event is one from a focus on an extensive or "historical" conception of media events to an intensive or "affective" conception of media events.

Contemporary media assemblages are characterised by a proliferation of vectors. There is still a singular focus, but this focus often surveys across a range of broadcast and internet-based media. Conflict in the realm of cultural taste – recognisable as social media arguments about the merits of one text over another or one perspective over another – are less about wasting your time (as the value of your attention sold to advertisers, for example) and more about wasting your affect (as social binding value in the relationality of a media event); exemplified by the view that *True Detective* is not worth your collective hype. This exercise in peer-to-peer media criticism has many effects, including on the cultural literacy of the audience and the relative disenfranchising of conventional critics. In complex media assemblages that subsist across media channels as part of a broader media event, *recommendation* has replaced *judgement*. The goal of recommendation is to signal something interesting and worthy of one's participation in the affective circuits of

[2] I am implying a relation between Wark's use of vector and the way Felix Guattari discussed vectors as integral to the "third ecology" of the social and cultural milieu particularly in the way we undergo processes of subjectivation, see Goddard 2011.

the media assemblage, and this results in a correlative increase in assemblage-centric media literacy, rather than a performance of text-centric or media channel-centric cultural capital.[3]

At stake here is what Antoine Hennion (2004) calls the "pragmatics of taste" as a way of understanding the appreciation of cultural objects or events and, importantly, the circulation of such appreciations. This is different to the familiar sociological interpretation of cultural consumption by Pierre Bourdieu, which is premised on cultural judgement, and is furnished by class-indexed expectations of cultural value. Primarily writing about music, Hennion is also concerned with the logics of cultural "expectation", but has a less rigid interpretation. Expectation, even that which scaffolds the driest of critical judgement, is also affective, so that cultural judgement is primed not only by generic or textual convention, but our embodied relations of anticipation, excitement and boredom. Even though Bourdieu (1984) famously develops an elaborate account of the bodily habitus as a "structurating structure" (see Noble and Watkins 2003), in the postscript of *Distinction* he dismisses "vulgar" cultural judgement that is explicitly embodied as indicating class-based distinction. The media event of *True Detective* is shaped in part by what Hennion (2001) calls "taste practices": "that strange mix of precision and invention that makes them define, little by little, their paths to pleasure". Writing with Genevieve Teil, Hennion writes that taste "is an *activity* and not a passive or determined state". They continue:

> Instead of seeing amateurs as passive subjects of objectifying (naturalising or sociologising) measurements and analyses, the idea is, on the contrary, to consider them as guides and to observe them as actively seeking the causes and determinations prompting them to make choices, to appreciate and consume (Teil and Hennion 2004, pp. 19-20).

The "review" is a kind of crystallised form of cultural and social judgement that fixes a closed cultural object as much as the audience and reviewer. For users of social media at least, the "recommendation" is a similar kind of cultural (para)text, but one that frames the cultural value of a work explicitly in terms of the experience of the audience or consumer. This is not to be critical of reviews in general; rather it is to suggest that in the assemblages of contemporary media events the "recommendation" is now the dominant critical form of appreciation. The "recommendation" is an example of what Hennion (2008) calls a "taste test" – tests of whether or not a given cultural text is worthy is also at same time a test of the audience or amateur's passion or enthusiasm.[4]

The distinction between the television program as a closed text and the television-centric assemblage-based media event is important for recuperating what Nussbaum dismisses as "atmospheric". I shall aim to do this by analysing the way the event of *True Detective* is *meta*. I am using "meta" here as an aesthetic category. By "meta" I do not mean the *True Detective* text is an example of meta-television, because it largely is not, except in the sense that it certainly does rely on an audience schooled in the conventions of crime or detective genre. It certainly is an example of meta-fiction; in the way writer Nic Pizzolatto inserted references to Robert Chamber's (1895/2011) *The King in Yellow* collection of short stories as one of the more notable intertextual references. In the current era of television shows, the text of *True Detective* needs to be read alongside, for example, Michael M. Hughes's (2014) post on io9.com titled "The one literary reference you must know to appreciate True Detective", which is about Pizzolatto's use of Chamber's text. Like Jason Mittell's (2006) work that shifts the focus of television scholarship from social effects to the aesthetics of television by engaging with what he calls "narrative complexity", I am using "meta" in a more expansive way to refer to the aesthetics of the event of *True Detective* in the context of a media assemblage. What makes the aesthetics of media assemblages "meta" in a way that is different to the meta-aesthetics of specific media forms? There are two ways the aesthetics of the media assemblage is meta in the example of

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[3] See for example Emily Nussbaum's (2014b) discussion of being deluged on Twitter about questions regarding Showtime's "The Affair". Curiously, even though it was the concerted work of Nussbaum's Twitter followers to ask questions about the show, Nussbaum frames this relationality as being between her and the text: "Whether or not I wanted 'The Affair', the show seemed interested in me".

[4] There is a parallel here with Weber's charismatic mode of authority that attracts followers not by judging the authority as being worthy of followers but by testing followers in terms of whether or not they are worthy of being lead.

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True Detective, as I shall outline below after introducing a concept of meta derived from the work of Gilbert Simondon.

The self-referential character of meta orbits a single site of both its emergence and its exhaustion, what Gilbert Simondon describes as a system's meta-stable conditions of individuation (see Barthélémy 2012, p. 217). The assemblage of the *True Detective* media event explicitly operates in such a manner to hold the audience in a state of potentialised meta-stability; this was expressed through speculation about the plot and then subsequent disappoint when some of these speculations proved overly imaginative. The notion of "meta-stability" comes from thermodynamics and refers to a state of a system where any change can shift the system to a new state or phase transition. Simondon calls this process of phase transition "individuation". A meta-stable system is characterised by its subsequent phases of individuation. Meta indicates a movement between "this" state of a system and via the passage of transformation of a phase transition to another "prior" state of a system. The complication is that there is no "prior" to which to gesture towards as soon as a system undergoes a phase transition, any other meta-stable state is in a state of potentialised superposition. This singular point is held in abeyance, yet nevertheless is *articulated* through an individuating intimacy folding the inside outside and vice versa as a virtual tendency. If you were to spatialise an event, lay it out without the potentiality of its meta-stable ontology, then the points of meta-stability would be frozen from a static fourth-dimensional perspective. This is actually dramatised through one of Cohle's speeches:

> It's like in this universe, we process time linearly forward but outside of our spacetime, from what would be a fourth-dimensional perspective, time wouldn't exist, and from that vantage, could we attain it we'd see our spacetime would look flattened, like a single sculpture with matter in a superposition of every place it ever occupied, our sentience just cycling through our lives like carts on a track. ("The Secret Fate of All Life", *True Detective*)

In *The Logic of Sense*, Gilles Deleuze (1990, p. 103) refers to beat poet Lawrence Ferlinghetti's description of "the fourth person singular" perspective to describe a series of singularities distributed in a potentialised meta-stable system.[5] Simondon's philosophy of individuation is very useful for exploring the dynamic character of the interaction between singular points. In Simondon's theory of aesthetics, singular points serve a special role to bridge the separation of figure through technics and ground through religion.[6] Readers of Deleuze will find Simondon's aesthetic theory to be familiar; Deleuze is arguably indebted to Simondon's conception of aesthetics concerned with the production of new singularities, what Yves Michaud describes in his summary of Simondon's aesthetics as "a network of key points" (2012, p. 125).

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[5] "…but I keeping slipping off the new wiped-off table because I and no one else has the true fourth sight to see without the old associational turning eye that turns all it sees into its own, and it is this fourth person singular voice of which nobody speaks but which still exists unvoiced that will speak in the eye of tomorrow's seeing man and which will see truly how there is no rapport of any kind between himself and natural objects except a rapport of strangeness…" (Ferlinghetti 1960, p. 93).

[6] There is a curious line in Yves Michaud's excellent summary of Gilbert Simondon's approach to aesthetics where Michaud proclaims that he "will not discuss the metaphysics of [Simondon's] hylomorphic conception [of aesthetics], renovated by the physics of phases and transitions" (128). Most accounts of Simondon's philosophy of technics and individuation borrow from this scientific terminology, if only because the key notion of a "singularity" (appears as "key point", "way point" and "special point") has been developed in a relatively straightforward manner using scientific discourse, not so much by "science" but from other philosophers working on "complexity theory" and the like. Michaud avoids using the terminology of phases and transitions and any of the terms from scientific discourse because he argues there is a danger of it imposing a "very systematic and even mechanical frame on thought" (129). A notable example is Delanda's *Intensive Science and Virtual Philosophy*, which is an explicit attempt to read some aspects of Deleuze's philosophy in ways congruent with scientific discourse. Simondon's philosophy is impossible without an effective appreciation of the notion of "singularity". If normative realist ontology is assumed when borrowing such concepts from scientific discourse, then the problem of imposing a systematic frame on thought is certainly possible. This is exemplified by Delanda's materialist philosophy, which has clearly been developed with a goal of systemising Deleuze's work. I am mostly using the notion of a singular or key point as akin to what Deleuze describes as a remarkable point in *Difference and Repetition*. Empirical ontologies (as compared to so-called "flat ontologies") require a distinction between remarkable points that signal a qualitative threshold and ordinary points that repeat a series so as to properly appreciate what Simondon describes as recursive causality.

As I shall explore in the next section, the first way the *True Detective* media event is meta is through its singular or key points. If nothing else, *True Detective* clearly triggers meta-detective work by the audience. The show, its inter-textual references, and non-diegetic exegetical explanations of these references produced new edges of surprise and a new sense of expectation. For example, there is a folding of the crime fiction genre into existentialist horror and a topological transformation wrought upon both. Both genres frame a passage of discovery by the characters and audience. "Discovery" has become a buzzword in user-centred design to describe the design of platforms that assist users discover appropriate content, and this refers to the way users willingly embrace the delegated agency of "smart" interfaces. The liminal epistemology of discovery in meta-stable media assemblages pose answers to questions that haven't yet been asked. The question isn't simply asked of the characters of the show, but of the entire event itself as it repeated different elements of genres in different ways; in effect, the audience carries out meta-detective work.

True Detective is also meta in another more complex way. In the final section I develop meta in terms of what Sianne Ngai (2012) calls a minor aesthetic category, and in this case what characterises meta as a minor aesthetic category is the way any text, object or event that dramatises the suspension of cultural values. In Simondon's terms, meta is an aesthetic category that refers to works that in some way repotentialise values that serve as the "preindividual norms" of value in a state of meta-stability ready to be potentialised in a multiplicity of ways (Combes 2013: 64). As I shall explore in detail, *True Detective* dramatises a conflict between systems of belief and cultural value through the figures of the two main characters, Rust and Marty. In this way, "meta" signals a threshold of value (or what Nietzsche (1968) calls "transvaluation") more often associated with nihilism. Instead of the great epoch-ending (or creating) nihilism that concerned Nietzsche, nihilism of the contemporary era is produced through the disjunctive synthesis of competing and sometimes opposing systems of cultural value. That is, contemporary nihilism holds in abeyance the singular points of cultural value as a meta-stable system. This everyday nihilism has a banality closer to the traumas of cultural and social change rather than existential crisis. My purpose for engaging with *True Detective* is that it is but one example of many from popular culture (mostly television-centric media assemblages) that problematises the value of cultural value and may borrow from specific genres but belong to an overall category of meta and aesthetic classification as nihilist pop culture.

Media assemblage aesthetics

> "It was a sheet of yellow paper with torn pieces of white paper pasted on it" (Chandler 1938/1988).
>
> "It goes on like that… you know the job: you're looking for narrative… interrogate witnesses, parse the evidence, establish a timeline, build a story, day after day" (Rust Cohle, "Seeing Things," *True Detective*).

There is a long history to meta- as a prefix, back to Ancient Greece continuing through to contemporary epistemology, where it means "about"; contemporary usage here includes metadata (or data about data) or Lyotard's meta-narratives (legitimating narratives about narratives). The term "meta" entered into popular culture in the early 2000s after almost two decades incubation in computer-based subcultures as a result of Douglas Hofstadter's 1979 book *Gödel, Escher, Bach*. Hofstadter can apparently claim the fame for the phrase "going meta", which is the rhetorical move to a level of logical abstraction above the terms being discussed. Hofstadter's meta is an example of a meta-argument, an argument about an argument. As an index of popular culture acceptance, according to a 2005 definition in the user-generated Urban Dictionary definition, "meta" is used as an adjective "to characterize something that is characteristically self-referential".[7] Practice-based understandings of meta in art and art theory have a longer history, back to the 1960s and 1970s, of art referring to itself, and indeed in literature the practice of the meta-novel emerges in the late nineteenth century, even if it is only described as such much later.

The history of meta- as a prefix in literary and media-based criticisms became very popular in the 1980s on, and Scott Olson's work on "meta-television" is exemplary in this regard. Olson characterises

[7] (2005) "Meta" Urban Dictionary, http://www.urbandictionary.com/define.php?term=meta

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meta-television as "self-conscious television" (1987, p. 284). By indexing the different levels of televisual self-reflexivity, Olson (1987, p. 285) argues that the relative "sophistication about conventions required to decode [in the semiotic sense] meta-television hints at the identity of its audience". The kind of audience that Olson was writing about no longer exists, or at least not in the same way. Meta-television for Olson was basically television about television and for it to function required an audience of knowledgeable television viewers. He speaks of television's second generation of viewers that have not known a time before television. His analysis is now historical not only due to the textual examples he cites, but because he is writing about a generation of television viewers that grew up with television before the internet existed.

True Detective is meta in the way it encourages the audience to read the show in terms of an intertextual cartography of its own self-developing media assemblage. Appreciating literary and "serious" televisual fictions in terms of the intertextual references invoked is now commonplace, so much so that it has become a generic convention. (We expect "Easter eggs" in all "serious" cultural works; being able to appropriate and appreciate a text for intertextual references is an index of its aesthetic of "seriousness"). For Nussbaum the philosophical dialogue between characters "was deeply, sometimes deadly serious, those layers of Lovecraft and nihilism just felt like red herrings". Pizzolato signals this in the form of a warning in the first episode as the two main characters discuss the murder scene of Dora Lang. Cohle suggests that murder victim Lang's "body is a paraphilic love map" and then goes on to offer a textbook-type definition of paraphilia when questioned by his partner Martin (Marty) Hart. Marty doesn't "buy it" and replies: "You got a chapter in one of those books about jumping to conclusions? You attach an assumption to a piece of evidence, you start to bend the narrative to support it... [you] prejudice yourself". Rather than a close reading of a text, the media event of *True Detective* requires a close mapping.

True Detective is an example of post-broadcast "anthology" television, a condensed season of limited run of anywhere from three to slightly more than a dozen episodes.[8] Post-broadcast practices of television viewing are at best loosely determined by broadcast television schedules. The contemporary anthology format, as compared to the mid-twentieth-century format, is designed to capitalise on new viewing practices, such as "catch up" television or "binge" watching. It also definitively signals to potential viewers that there will be an end and the narrative shall be "tied off". The regularity of contemporary television viewing is no longer anchored by broadcast media technologies and is instead anchored by the affective dimension. The affective dimension of television viewing is not new, now it has just become central in scheduling rhythms of engagement.

The experience of contemporary television is imbued with an anticipatory logic in the pre-view (everything from set photos to script leaks to press release materials) to post-view experience (summary judgement of whether or not the television show in question lived up to what had been anticipated). Promotional pre-view material dominates much of the cultural magazine-based content online (Gray 2010); this writing serves to shape the viewing experience – you feel it: the excitement or disappointment. Practices of participatory culture, including practices of television viewing, are characterised by an augural temporality of "yet" ("Have you seen it yet?"). Hence, the ironic manifest urgency of *having to* watch television in an era of maximum technical flexibility. *True Detective* is an exemplar of the furtive event-based relations of intensive temporality produced in the participatory culture of networked media.

One way to engage with the *True Detective* media event in its completed form as a work of anthology television: draw it out atemporally all at once and spatialise it once and for all. Spatialising an event is the equivalent of reading an unfolding narrative as simply indicating a series of situations that at the end of the narrative have always already have happened. This is the founding problem engaged with by the field of narratology: what are the generic techniques in presenting the relation between the story as a series of situations and the plot as the way these situations are told. Fredric Jameson (2005, p. 101) describes this as the "double inscription" which marks the "vocation of the mystery writer: namely that of inventing some first narrative which is to be hypothetically reconstructed as 'fact' in the second or properly narrative time of the detective himself". Is there not, however, a third narrative, which can be complicated in any

[8] Mauer, Mark "'True Detective', 'American Horror Story' and Why the Anthology Series is All the Rage" Indiewire, February 12, 2014. http://www.indiewire.com/article/television/rise-of-the-anthology-series

number of perspectival articulations and is particularly evident in mystery or detective fictions dealing with "serial killers"? This is the narrative of the "next" of when the killer is expected to "strike again" and of when the work of detection is mobilised not so much to "simply" solve the existing crime but to thwart the crime to come and to do so "in time". The third narrative of "next" thus functions intensively, not as an index of two narratives moving against each other in a spatially deductive hermeneutic similitude (what "really" happened), but operates affectively as a relation of anticipatory futurity.

True Detective moves beyond the "simple" complexity of a non-linear narrative, however. *True Detective* has a non-linear narrative structure of multiple pasts and futures, involving past crimes, present detection, plus the future crimes/detection. It is an exemplary work of analepses (or "alterations in chronology", see Mittell 2006: 36-37), temporal cuts that frame the action through the multi-temporality of the show's self-contained seasonal arc. The plot of *True Detective* unfolds in increasing levels of complication between events of 1995 and 2002 (told from the perspective of the "present" in 2012 as narrative flashbacks), until Rust and Marty cease participating in the interviews with the 2012 detectives and begin operating themselves as detectives once again. They shift from telling a story to living it. Once the pair begins operating as detectives once again, Marty is not convinced of Rust's guilt or innocence, and takes his gun with him into Cohle's storage unit. He is won over only after he watches the video of a terrible ritual being carried out upon one of the missing children. Rust is the only character that watches the video all the way to the end. The video serves as a *key point* in the series – it signals a threshold in the individuation of the *True Detective* narrative complexity *and* media event – the metastable superposition of multiple plot speculations is reduced or actualised as a conventional detective narrative. As such, one way to approach the narrative complexity is in terms of spoiler-based fan practices. The superposition potentiality of narrative speculation signals that this key point could also serve as a spoiler. Jonathan Gray and Jason Mittell (2007) discuss spoilers in multiple ways including both as epistemological objects and signifiers of status within fan-based communities. Gray and Mittell note that fans look beyond a normative conception of "what will happen?" (story) to a question of "how is it being told?" (plot). There is a complex affective relationship between recommendations and spoilers in that both function as affective and epistemological primers.

Pizzolato does not rely on a kind of layered Neo-Aristotleanism, rather the layering of narrative and diegetic voiceovers of Marty and Rust retelling events to the 2012 detectives of their detective work in 1995 and at the end of their partnership in 2002 makes it obvious that there is a degree of falsity at play (specifically, the events of the 1995 raid and 2002 "breakup", etc.). In his brief remarks about detective fiction Deleuze (2004, p. 84) suggests that in "bad literature the real is an object of stereotypes, puerile notions, and cheap fantasies, worse than any imaginative imbecile could dream up". (Doesn't this description match most experiences of playing first-person shooters over the last two decades?) Rather than this ontology of similitude and representational identity, Deleuze (2004, p. 85) gestures towards the work of parody "that shows us directions of the real which we would not have found otherwise". Yet, there is a danger in postmodernist forms of parody and irony, as Massumi (2002, pp. xv-xvi) notes, not only "covertly conserving the true," but also conserving the true so as to perform a kind of nostalgia-driven mastery over it. The properly "meta" aspects of *True Detective*'s narrative structure is that truth itself is only ever partial and even at the end of the series when the case of the serial killer is seemingly resolved, it is apparent that this case is merely a perspectival glimpse on a sadly familiar societal horror of systematic abuse and cover-up.[9] *True Detective*'s narrative is used as a dramatic device, not to signal an ironic lassitude, but to affectively potentialise the (meta) experience of *detection* in the narrative. This level of meta cuts across both the work of manipulating audience expectations through intertextual meta-genre references and the representations of meta-detective work of a shared liminal epistemology.

Contemporary popular culture is an effect of the globalisation of the creative industries and the ongoing territorialisation of everyday life by mass-media spectacles intensified through personalised vectoral modes of delivery. Sianne Ngai provides an insight here, as she seeks to address the open-ended question, how has aesthetic experience been transformed by late capitalism? Her response is to investigate the way

[9] As Deleuze (2004, p. 84) points out "capitalist society more willingly pardons rape, murder, or kidnapping than a bounced check, which is its only theological crime, the crime against spirit".

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late capitalism's socially binding processes of production, circulation, and consumption are indexed by the "minor" aesthetic categories – the cute, the zany and the interesting. At stake for Ngai is the way "basic human and social competencies [affect and emotion: zaniness; language and communication: interesting; intimacy and care: cute] are increasingly encroached on by capitalism":

> The zany, the cute and the interesting thus call forth not only specific subjective capacities for feeling and acting but also specific ways of relating to other subjects and the larger social arrangements these ways of relating presuppose. In doing so, they are compelling reminders of the general fact of social difference and conflict underlying the entire system of aesthetic judgement or taste, making that underlying condition transparent in ways in which many other aesthetic categories do not.
> (Ngai, 2012, pp. 11, 13)

Alongside Ngai's production, circulation and consumption as three socially binding process of capitalism, the use of "meta" similarly indexes *logistics* as a mode of social organisation. Meta is the aestheticisation of the intertextual and socio-technical supply chain of culture and the nested circuits of meaning that resonate across cultural texts organised as discrete media assemblages. It is experienced as a kind of contradictory intensive concentration of ambiguous focus, which in a negative example is akin to the agitation of checking the timetable when waiting on a late train or the pleasure of finally receiving a pre-purchased novel based on an Amazon.com algorithm recommendation. The liminal epistemology of "meta" is dramatised in *True Detective* through the nihilistic dialogue and perspectival embodiment of the two main characters. Meta calls forth a way of relating to other subjects and ourselves through a shared liminal epistemology. The analogical relation between the detective work in *True Detective* and the meta-detective work of the audience that constitutes the media event of *True Detective* frames an investigation into the value of cultural value operating in a transversal manner diegetically and non-diegetically.

Nihilism and the meta-stability of cultural value

> "We know what transmutation or transvaluation means for Nietzsche: not a change of values, but a change in the element from which the value of values derives" (Deleuze, 1983, p. 171).

> "People follow their intuitions about what they don't know and so change the shape of the present, which is not fleeting at all, but a zone of action in a space marked by its experiments in transitioning" (Berlant, 2011, p. 77).

The nihilist dialogue of *True Detective* should be understood in the larger cultural context of the show belonging to a series of nihilist popular cultural works. Nihilism often appears almost too big a concept, so large in scope that it becomes naïve or intellectually adolescent to think it. Yet, there is a case for recognising a large number of examples of contemporary nihilist and crypto-nihilist popular culture. Most are pre- or post-apocalyptic, from the brutal hyper-pragmatism of UK Channel Four's *Utopia* through to the survivalist post-apocalypse zombie genre of *The Walking Dead*. Basically all of British television creator and media critic Charlie Brooker's works can be appreciated for their celebration and mockery of nihilistic media cultures. The television adaptation of Tom Perrota's *The Leftovers* is another example that turns on challenging normative systems of social valorisation, explicitly dramatised in the novel through the actions of the cultish "Guilty Remnant" group.

There are multiple models of nihilism, but for my purposes I need to only discuss two broad types. The first type of nihilism is a conservative (or postmodernist) lament for the loss of moral or cultural value as represent in cultural texts due to an alleged waning of belief or faith in normative social ideals (Hibbs 2012). Conservative nihilism is born of a loss of religio-epistemological "certainty". The production of certainty through faith attempts to "fix" truth: the truth of faith, the truth of the family, the truth of being a man. This is dramatised in *True Detective* through the perspective of Marty. He apprehends these truths, and lives as if he is certain of them, but in spite of his belief in the certainty of these truths he fails as a "man" to live in accord with the correlating normative social ideals. Nietzsche (1974) emphasised the role

of these "articles of faith" as "goals" that, in themselves, were not good or bad, but functioned in certain ways to stretch or diminish human capacities. The resolution of tension is mistaken for "truth", as represented in the *True Detective* scene from 1995 involving the travelling evangelical preacher. Marty suggests that people should be left to their faith, but Rust is unforgivingly critical when he says:

> Transference of fear and self-loathing to an authoritarian vessel. It's catharsis. [The preacher] absorbs their dread with his narrative. Because of this, he's effective [in] proportion to the amount of certainty he can project.

"Certainty" is not related to truth, but the cathartic transference of existential dread. The conflict over who directs the investigation (with the "Billy Lee Tuttle" character) is actually a conflict over the police investigation not as way to detect "the truth" but to transform the case so it serves as a cathartic process involving a tabloid journalism "devil worshipping" narrative. The decline in the belief of God and the efficacy of compositions of social relations organised around the associated goals leads to nihilism as a "psychologically necessary affect" (Ansell-Pearson and Morgan 2000, p. ix). Daniel Colucciello Barber engages with this problematic in *True Detective* through dialectical relationship between story and what he calls "sprawl" and what I've described as an affective meta-stability:

> Affection of the all-sprawl dissolves and drowns every story. Affect has no story, and so the story can be imagined only as a detection-of-story; one can stop being affected by the sprawl only insofar as one detects a story, or as one tells the story of detection. In these ways, one denies the sprawl in favour of the contingent drama of detection. And what is at stake in this drama is less the outcome that is established, and more the establishment of a contingency of outcomes (Barber, 2014, pp. 203-204).

The second model of nihilism is derived from Nietzsche (1968: S22-23) and is framed in terms of being an active nihilism or a passive nihilism. This dialectical nihilism becomes necessary when social and cultural values become insufficient for directing the "circumstances under which one flourishes, grows [and] gains power". Jean Baudrillard (1994, p. 160) was concerned about the possibility of nihilism after the great liquidation of "appearances" (i.e. the symbolic realm through which values are anchored); instead we are "fascinated by all forms of disappearance". Fascination, as a mode of affective engagement, "for the very operation of the system that annihilates us […] is nihilistic passion par excellence" (Baudrillard, 1994, 160). Keith Ansell-Pearson and Diane Morgan associate Baudrillard's nihilism with that of the "observer and the accepter":

> It is the nihilism of the passive nihilist who no longer aspires towards a transcendence or overcoming of the human (condition), but who simply announces and enjoys its disappearance, the spectator watching the spectacle of its own demise (Ansell-Pearson and Morgan, 2000, p. ix).

Rust's appreciation of "truth" is underpinned by a kind of socio-biological or evolutionary pessimism expressed at multiple times throughout the series including the first and last episodes. The "illusionary" aspect of identity in Rust's dialogue is what Nietzsche describes as the realm of "appearances" and Baudrillard as "disappearance":

> I think human consciousness is a tragic misstep in evolution. We became too self-aware, nature created an aspect of nature separate from itself, we are creatures that should not exist by natural law. We are things that labor under the illusion of having a self; an accretion of sensory, experience and feeling, programmed with total assurance that we are each somebody, when in fact everybody is nobody. (Rust Cohle, "The Long Bright Dark", *True Detective*)

In the final episode Rust is arguing with Marty about the ethics of value judgements and implies value judgements are a necessity: "as sentient meat – however illusory our identities are – we craft those identities by making value judgments". Does Rust's relentless "pessimistic" focus on the material and the

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biological underpinning of human nature, using what Marty calls "ten dollar words," present a different kind of certainty? I am certainly not going to romanticise Rust as a heroic Nietzschean-style nihilist. The character of Rust needs to be located in the context of the media event of *True Detective* and the media event of *True Detective* needs to be understood in the context of exemplifying contemporary nihilist popular culture. Nihilism is a culturally specific *event*. I want to locate this quasi-Nietzschean conception of nihilism – as an active affirmation of the possibility of value and transvaluation in response to a crisis of meaning and value – in what Deleuze and Guattari might have called a "schizo" context. Ansell Pearson and Morgan (2000, p. xi) suggest that as an experience nihilism "appears as a force that comes, like a shockwave, from the future, destabilising established values and petrifying ossified forms of life". Yet, there is no singular future through which we pass, but multiple relations of futurity for every assemblage and universe of value of which we are part.[10] The presentation of possible futures implicates us through charismatic tests of participatory worthiness – do you "get" the joke, "get" the inter-textual popular culture reference or "get" the dead French intellectual's concept? Don't we immediately respond by rejecting such naked interpellation and questioning the assumption of underpinning values? I am suggesting there has been a multiplication of the conditions of possibility for nihilism, not least of which is because of the changes to perception and feelings of belonging in the mediated experience of socio-technical assemblages. In some ways we are passive and are constitutive spectators of great existential worlds of symbolic efficacy and in other ways we are active destroyers not only of these systems but the transmutation of new values.

The conservative conceptualisation of nihilism is to understand this loss of narrative efficacy of the "family" or "religious institutions" as catastrophic. The family assemblage, for example, collectively individuates material, social and psychic registers and there is a truth to this assemblage more powerful than the convenience of mere convention. In this case, the reproduction of biological and social life necessitates a concept analogically congruent to "family", but *not the specific concept of "family"*. The incorporeal materiality of the concept of "family" that narrativises contingencies is itself an expression of the "family" assemblage. Nihilism is a critical event of transvaluation; not as the loss of meaning, but a working backwards to the primary scene of the "crime", a kind of practice of existentialist detective work. Beyond the trappings of genre what the contemporary run of television-centric media assemblages characterised by a fascination with nihilism have in common is a problematisation not only of value, but the *conditions of possibility for value*, such as "the church", "the family", governmental authority and so on.

Conclusion

True Detective is meta because it encourages the audience to operate across at least three registers of the *True Detective* media assemblage. The first level of meta analyses the detective work as represented in the plot of the television show. Detectives interview ex-detectives about previous detective work while the ex-detectives are attempting to detect what current detective work needs doing. Relatedly, the *True Detective* media event is meta at the level of narrative, generic conventions of crime fiction and the affective potentiality that Nic Pizzolatto creates through inter-textual references in concert with the participatory commentary of fans and critics. The meta-stable virtuality of future detection/crime is articulated at a structural level through a certain affective tension or even a sense of dread. The individuation of the story (as the actualisation of future detection/crime events in the present) is maintained in *True Detective* as a state of narrative meta-stability, so what happens in the "present" and the "past" exist as phase transitions of each other. The particular aesthetic character of this meta-stable state is what characterises *True Detective*.

Second, *True Detective* can be aesthetically appreciated as "meta" in the way fan and mass audiences can be encouraged to develop an intertextual "meta-detective" media literacy. It is the event of *True Detective* in the context of a cross-platform media assemblage that is self-referential. This includes all the paratexts of amateur television criticism that I have characterised as belonging more to the genre of the "recom-

[10] Even within the *True Detective* media event there are multiple relations of futurity – the diegetic world of the show and the present detection of future crimes and the contemporary experience of television and commentary that develop in different ways the media event (even into the second season).

mendation" as an affective aestheticisation of a relation of belonging rather than that of the 'review' as a performance of critical judgement and cultural capital. "Media Assemblage Studies" is not yet a sanctified scholarly discipline, but it is possible to glimpse what Television Studies, Platform Studies and many other disciplines concerned with networked aesthetics will become with the ubiquity of the deterritorialising "screen". It is clear that examples of the aesthetic category of meta have multiplied due to the vectoral character of the creative industries and the current attempts to commodify entire media assemblages as cultural franchises.

Lastly, *True Detective* is also meta in the way it dramatises the value of cultural value. As such, it belongs to a larger context of nihilist popular culture. I have argued that for my purposes nihilism can be understood in two ways, and these are dramatised through the conflict of values between the two main characters of *True Detective*, Marty and Rust. The first kind of nihilism is a state characterised by a social-conservative lament for institutional loss of social efficacy. The other kind is a process of transvaluation whereby cultural values are suspended in such a way to present the opportunity to affirm new values appropriate for a new set of circumstances. The nihilist potential of *True Detective* and other related media events is that the audience is presented with the opportunity for a process of transvaluation.

Ironically, the limit of meta may be nihilism, but the meta-detective work of transvaluation is fuelled by optimism. Lauren Berlant has explored ambiguities and nuances of the relation between optimism and trauma. The aesthetic category of meta is a dramatisation not of the everyday experience of apocalyptic loss of value, but the regular traumas that we encounter as part of contemporary existence. Berlant (2011, pp. 77, 9-10) describes "trauma" as "a zone of action in a space marked by experiments in transitioning" and argues that trauma is the "primary genre of the last eighty years for describing the historical present as the scene of an exception that has just shattered some ongoing, uneventful life". There is possibly an even longer history to trauma and its relation to such experiments in transitioning, with the most famous being Shakespeare's *Hamlet* (loss of father triggers a "transition" and possibly the most well-known existential crisis in all literature). What if we actually lived in an inherently abusive culture that operated through the continual production of trauma? For Berlant (2011, p. 77) the potentiality of trauma (that "the deal could turn out sour") is also the "primary scene" of optimism, hence the inherent "cruelty" of "the potential for achieving genuine human reciprocity is always held out as the seduction to become further invested in the normativity of the techno-political game". Is *True Detective* worthy of our optimism? I am not sure. To return to Nussbaum's critique of the representation of women, it is clear that there is no "genuine human reciprocity" or (in Simondon's terminology) the possibility of "collective individuation" organised around the traumas of the female characters in *True Detective*. Hence, the show is clearly insufficient to herald more than what is at best a critical questioning. Yet, the apparent popularity of nihilistic popular culture allows me to feel optimistic for the possibility of transvaluation and the ongoing detective work of creating new values.

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Two examples of concretization

Andrew Iliadis – Purdue University
ailiadis@purdue.edu

This paper provides two examples of concretization, an important concept in philosophy of technology that can also be applied to the study of media more broadly construed. It begins with a short summary of the preexisting literature on concretization, followed by a survey of the uses of concretization in the work of its primary theorist, the French philosopher Gilbert Simondon. The paper proceeds with a brief analysis of a famous example of concretization offered by Simondon (the Guimbal turbine) before engaging a new analysis of concretization in the context of contemporary information and communication technologies (planar transistors). The argument is made that Simondon provided an early (and simple) philosophical explanation of concretization, one that is useful for tracking (analog and digital) technological evolution over time.

"Mechanology" was the preferred term for a field started by a group of thinkers in France who, inspired by early cybernetics, wanted to create a universal philosophy of technology. Their spiritual godfather was a man named Jacques Lafitte. Lafitte wrote a philosophical treatise on machines that included reflections on the great British polymath Charles Babbage and his landmark paper, "On a Method of Expressing by Signs the Actions of Machinery" (1826). On the topic of Babbage's difference engine – the famous calculating machine that Babbage (1826, p. 250) described as "for the purpose of calculating tables and impressing the results on plates of copper", a machine that would never be built in Babbage's own lifetime – Lafitte (1932, p. 26) wrote: "What is important to determine is less the very form of the organs than the sequence of the functions". In the same book, Lafitte included passages on the work of Robert Willis, Auguste Choisy, Eugène Viollet-le-Duc, and Franz Reuleaux, among others. This obscure little book on the "philosophy of the machine" as "an organized extension of ourselves" (Lafitte, 1932, p. xv) was published in 1932. Lafitte called it *Reflections on the Science of Machines*.

The French philosopher Gilbert Simondon was influenced by Lafitte's mechanology of functions, and the bulk of Simondon's work on Lafitte can be found in the posthumous publication *Invention in Technics* (2005), in two chapters titled "Passive Individualized Technical Objects (Or the Passive "Machines" of Lafitte)" (p. 170) and "Information Devices (Lafitte's "Reflexive Machines") (p. 221), as well as in a few other sporadic places. Simondon (1958), it can be said, attempted to further the "philosophy of the machine" proposed by Lafitte, arguing for a theory of "general technology". He would eventually introduce the concept of *concretization* into this philosophy, and it would become one of his most important and lasting philosophical contributions. In the present paper, I will start by offering a definition of concretization before glossing over a short summary of the preexisting literature. Then, I will conduct a brief analysis of one of Simondon's own examples of concretization (the Guimbal turbine) before offering one of my own (planar transistors).

The word "concretization" is generally used in regard to the evolution of technological artefacts. It is not concerned with concretization in terms of its common sense usage or etymological history, such as "to make" something "real", "tangible", or "specific". Nor is concretization meant to represent something like that which is implied by the sentence "the concretization of an abstraction". Rather, concretization is a useful concept for thinking technological artefacts and their evolution over time. It is offered as a concept that can be put to work in thinking about technological things. Concretization deals with the ontological engineering of technical artefacts and, as such, it is closely tied to reality and all of the minute technical details that researchers and philosophers use to confront it. In this sense, one could call concretization a type of "philosophical engineering". Gilles Deleuze and Félix Guattari (1994, p. 8) once said that philosophy is "the creation of concepts". Luciano Floridi (2011) has likewise stated that philosophy is a type of "conceptual engineering". It is with a similar idea in mind that that one should approach concretization. Concretization deals precisely with "the things themselves", that is, with what happens to the specific elements that make up technological artefacts over the course of their evolution.

Literature on concretization

Simondon's closest philosophical contemporaries included Raymond Ruyer (1954) – who, along with Simondon, also published on philosophy of information – and Gaston Bachelard, who worked predominantly on the philosophy of science (Simondon remained friends with both throughout his life, debating Ruyer in papers and conversing with Bachelard in letters). It is becoming well-known that Marshall McLuhan read French philosophy, particularly the work of Lafitte, Simondon, and Jacques Ellul; an English translation of Lafitte's text was carried out and published at the University of Western Ontario under the auspices of John Hart (founder of Computer Science at the University of Western Ontario in 1964) and Jean Le Moyne (a Canadian journalist and eventual senator), both of whom attempted to popularize mechanology in Canada via French philosophers (Hayward and Thibault, 2014; Thibault and Hayward, 2014). They began a translation of Simondon's *On the Mode of Existence of Technical Objects*, but the project stalled and was never finished. Back in France, Simondon would go on to influence a wide variety of philosophers and researchers, including, most famously, Gilles Deleuze, Bruno Latour, and Bernard Stiegler.

The secondary literature on Simondon and the concept of concretization is growing, mostly in France, with works by Muriel Combes (2013), Pascal Chabot (2012), Stiegler (1998), and Barthélemy (2005a; 2005b), the last of whom is regarded as the world's leading expert on Simondon, having founded *Cahiers Simondon* (2009, 2010, 2011, 2012, 2013, 2015), currently in its sixth volume and the Centre international des études simondoniennes. Barthélemy (2005a; 2005b; 2008; 2014) has written four books about Simondon's philosophy that provide very clear exegeses of his work and offer new, unique perspectives from which to read Simondon (quantum information and mechanics). While Combes' and Chabot's texts have been translated and published in English, the works of Barthélemy are yet to be so, which is unfortunate. Lastly, as for original English books on Simondon, Edinburgh University Press' edited collection *Gilbert Simondon: Being and Technology* (2012) is an excellent anthology and concretization is covered there in some detail. David Scott's *Gilbert Simondon's Psychic and Collective Individuation: A Critical Introduction and Guide* (2014), also published by Edinburgh, is a good introduction to that text.

Gilbert Simondon's concept of concretization

The concept of concretization is one of the most important notions in the philosophical system laid out by Simondon. His most thorough explication of it is found in chapter one ("The Genesis of the Technical Object: The Process of Concretization") of the first part ("The Genesis and Evolution of Technical Objects") of *On the Mode of Existence of Technical Objects* (1958a), the shorter of his two published doctoral dissertations.[1] There are areas where Simondon references "concrete" reality and "concreteness" in *Individuation in the Light of the Notions of Form and Information* (1958b), the larger of the two books, however Simondon offers a much deeper account of concretization proper in the shorter (though certainly no less complex) book. Along with Simondon's concepts of individuation, allagmatics, disparation, transduction, and the preindividual, concretization stands among his most technical and powerful. Like the others, it is a mediatory concept, meant to be applied to technological objects that are themselves, Simondon (1958a, p. 10) will tell us, "mediators between nature and man".

The first task should be to find a definition of concretization. Putting aside *On the Mode of Existence of Technical Objects* (hereafter METO) for a moment, Simondon discusses variations on the theme of concretization in other texts, including the posthumously published works that emerged as books containing papers from his courses and conferences. The benefit of beginning with these texts is that they generally do not contain substantive remarks on concretization and therefore, where concretization is mentioned, it is explained simply and clearly. Many of these titles have been released in France; however as of this writing none of them have appeared in English. These are *L'invention dans les techniques* (2005), *Cours sur la Perception* (2006), *Imagination et invention* (2008), *Communication et Information* (2010), *Sur la Technique* (2014), and *Sur la Psychologie* (2015).

[1] Hereafter, all references to Simondon's work are my own translations from the original French.

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Simondon mentions concretization by name in some of the posthumous publications and not in others. For example, in *Course on Perception* (2006), a book based on a seminar on phenomenology that Simondon gave during the school year 1964-1965, he spends some time talking about concrete reality and concreteness, as in the larger dissertation book, but he does not engage concretization proper. On the other hand, in *Imagination and Invention* (2008), another collection of papers that have been published in France from a seminar on innovation that Simondon gave in 1965-1966, Simondon does reflect on concretization in a fashion that is similar to that found in METO (for more on Simondon and innovation, see Bontems 2014). Under the section "Invention as Production of a Created Object or Work", Simondon (2008, p. 163) references concretization in a chapter titled "The Creation of Technical Objects". Here he offers a simple definition, writing that concretization concerns the iterations that technological objects go through as they evolve. Iterations, Simondon (2008, p. 171) says, often contain an invention that "provides a wave of condensation, of concretizations that simplify the object by loading each structure with a plurality of functions". Concretization, then, is when an element in a new iteration of a technological object has been endowed with a greater "plurality of functions". It simplifies the object by assigning a plurality of roles to the elements. Following this, the total amount of elements tends to decrease. As a particular element fills another element's role, that element may fall to the wayside.

Simondon (2008, p. 171) writes that concretization can not only preserve the "old" functions of technological objects, but that concretization brings, "in addition new properties of additional functions" which he calls, importantly, "overabundant functions". A technological object is charged with overabundant functions when it concretizes; each individual element fulfils additional functions that increase while the total amount of elements decrease, leading to a deceivingly complex yet "simple" object. These overabundant functions constitute "the class of a true advent of possibilities in addition to the expected properties of the object" (Simondon, 2008, p. 171). A new iteration of the technological object offers a concretization of overabundant functions that can be the source for new technological possibilities. The technological object becomes (oddly) less complex, particularly in regard to its quantity of physical elements, as it develops. In offering a general definition of concretization, Simondon (1958a, p. 31) says that "each structural element" may fulfil "several functions instead of only one".

It is important to understand that not all iterations of a technological object qualify as examples of concretization. For concretization to occur there must be some way by which the object has reduced the number of component elements while at the same time assigning one or more of the existing elements an overabundant functionality. The technological object must become more self-sufficient, relying less and less on "extra" parts: what Simondon (1958a, p. 25) will refer to as "analytic" components. A genuinely new iteration will seek external support in its "milieu" (Simondon, 1958a, p. 21), effectively "offloading" the burden of functions to its environment so that the object does not need to maintain a high amount of functions. The milieu stands for the surrounding environment and can mean something as simple as water or air. As it concretizes, the technological object may use its milieu. At the same time, a "minor" improvement (to use Simondon's term) is not an instance of concretization. He mentions the invention of the rotating anode for the Coolidge tube as an instance where concretization does not occur (Simondon, 1958a, p. 37). Rather, it lessens a disadvantage instead of converting it into a "positive" function for the whole object. Minor improvements are only "detours" that, while sometimes practical and helpful, do not "promote the evolution of the technical object" (Simondon, 1958a, pp. 39-40). In ignoring the schematics of technics by installing what Simondon (1958a, p. 40) calls "palliative measures", minor improvements provide a "false understanding" of the evolution of technical objects. What Simondon is describing here are basically "quick fix" solutions. They may work in the short run, but in the long term they do not provide an overabundant functionality.

Simondon (1958a, pp. 45-46) offers the evolution of the tetrode and pentode as an example of proper concretization, contending that they result from the evolution of the original diode system through "saturation and synergetic concretization". With the tetrode and the pentode, concretization concerns schemes of technology and organization of invention so that iterations of the technological object lead to unity and the discovery of what Simondon (1958a, p. 40) calls "the distinction of a technical lineage" that is almost natural. What is more, this lineage is provided to us in a mediatory and intermediary way in that the natural world and the world of technics are already engaged in an interrelated concretization that is defined

by a relational function (Simondon, 1958a, p. 52). Simondon (1958a, p. 55) invents the word "techno-geography" to describe this relation. Concretization operates in a type of middle-zone between nature and technics.

Simondon warns us that a concretized technological object sits in an "intermediate place" between natural objects and scientific representation: given the technical object cannot be fully concretized, it can never become fully natural. The "artificialization" of a natural object is not an example of concretization, since such a process would need additional analytical functions to thrive. In the concretization of the technological object, however, the originally artificial object becomes more and more natural. Yet, one must always be careful to remember that there is a division between the milieu (nature) and technics (concretization). Although Simondon (2008, p. 175) goes so far as to say that nature is recreated in technics – that he sees nature as necessitating formalization and concretization in the world of technology – he is careful to observe that nature is already completely concretized while technological objects can never be so. All technological objects can do is continue to concretize as their components give way to overabundant functions. He notes that in English the word "versatility" is used to describe something like the process of concretization (Simondon, 2008, p. 177), and that concretization deals with "raising the level of internal compatibility to produce external adaptability". This is one of Simondon's most beautiful and helpful phrases: in its quest to concretize, the technological object *increases internal compatibility to produce external adaptability*.

Elsewhere, Simondon will refer to the process of concretization as "internal resonance". In *Invention in Technics* (2005, p. 85), he states that technological evolution is "made possible by internal resonance, the concretization, the multi-functional overdetermination that is the auto-correlation of various components". He often uses other terms; Simondon also describes concretization as "synthesis" or "*tetrium quid*" (a term associated with alchemy), this *tetrium quid* meaning a type of third additional "thing" that is unclear but which is connected to two others that are clear or known. The synthesis of these known elements produces the third and "raises the level of organization" (Simondon, 2005, p. 164), offering yet another formulation for describing concretization. In a paper on Lafitte, Simondon (2005, p. 169) describes concretization as "functional condensations for synergies".

"Synergy" is repeated often in METO; in concretization the technical object progresses by an "interior redistribution of functions" that is not done "function by function" but "synergy by synergy" (Simondon, 1958a, p. 34). Simondon believes that it is the synthesis of functions and not the functions themselves that matter. It is through this synergy that concretization can "result in an aspect of simplification" where a single "function can be performed by a number of synergistically related structures" (Simondon, 1958a, p. 34). Concretization concerns the organization of what Simondon refers to as the "subassemblies" of the technical object into synergistic units that contribute to the total functioning of the object, rather than contributing a single unique function. In concretization, "marginal aspects" become incorporated into the "functioning scheme" (Simondon, 1958a, p. 35): the elements that at first might have seemed unusable are turned into "functional links". Although each of the definitions that Simondon provides is slightly different, they maintain enough commonality such that the essence of concretization should remain clear. There is a list of helpful concepts to think through the concept of concretization in Simondon: overabundant functions, internal compatibility, external adaptability, internal resonance, *tetrium quid*, synergy, overdetermination, and so on. However, in order to understand concretization, there is another important concept that must be explained, and that is Simondon's concept of "technical essence".

Technical essence

Ostensibly a book about technology, Simondon (1958a, p. 26) states quite explicitly in METO that he is rather unconcerned with the material technical object *qua* object, and that he is instead interested in the *essence* of the technical object, its evolution. "Essence" is a curious word to use in a book about the philosophy of technology, but it is fitting when one understands precisely what Simondon means by it. For Simondon (1958a, p. 48), essence in technology is a certain type of mode or operation and not a type of unchanging universal quality, writing that what "alone count are exchanges of energy and information in the technical object or between the technical object and its milieu". Indeed, "the essence of the concretization of the technical object" is described as the "organization of functional subsets within the

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total operation" (Simondon, 1958a, p. 34). For Simondon, the technical object exists as a type of shell, something that "envelops" (Floridi, 2014) the informational essence or interacts with the essence of another informational milieu. There is a whole line of philosophy in Simondon on the invention and creation of such essences (Simondon, 2005; 2008), and one of his first examples is given at the beginning of METO. In the section titled "Absolute Origins of a Technical Lineage" (1958a, pp. 41-42), he describes the invention of the diode as one such beginning:

> [t]he diode is made from the association of this reversible phenomenon of the transport of electric currents through a field and the irreversibility created by the fact that the production of transportable electric currents is the production of a single kind of electric charge (negative only) and by one of two electrodes, the hot electrode; the diode is a vacuum tube in which there are hot and cold electrodes, between which an electric field is created. Here surely we have an *absolute beginning*, residing in the association of this condition of electrode irreversibility and in the phenomenon of the transport of electric currents across a vacuum: *technical essence* has been created.

Technology begins with a single act of invention that belongs to the order of information or energy and not technical objects as such (this is why Simondon has little patience for those who are concerned with what he calls the "minor" improvements of technical objects). METO concerns itself with the evolution of technical objects that begin each of their series with "a defined act of invention […] what was necessary was a new phenomenon" (Simondon, 1958a, p. 43). He writes that the "beginning of a lineage of technical objects is marked by a synthetic act of invention that is basic to a *technical essence*". This essence stays with the technological object throughout its evolution; "Technical essence can be recognized by the fact that it remains stable throughout the evolutionary lineage, and not only stable, but also producing structures and functions through internal development and progressive saturation" (Simondon, 1958a, p. 43). Simondon (1958a, p. 44) uses the example of the internal combustion engine and claims that its technical essence allowed for it to become, eventually, a diesel engine; it did so by "a supplementary concretization of functioning". This, again, is what Simondon (1958a, p. 20) means by "internal resonance" of the technical object; the technical object "evolves by convergence and by adaptation to itself; it is unified from within according to a principle of internal resonance". A connecting of milieus begins the moment of technological evolution, and this original convergence lasts as newer ones develop. Now, let us move on to some examples of concretization. The first is a famous example that Simondon references throughout his work (the Guimbal Turbine), while the second is a new example to explain how concretization can be applied to the study of digital technologies.

Jean-Claude Guimbal's turbine

Simondon often uses the example of the Guimbal turbine to describe concretization. The engineer and inventor Jean-Claude Guimbal was born in Simondon's hometown of Saint-Étienne. Saint-Étienne has historically been an industrial centre that once produced arms, coal, and bicycles. These industrious surroundings may have influenced Simonton's thinking, and his choice of the Guimbal turbine was almost certainly a reflection of his upbringing in Saint-Étienne (a city once named the "city of design" by UNESCO). Simondon (1958a, p. 72) even mentions his hometown in METO, referring to "the quality of Saint-Étienne steels".

Guimbal issued a patent for his turbine in 1953. In it, he outlined the distinctive characterizes of his design, which included up to then unprecedented techniques for turbine manufacture. In his original patent for the turbine, Guimbal (1953, p. 4) includes four main objectives:

> [i]n a unit constructed in accordance with the present invention the turbine and generator are built together as a single unit for installation under water. The unit is preferably constructed for installation at the throat of a convergent-divergent conduit which conveys water to and conducts it from the turbine unit. An object of the invention is to provide a turbine and generator unit of the type described in which the space required is reduced to a minimum. Another object is to provide, in a turbine unit of the type described, improved means for preventing leakage of water into the unit. A further object

> of the invention is to provide, in a unit of the type described, improved apparatus for cooling and for lubricating the unit. A further object is to construct a unit of the type described which may be installed with its principal shaft either horizontal, vertical or at any oblique angle.

As noted by commentators such as Brian Massumi (De Boever et al. 2012, p. 23-24), Simondon references such a Guimbal turbine in an essay titled "Technical Mentality" (the original can be found in the collection *Sur la Technique*, 2014, p. 301, while a translation can be found in De Boever et al. 2012, p. 1), but once again his most insightful observations are made in METO. In METO, Simondon (1958a, pp. 54-55, 57) writes that the Guimbal turbine can be seen as a paradigmatic example of concretization, and the amount of technical knowledge that Simondon displays here is impressive. He states that the genius of Guimbal's concretization is in placing the turbine into the penstock (a sort of intake tunnel or pipe that controls the flow of water), thus submerging it in water, as well as in connecting the turbine to a generator contained in a crankcase (housing for a crankshaft) filled with pressurized oil. Given this, Simondon (1958a, p. 54) notes that the dam contains everything in the penstock and that both the water and the oil become "multifunctional". First, the water becomes multifunctional by supplying the energy that activates the turbine and the generator. Second, it serves another function by evacuating the heat that is produced by the generator. Next, Simondon notes that the oil becomes multifunctional in four ways. First, it lubricates the generator. Second, it insulates the coil. Third, it conducts heat from the coil to the crank case. Fourth, it prevents the seepage of water into the crankcase, since the pressure of the oil is greater than that of the water. Simondon also notes that the pressure itself is multifunctional, since it causes permanent greasing under pressure and thus prevents seepage. All paradigmatic examples, Simondon says, of multifunctionality in concretization.

Before Guimbal's invention, argues Simondon, no one would have dreamt of placing the generator under water since, regardless of seepage problems, generators were unusually large at that time. However, it is due to Guimbal's genius in realizing that the turbine could be cooled in water that this concretization could occur, since it is by virtue of the automatic water cooling that the turbine could be built much smaller (becoming a technological object interacting with its milieu to achieve the next iteration in its evolution). Simondon (1958a, p. 55) goes on to suggest a weird sort of technological reverse-causality given that the turbine could not even be submerged if it were not for the fact that water produced cooling. This same invention would be perfectly impossible if it were set in the air, he notes. It is the milieu of the water that is necessary for the concretization to occur.

Building on this, Simondon ends METO's section on the Guimbal turbine with a highly insightful passage. He stresses that concretization is determined in the case of the turbine according to "an invention *which assumes that the problem is solved*" (Simondon, 1958a, p. 55). The concretization of the turbine was only possible due to the conditions that were established by the concretization itself. He says that the "act of adaptation" is not only established with predetermined milieus but that "adaptation-concretization" is a process that itself can *cause* the birth of a milieu (Simondon, 1958a, p. 55). Adaptation-concretization is caused by a milieu, according to Simondon (1958a, p. 55, my emphasis), that "had merely *virtual* existence" before the invention. The invention occurs due to a "jump" that the invention makes possible due to the appearance of a new "techno-geographic" milieu that is its condition. Simondon (1958a, p. 55) writes: "*Therefore, the technical object is the condition of itself as a condition for the existence of this mixed milieu,* which is at once technical and geographical". The invention of the technological object in a sense retroactively "invents" its new milieu.

Jean Hoerni's "dirty" planar transistors

The idea that a technological object can retroactively necessitate its own milieu, one that is capable of finalizing the technological object's "jump" to the next stage of its evolutionary iteration, can be explained by looking at the evolution of transistors. While Simondon provided examples of concretization from his own time (largely analog technologies such as the lever or the engine), little work has applied Simondon's theory of concretization to specific, contemporary information and communication technologies (ICTs) – Mills (2011), Hui (2015), and Bontems (2009) being three exceptions. Concretization is valuable for

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describing the evolution of ICTs in the same way that it is useful in analysing the development of analog technologies.

In the past, transistors had to be kept absolutely clean and scrubbed of dirt or excess particles that may have appeared during construction, but this would soon change. Jean Hoerni was one of the "traitorous eight" who left the Shockley Semiconductor Laboratory to form Fairchild Semiconductor in 1957. Hoerni was responsible for elaborating "a radically new kind of transistor: a more compact, flatter device whose sensitive parts were protected beneath a thin layer of silicon dioxide" (Riorden, 2007, p. 1). This was in part due to the fact that Hoerni utilized the multiple layers of silicon oxide growth leftover from the construction of the transistor that often formed on the silicon itself, usually a nuisance. The oxide growth, Hoerni discovered, was not simply a dirty, natural excess to be wiped off. It could be used for insulation. After Hoerni's discovery, engineers could "begin printing transistors on silicon. Planar transistors would prove to be much more reliable and perform far better than other designs" (Riorden 2007, p. 1). The dioxide that was naturally produced during the construction process could actually be used and harnessed as a type of insulator, contrary to widespread belief. As such, the "dirty" planar transistor is an even more interesting case of concretization than the one found in the Guimbal turbine. Where the turbine removed an element and used the milieu of the water to concretize, the transistor here does not even add a milieu in that it simply utilizes an excess element contained in itself to cause the next iteration of its evolution, something that is closer to Simondon's technological essence. The planar transistor's "dirty" excess was put to use.

To fully grasp what it was like to keep a traditionally clean piece of electronic equipment *dirty*, one must understand just how counterintuitive it was. Christophe Lécuyer and David C. Brock (2010, p. 29) write, in their masterful book on the history of the Fairchild semiconductor, that Hoerni

> would leave the oxide on top of the silicon wafer and open small windows in it to create transistor contacts. […] the idea of leaving the oxide layer on top of the wafer after multiple diffusion processes went, like gold doping, against all accepted knowledge in the semiconductor community. Semiconductor engineers and scientists considered the oxide layer that had served as a mask for diffusions to be "dirty"—that is, full of contaminants that would impair the electrical characteristics of the transistor. This idea of the "dirty" oxide seems to have originated at Bell Labs in 1955 and then spread rapidly to the entire community of semiconductor scientists and engineers. By the time Hoerni jotted down his ideas on the planar process in his patent notebook, it was widely accepted that the oxide layer that had been exposed to diffusions had to be stripped off and replaced by a "clean" re-grown oxide.

The dirty oxide allowed for better transistor insulation and a leap forward in transistor innovation by virtue of the introduction of an "internal" element to the transistor. In this way, one might say that the technological essence found in the invention of the transistor is located in this process, since it follows an internal path of resolution over additive or palliative measures. The dirty planar transistor, as a paradigmatic example of concretization, shows that such moments in the history of technology may be instructive for thinking about technological evolution today, and may offer a glimpse into the types of internal, multifunctional iterations and innovations that should be sought in technological research and development over external additives.

The concretization of artefacts

Contrary to much of the current literature on concretization that focuses on its metaphysical underpinnings, concretization is much more than metaphysics of technology; it has the potential to think the technological object from speculative and analytic perspectives. Marc de Vries (2007, p. 1) suggests that it would be valuable to revisit some of the early philosophers of technology such as Simondon, who "published ideas that were not yet followed up because they were too analytically-oriented to be recognized as interesting in an era in which the overall approach in the philosophy of technology was still Continentally-dominated".

It is true that Simondon's philosophy can be re-examined in light of the current growth of analytic philosophy of technology, particularly as practiced by the Dutch School and their strikingly similar "dual

nature" approach (which views technological artefacts as at once physical and intentional). Vries (2007, p. 12) ends by stating that "the dual nature account of technical artefacts should be preferred over Simondon's more speculative account", before admitting that his work "does bear resemblance" to the dual nature account and seems to "fulfil the criteria for an ontology of technical artefacts". Now, while Vries contributes some insightful observations in his text, Simondon's philosophy still offers a very fruitful philosophical foundation for thinking about technology that attempts to go beyond such easy distinctions. Simondon (1958a, pp. 12, 87) states that "there is a human reality in technical reality" and that "human action" is "fixed and crystallized" in the "functioning structures" of technology. He attempts to go beyond the dualisms of "culture and technology" and "man and machine", searching instead for an "alien reality" (Simondon, 1958a, p. 9). He starts from the observation of our failure to understand the machine, yet he is not concerned with science fiction, nor is he concerned with inert matter only. Simondon's (1958a, p. 13) work attempts to start a new philosophy of technology and calls for a new figure: a philosophy on the "open plurality of technics", done by a technologist, or better yet, a *mechanologist*.

As has been well documented elsewhere, Simondon (1958a, p. 20) refers to his approach as a "genetic method" in that he is less interested with objects themselves (the "final product") then in the structures and functions of which they are comprised (Barthélémy 2008; Bontems 2009). He leaves aside "closed" automata (he says they are low degrees of technical perfection) and looks for the "margin of indeterminacy" (Simondon, 1958a, p. 30) in "open" technological objects that have the ability to interact with their environments. To begin thinking about this, he divides technical objects into his three famous types; elements, individuals, and ensembles. Roughly, elements are simple technical objects like hammers and cups, built by artisans. Individuals are machines, run mostly by thermodynamics (the industrial revolution). Lastly, ensembles are a product of the twentieth century and information theory, which replaces thermodynamics. It is with the latter that Simondon became primarily interested. But this is not to say that he was only interested in the abstract or the speculative. On the contrary, Simondon sought out and developed a highly analytical way to parse the distinctions between "abstract" and "concrete" technological objects.

One simple way to imagine what Simondon means by "abstract" and "concrete" is the following. Take an engine. In an abstract (older) engine, each element comes into play at a certain moment and does not contribute to the overall functioning of the machine and its other elements. Conversely, in a concrete (more modern) engine, the technical problem has to do more with the convergence of functions as a total structure. One of Simondon's favourite examples is the water-cooled engine and the air-cooled engine. In the former, the water acts as an additive element meant to solve the problem of cooling. It is "abstract" because it does not affect any of the other elements of the engine. An air-cooled engine, on the other hand, has the engine interacting with its environment. There is a convergence there that is not present in the water-cooled engine. The reason an older engine is "abstract" is that parts are literally added to increase functionality. Simondon describes this type of procedure as analytic. In this analytic technics, the object is additive, but it also becomes weaker, and this is the important point. It uses more material and work. It is simpler logically while complicated technically (Simondon, 1958a, p. 25). This is why Simondon (1958a, p. 33) emphasizes the stronger synergetic functions of a concretized technological object: those that are "performed by a number of synergistically associated structures". In the analytical object, each element is designed for a certain function and so the "chain" becomes weaker (Simondon, 1958a, p. 24). The analytical technical object adopts palliative measures to solve a problem, while in the concrete technological object the scheme incorporates everything. But this strength, at the same time, relies on and exploits a constitutive weakness in terms of knowledge of the universal structures of science.

There is always, Simondon tells us, a leftover margin of indeterminacy between the schema of the technical object and the universal schemas of science, and it is the "narrowing of the gap" between these two that motivates the process of concretization. The difference "resides only in the imperfection of science", and to this end, "the technical object is never completely known" (Simodnon, 1958a, p. 35). For this reason, the object is never completely concrete. The question of bridging the gap between science and technics then assumes two kinds of improvement. Those that "modify the division of functions", increasing the "synergy of functioning", and those that, without modifying the division in question,

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"diminish the harmful consequences of residual antagonisms" (Simondon, 1958a, p. 38). These Simondon calls "major" and "minor" improvements, and one quickly understands that major improvements are to be preferred, since minor improvements are potentially harmful to the technological object in the long run. They hide the true imperfection of a technological artefact by using "non-essential devices, incompletely integrated into the functioning of the whole, to compensate for real antagonisms; the dangers attendant on abstraction are evident anew in the case of minor improvements" (Simondon, 1958a, p. 37). Technological evolution, in this sense, does not appear in minor improvements of functioning at all. Only "discontinuous improvements" bring about "modifications in the internal scheme of the technical object" (Simondon, 1958a, p. 13) which can then constitute an instance of technological evolution.

If one considers technological artefacts from the point of concretization, then, one may better see each artefact in light of a technical object's virtual schemes. These leave open a space for contemplation of technical evolution as well as space for other considerations, such as safety. In following concretization – that is, in tracing the schematic evolution of technological objects via their iterations – one becomes attuned to the technological object's objectively defined and schematic necessity rather than to a wilfully imposed human abstraction. In this way, Simondon calls for a new *technological humanism*, one that saw the human in the machine. In an interview from 1983 titled "Save the Technical Object" (2014, p. 454), he invokes the myth of Prometheus: "I think, to me, the technical object has multiple values. It is primarily something that comes from a very old activity of man, and which has probably pulled us away from barbarity". For Simondon, technology is the pathway to civilization. Concretization, then, is one way of following that path.

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Prehensive transduction: Techno-aesthetics in new media art

Tyler S. Fox – Simon Fraser University
tylersfox@gmail.com

Gilbert Simondon's philosophy of individuation and technology provide valuable conceptual tools for understanding contemporary, technologically-based artworks – what we consistently refer to as "new media." Simondon offers a form of analysis that brings the functional, or operational, aspects of the machine to the fore. It is a model of analysis well suited to understanding technologically-based artworks. That is to say, to understand how a work of technological art mediates between humans and the world, we must begin with its functions and not with the audience. This is especially true for responsive or interactive works that physically relate to the world through sensors. Simondon understands a technical object based upon its functionality within a specific, localized milieu that is also conditioned by the object's functions. The environment sustains the machine, but is also changed by the machine. Simondon calls the resulting environment the "techno-geographic milieu." It is a case of transduction: an individuation of what previously did not exist. He attempts to understand the machine's relation to the world through transductive processes. Alfred North Whitehead's concept of prehension can productively extend these ideas, especially in consideration of sensorially-enabled artworks. Prehensions are a form of non-conscious feeling; those things in the world that an entity can feel – the individual facts of its relations to the world. In this paper, I use the concepts of Simondon and Whitehead to examine Biopoiesis*, a recent technology connected to its environment via camera and microphones. The artwork is an experiment in analog computing, featuring dynamic electro-chemical responses to the gallery environment. In so doing, I will explore the functions and prehensions of this artwork in an effort to understand their transductive potential.*

In the introduction to *On the Mode of Existence of Technical Objects* Gilbert Simondon critiques human culture for "[failing] to take into account that there is a human reality in technical reality and that, if it is to fully play its role, culture must come to incorporate technical entities into its body of knowledge and values" (Simondon, 1980, p. 11). Simondon's attack on the perceived split between technology and culture is a failure to fully adopt what he later calls a "technical mentality." In a posthumously published essay with this title, Simondon argues that such a mentality was still in development, but emergent. He claims that, "an extension of the technical mentality is possible, and begins to manifest itself in the domain of the Fine Arts in particular" (DeBoever, 2012, p. 13). In this essay I will explore the relation of technology and art through the analysis of one recent work of interactive media art, *Biopoiesis,* by artists Carlos Castellanos and Steven J. Barnes.[1] My reading of this work will be in dialogue with my reading of Simondon.

Central to my inquiry into this work is the consideration of technical aesthèsis, or sensation. Interactive media, especially artworks, use environmental inputs to engage with a human audience, creating a heightened sense of engagement through alternative means of interaction. However I will argue that there is more at work here than the engagement of a human audience. While Simondon does provide some insight into the potential for technical sensation, I draw on Alfred North Whitehead and his concept of prehension to extend and strengthen this idea. Whitehead's philosophy allows us to consider an entirely non-conscious form of experience, which is essential when considering interactive artworks. It allows us to consider the agental and creative response available to non-humans, living or not. This is not to suggest that Simondon's work is not applicable to non-human realms, far from it. However, Whitehead offers us explicit routes of engagement that are not as evident in Simondon's philosophy. Where Simondon focuses on the physico-chemical relations of machines in a given milieu, Whitehead helps us understand these

[1] In the interest of full disclosure, I too am a member of DPrime, though I have not worked on *Biopoiesis.*

processes in terms of sensation. It will be useful to begin our journey with the connection between individuation and technology.

Simondon is arguably best known as a philosopher of technology, yet his main doctoral thesis was focused on individuation. It is a mistake to separate these aspects of his work; instead we must consider his philosophy of technology as a specific form of individuation, technical individuation. Simondon claims that it is necessary, "*to understand the individual from the perspective of the process of individuation rather than the process of individuation by means of the individual*" (1992, p. 300). Thus Simondon seeks to understand the processes, or operations, of individuation as they unfold. As Arne de Boever notes, "The main point of Simondon's philosophy of technology is well known: when considering a technical object, Simondon does not so much see a stable identity or substance, but something that is the result of (and often still involved in) a process" (De Vries et al, 2014, p. 13). As we shall see, this is entirely appropriate to understanding our subject of inquiry, *Biopoiesis*.

Simondon identifies a stage prior to individuation, which he names the preindividual – the phase in which individuation occurs and from which individuals emerge. He claims that the preindividual stage is metastable. This term, borrowed from physics, describes a set of conditions that are precariously stable. The smallest change of these conditions breaks the stability and initiates change in the system. For example, supercooled water, that is water that is below the freezing point but still liquid, rapidly transforms into ice the moment the smallest impurity enters the water. As Muriel Combes writes,

> Before all individuation, being can be understood as a system containing potential energy. Although this energy becomes active within the system, it is called potential because it requires a transformation of the system in order to be structured, that is, to be actualized in accordance with structures. Preindividual being, and in a general way, any system in a metastable state, harbors potentials that are incompatible because they belong to heterogeneous dimensions of being (Combes, 2013, pp. 3-4).

Individuation, then, is a process of resolving tensions and incompatibilities. Combes (2013, p. 3) makes clear that metastable relations are key to individuation, and that they allow us to understand the individual "in *excess* over itself". Simondon (1992, p. 319) provides the example of a plant, which he claims, establishes relations between "cosmic" and "inframolecular" orders by means of photosynthesis and processing chemicals in the soil. He describes the plant's individuation as a bridge between two "layers of reality that originally had no contact with each other". Simondon (1992, p. 300) states that processes of individuation produce more than just the individual, which is itself a partial resolution to the tensions, forces and energies present in the preindividual stage. "Individuation, moreover, not only brings the individual to light but also the individual-milieu dyad". The milieu sustains the individual. Both individual and milieu carry forth latent potentials from the preindividual stage. We can see how a plant individuates alongside of a living milieu. This allows the processes of individuation to continue. Though conditioned by the past, individuation is always in the present. Simondon stresses the present as he describes the informational quality of the tensions that spur individuation.

Simondon offers an understanding of information that is at odds with contemporary information theory, which focuses on a conception of information that is sent and received. For Simondon (1992, p. 311, emphasis in original), information is "*the signification that emerges when* a *process of individuation reveals the dimension through which two disparate realities together become a system"*. Information, then, begins in the preindividual stage, preceding individuation. In Simondon's philosophy, incompatibilities of the preindividual that must be resolved through individuation are information. Information drives individuation, instigating it and in-forming ongoing processes of individuation. Simondon (1992, p. 311) describes information as "the tension between two disparate realities," this tension requires a resolution, thus individuation. Even though information instigates individuation, it is also contemporaneous with the unfolding individuations, "it is always contemporary, because it yields the meaning according to which a system is individuated". As Combes (2013, p. 5) writes, information "designate[s] the very operation of taking on form, the irreversible direction in which individuation operates". Information continuously modulates an ongoing individuation.

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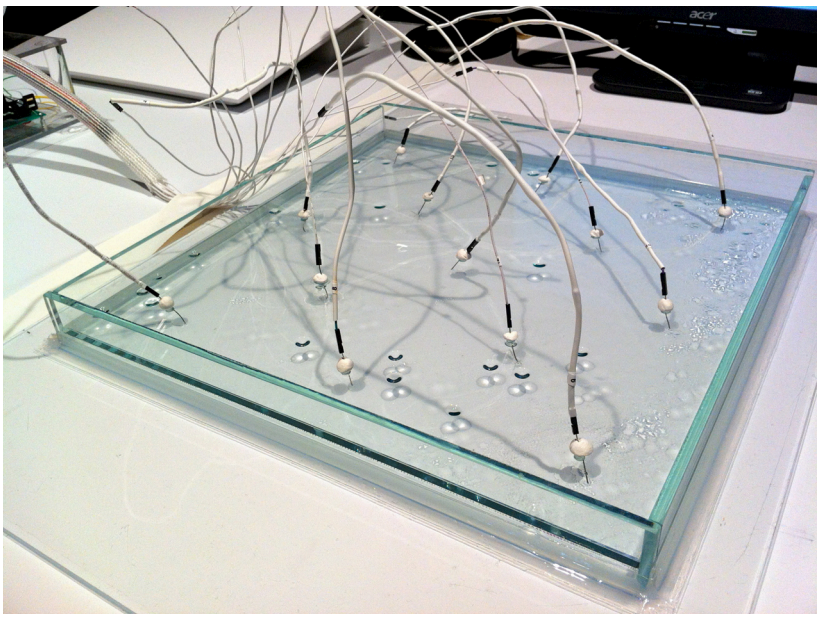
The operation of individuation is modulated through information, but it is not just a process of call and response, for there is an internal resonance of each individual. In the living individual, internal resonance is how the living being systematically individuates on an ongoing basis. Simondon writes:

> *The living individual is a system of individuation, an individuating system and also a system that individuates itself*. The internal resonance and the translation of its relation to itself into information are all contained in the living being's system. In the physical domain, *internal resonance* characterizes the limit of the individual in the process of individuating itself. In the domain of the living being, it becomes the criterion of any individual qua individual. It exists in the system of the individual and not only in that which is formed by the individual vis-a-vis its milieu (Simondon, 1992, p. 305).

Simondon's work is well suited to the contemporary, technological artwork. The subject of this essay, *Biopoiesis,* provides a useful example of the individuation of a technical art object in relation to its milieu. The work also complicates Simondon's strict delineation between living and non-living individuation. The artwork is based on the research of cyberneticist Gordon Pask. It uses natural processes to explore alternative forms of computing, privileging the organic over the digital. The artists refer to their work as a "computational primordial soup" (Castellanos and Barnes, 2014). These primordial qualities make it an apt object of analysis for Simondon's work. As we shall see, *Biopoiesis* also shows how and why Alfred North Whitehead's philosophy can productively add to Simondon's.

Biopoiesis

A clear acrylic box (roughly 21x21x2 inches) rests on a table. Thirteen white wires emerge from the top of the box. The wires appear chaotic, snaking out of the small tank in multiple directions until they gather into one large bundle wrapped in white mesh, connecting them to back to a computer (see fig. 1). Within the box is a clear solution of stannous chloride, a metallic ion solution.[2] Though not readily apparent, sound and motion in the area immediately surrounding the installation are monitored through microphones and a web camera, also connected to the computer. The artists write custom code that translates motion and sound into electrical signals routed through the wires. The electrical current causes crystal-like forms to grow where the incoming electricity meets the metallic ion solution.



[2] It is important to note that *Biopoiesis* is modular, and could be setup in a variety of ways. In this essay, I discuss recent iterations of the work.

Figure 1

Castellanos and Barnes (2014) describe a recent iteration of *Biopoiesis* as such:

> Features of a gallery environment controlled the gating of current through each of the individual electrodes. Each of nine electrodes (the anodes) was gated by motion in one zone near the test apparatus, while each of the remaining four electrodes (the cathodes) was gated by the presence of sound within a particular frequency range (i.e. low, low-mid, high-mid, and high range) in the gallery.

In this configuration a circuit forms only when both a cathode and an anode are active, that is sound and motion occur simultaneously. When a circuit closes, electrical energy flows between cathode and anode, causing dendritic, or branching, growth (see Fig 2). The dendrites grow vectorially, that is to say that the crystals grow in the metallic ion solution from the active cathode in the direction of the active anode(s). The crystal location, and their directional growth provide indicators of both which frequencies were detected and where motion was most prominent.

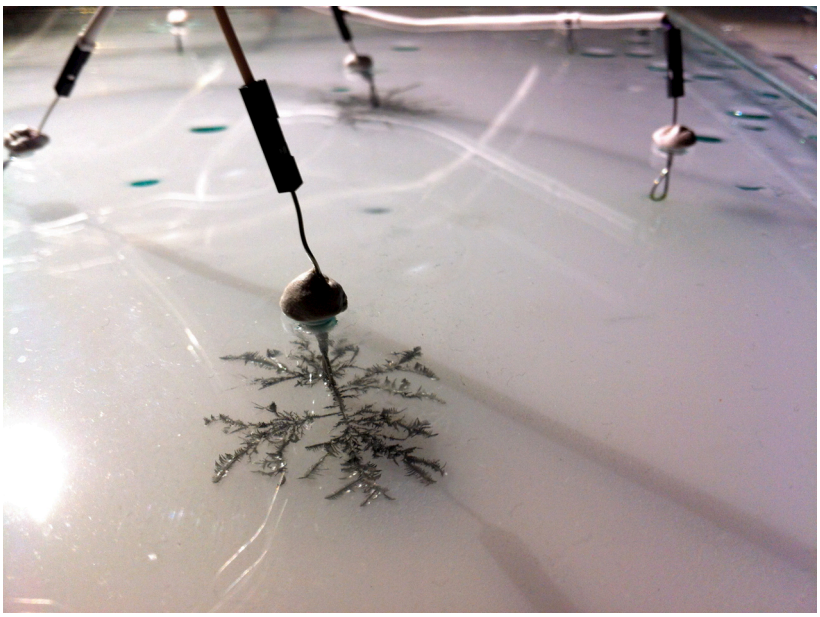


Figure 2

There is an immediate resonation with Simondon's work and *Biopoiesis*. Simondon stresses that "individuation must be considered primordial" (1992, p. 300). Simondon's paradigmatic example of individuation is also the crystal. As he describes it, super-saturated mother water is perturbed by a seed that extends and grows layer-by-layer in a reticular fashion. The disparation between seed and water creates a phase shift where a new individuation actualizes:

> Such an individuation is not to be thought of as the meeting of a previous form and matter existing as already constituted and separate terms, but a resolution taking place in the heart of a metastable system rich in potentials: *form, matter and energy pre-exist in the system*. Neither form nor matter are sufficient. The true principle of individuation is mediation, which generally presumes the existence of the original duality of the orders of magnitude and the initial absence of interactive communication between them, followed by a subsequent communication between orders of magnitude and stabilization. (Simondon, 1992, p. 304)

Simondon is known for his critique against hylomorphism, which is apparent in this quote. Processes of

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individuation are more complex than the meeting of form and matter; individuation is the mediation of different orders of magnitude. Individuation results from its constituting relations. Mediation is also central to *Biopoiesis*. The system mediates sound and motion of the gallery environment via microphones, webcam, and algorithms in such a way to trigger dendritic growth in a metallic ion solution – this, of course, is a subsequent mediating process. The arrangement of anodes and cathodes structures the potential crystal formation. Mediation across these different domains, the structuring of energy from sound and motion into electricity and crystals is transduction, one of Simondon's core concepts: transduction.

Simondon describes transduction as, "a physical, biological, mental, or social operation, through which an activity propagates from point to point within a domain, while grounding this propagation in the structuration of the domain, which is operated from place to place…" (Combes, 2013, p. 6). It is easy to see why Simondon's paradigmatic example of individuation is the crystal, for the structured, layer-by-layer growth demonstrates transduction so well. However another example of transduction, binocular vision, demonstrates the importance of binding together disparate sources into a single system. Anne Sauvagnargues describes this process as "transductive disparation."

"'[D]isparation', which Simondon borrows from the psychophysiology of perception, refers to the production of depth in binocular vision and describes the incompatibility of retinal images, the irreducible disparity between the images that produces three-dimensional vision as a creative solution" (Sauvagnargues, 2012, p. 6). Binocular vision allows us to understand a key principle of transduction. The transductive result, the resolution of the original disparation, does not "preexist," it is a novel production of the system (Simondon, 1992, p. 311). Transduction provides unity where previously there was disparity. This is central to all aspects of individuation for Simondon. Muriel Combes (2013, pp. 7-8) writes, "Transduction expresses the processual sense of individuation; this is why it holds for any domain, and the determination of domains (matter, life, mind, society) relies on diverse regimes of individuation (physical, biological, psychic, collective)". I will return to the connection between physical sensation and crystal growth below.

Returning to *Biopoiesis*, we can understand it as a complex, ongoing event of simultaneous transductive processes. The crystals are dynamic and emergent, responding to the environmental changes. What we witness as audience members is a late stage of a chain of transductive events. The intricate patterns of crystalline growth capture our attention, but there is more going on here than the formation of mesmerizing fractal patterns.

Akin to Simondon's arguments on individuation, the crystals do not provide us with the means to understand their individuation. Instead, we must examine the operations of individuation, or, the processes that inform crystalline growth. The role of sound in the artwork offers a prime example. The resulting electrical signal of the vibrating diaphragm of a microphone in response to sound waves is an early transductive process. These signals are structured through algorithms created by the artists, which distinguish between low, low-mid, high-mid and high frequencies. Each of the four frequencies is then routed as electrical current to corresponding cathodes. The physical arrangement of anodes in the installation provides structure for potential crystal growth.

Similar processes are at work in motion detection. A web camera monitors the area immediately surrounding the installation. The camera restructures analog activity into digital signals sent to the computer. These signals are processed algorithmically, seeking signs of motion in the gallery space. Each anode is correlated with a given area around the installation and is activated when motion is detected in that area. This final act closes a circuit, triggering crystal growth in the stannous chloride. Greater occurrence of sound within one of the four frequencies will cause more crystalline growth at that cathode, while more motion in a given area of the installation will pull crystals in the direction of the corresponding anode.

The structured growth of crystals is informed by the unfolding events of the gallery environment, the milieu. As mentioned, a key tenet of Simondon's arguments is the connection between individual and milieu; the individual and milieu are co-emergent in the processes of individuation, forming a dyad. The milieu of *Biopoiesis* includes visitors to the gallery, and whatever makes up the sonic characteristics of the space (audience members, other artworks, external noise and so on). As audience members come near the installation, they affect it. Even if they do not linger, their presence activates an anode. Any noise they

make will likely activate a cathode. The milieu of the dendritic patterns growing in *Biopoiesis* is more than just the interaction between stannous chloride and electrical stimulation. The pattern of visitors around the artwork spurs the emergent growth of crystalline forms. It is a non-human form of pattern recognition and recording of events. The artwork dynamically records what transpires in the milieu of the gallery, though it is a record that we have no ability to decipher. However, I would argue that we can go further with our interpretation of this work: *Biolesce* experiences its environment.

This experience is perhaps best understood through the philosophy of Alfred North Whitehead and his concept of prehension. Whitehead argues that all actual entities (those entities that make up our real, physical world) are subjects and that they experience their world. Experience is central to Whitehead's (1929, p. 167) philosophy; we might even consider it foundational to his philosophy, writing that "… apart from the experiences of subjects there is nothing, nothing, nothing, bare nothingness". Prehension is the term Whitehead applies to the non-conscious perceptions of the world, or non-conscious feelings. They are the individual facts of an entity's relations to the world. That is to say, prehensions make up experience. Non-consciousness is key here, for in Whitehead's ontology all things, living or not, feel.

The unfolding of experience is processional: an entity does not just take in an experience all at once; experience emerges bit by bit. Whitehead writes:

> The subject emerges from the world...The feeler is the unity emergent from its own feelings; and feelings are the details of the process intermediary between this unity and its many data. The data are the potentials for feeling; that is to say, they are objects. The process is the elimination of indeterminateness of feeling from the unity of one subjective experience (Whitehead, 1929, p. 88).

Whitehead's terminology is quite important here, experience is emergent, and what emerges are feelings. Feelings are born out of data inherited from the world; it is never a question of subject or object, it is always both for Whitehead. The forming subject, what Whitehead refers to as the superject, is not singular. It is a combination of subject and the objects it encounters in its becoming. All actual entities are superjects. "An actual entity is at once the subject experiencing and the superject of its experiences. It is subject-superject and neither half of this description can for a moment be lost sight of" (Whitehead 1929, p. 39). Feeling emerges from the unity of the subject and its data, but also in the way that data is received. "*[H]ow* an actual entity *becomes* constitutes *what* that actual entity *is*...its 'being' is constituted by its 'becoming'" (Whitehead 1929, p. 23).

The how of becoming in Whitehead's estimation occurs through prehensions. As Whitehead explains, "Actual entities involve each other by reason of their prehensions of each other. There are thus real individual facts of the togetherness of actual entities" (Whitehead 1929, p. 20). However, prehensions are not just fact.

> [T]he first analysis of an actual entity, into its most concrete elements, discloses it to be a concrescence of prehensions, which have originated in its process of becoming...every prehension consists of three factors: (a) the 'subject' which is prehending...;(b) the 'datum' which is prehended; (c) the 'subjective form' which is *how* that subject prehends that datum (Whitehead, 1929, p. 23).

Prehension is the non-conscious feeling of becoming. The act of prehension forms the superject. Whitehead avoids the splitting of subjects and objects, for the actual entity, the event itself, is the superject. Gilles Deleuze (1993, p. 79) writes, "the event is inseparably the objectification of one prehension and the subjectification of another...it is...participating in the becoming of another event and the subject of its own becoming". Prehensions form an ontology of feeling. As Brian Massumi (2011, 85) suggests, "To accompany this kind of thinking you have to be open to the possibility of rethinking the world as literally made of feelings of prehensive events".

Though tensions exist between the philosophies of Simondon and Whitehead, they also resonate strongly. Both found their philosophies on relational ontologies, emphasizing the relations between entities and their surrounding environments. Simondon's individual-milieu dyad is similar to Whitehead's superject, though clearly they are not direct corollaries. Simondon's project is one of understanding the

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processes of individuation, eschewing the individual. Whitehead's focus is, arguably, more concerned with individuals, or actual entities. However, as Emeline Deroo writes, this comparison is potentially misleading. For, Whitehead's actual entity and Simondon's individual are of different levels. She writes: "[a]ctual entity belongs to the field of ultimate and non-perceptible components of an real fact whereas with Simondon's concept of individual, we are already situated at this ordered level of reality – the spatio-temporal level" (Deroo 2011, p. 307). Deroo emphasizes that what connects these two philosophers is a relational ontology attuned to the structured processes of becoming. Experience itself is a processual event for Whitehead. One can consider experience as unfolding individuation, where subjects and objects are prehended by one another.

There is much to be said about the resonances and divergences of these two philosophers, for which I do not have the space in this essay. Yet, I believe their focus on dynamic becoming and the relations between entities provides creative leeway to bring their ideas together. In the case of this essay, the understanding of Whitehead's prehensive experience and adding it to Simondon's philosophy of technology is critical. Simondon does not explicitly provide us with an understanding of technology that experiences the world. What is gained through the addition of Whitehead here is the consideration of technologies as *feeling* individuals. So, then, we might ask what are the subjective forms of *Biopoiesis*? How does *Biopoiesis* feel? For the moment, I shall let these questions remain open and consider Whitehead's philosophy a little further.

Feelings, for Whitehead, are "vectoral"; they come from the past and lead to the future. They have a direction, one that is shaped in how that feeling becomes. He writes:

> feeling from a beyond which is determinate and pointing to a beyond which is to be determined. But the feeling is subjectively rooted in the immediacy of the present occasion: it is what the occasion feels for itself, as derived from the past and as merging into the future (Whitehead, 1929, p. 163).

The vectors of feeling can help describe our enduring experience of becoming. Even though my becoming is punctuated by specific events brought about by my interaction within a given milieu, I still have an enduring sense of self. I, in the terminology of Whitehead, am a society. Isabelle Stengers (2008, p. 104) describes societies as "complex routes of occasions exhibiting some level of conformity as each reproduces and confirms a way of feeling, of achieving its own identity". However, the important point here is not the enduring identity, but that entities are constantly becoming in unison with what they prehend. "Every achievement of unity is something that has never existed before: something different, something radically new" (Shaviro, 2009, p. 75). Experience is emergent. There is choice and novelty. "An act of feeling is an encounter – a contingent event, an opening to the outside – rather than an intrinsic, predetermined relationship. And feeling changes whatever it encounters, even in the very act of 'conforming' to it" (Shaviro, 2009, p. 63). I will return to the changing acts of feelings below.

Before turning to *Biopoiesis,* I wish to consider one other term in Simondon's vocabulary, and its relation to prehension. In his example of the Guimbal turbine, Simondon provides a detailed account of how the technical object interacts with its milieu. The Guimbal turbine is a hydroelectric generator housed in a water pipe. When the generator is turned on, the water surrounding the turbine and the oil in the turbine become "plurifunctional." The water is the energy source of the turbine and it also dissipates heat from the engine. The oil lubricates the components of the machine, conducts heat, and forms a barrier between the engine and the water (Simondon, 1980, p. 47). The water, transformed by the heat of the turbine, becomes an associated milieu for the machine. Without the water to dissipate heat the machine would not work – operating in the air would cause it to explode. Thus, the water becomes an environmental condition for the machine's continued operation. Simondon writes:

> It could be said that concretizing invention brings into being a techno-geographic environment (in this case, oil and water in turbulence) which is a condition upon which the possible functioning of the technical object depends. *Therefore the technical object is the condition of itself as a condition for the existence of this mixed environment that is at once technical and geographical*" (Simondon, 1980, p. 48).

Water and oil, previously disconnected, are transformed by the turbine, at the site of the turbine, into a cohesive system that allows for the machine to continue running.

Simondon understands a technical object based upon its functionality within a specific, localized milieu that is also conditioned by the object's functions. Whitehead's prehension offers a way for us to consider how the turbine *feels* its processes of becoming. The machine prehends the water and the way in which the water moves the heat away from the turbine. The environment sustains the machine, but is also changed by the machine. Bringing these ideas together helps understand prehension as a transductive process and allows us to speculate how the technologies (and, by Whitehead's philosophy, all things in the world) may feel, in a non-conscious way.

Simondon privileges technological functionality over a user-centric understanding of technology. How we use a given technology does not help us understand the physic-chemical interactions that comprise the functional operations of a technical object in the world. Yet, Whitehead's philosophy of experience helps further this idea even more. It de-centres the user, without completely removing considerations of the user. For, considering the prehensive aspects of technical objects helps understand the material relations they bring into play. It can help reveal the material relations of a given techno-geographic milieu, per Simondon, but also deepen our understanding of the relations between users and technology via Whitehead's concept of the superject. When considering new media art and design, technical prehension becomes a mode of analyzing the affective experience of the technical object.

Biopoiesis offers an excellent example of a technogeographic milieu of the technological art object. Andrea Oliveira and Felix Rebolledo write about the associated milieu of art. They argue that art, especially interactive work, forms an associated milieu in combination with the gallery space and viewers. They write, "The exhibition space facilitates the creation of an associated milieu which allows us to realize that with the artwork, the viewer causes the associated milieu which in turn allows the reciprocal coming-to-being of each other" (Oliveira and Rebolledo, 2011, p. 220) That is to say, that the authors envision audience engagement with the work as a form of becoming: "as viewers become one with the installation, they act as ingressive entities fomenting new associated milieus which in-turn establish 'individual' and 'collective' aesthetic events" (Oliveira and Rebolledo, 2011, p. 221).

In the milieu Oliveira and Rebolledo describe, there is a focus on the human audience of the artwork. Lacking from this associated milieu is the technogeographic – the ways in which the milieu interacts with the specific technological forms of the interactive installation. Furthermore, after Simondon and Whitehead, we can understand that interactive artworks do not require humans with which to interact. *Biopoiesis* is an excellent example of this; it needs environmental inputs, not human input. What Castellanos and Barnes do, however, is to make the relations between art and audience the drivers of non-human individuation on display in the artwork. It is a feedback loop, both relevant to their interest in cybernetics and contemporary art: as we experience the artwork the artwork also experiences us. The visual component of the artwork, the crystals, grabs the audience attention and focuses our observations on the emergent experience of the art. We can understand dendritic growth as a creative response to the surrounding milieu, the audience, which it prehends. Yet, the configurability of this system would allow us to see any number of environmental inputs through the experience of *Biopoiesis.*

Prehensions offer a way for us to trace transductive processes. In *Biopoiesis*, crystal formation indicates its own experiential process; prehension of the surrounding milieu leads to the transduction of crystal formation. It is important to remember that the crystal growth is a function of the artwork; they are products of technological configuration. The gallery and artwork form a technogeographic milieu, one which is specific to the here and now of the installation. *Biopoiesis* reveals the relations of its individuation through its own non-conscious, and non-human, prehension. While Whitehead allows us to consider the experiential feelings of things, prehensions, in the world, Simondon's philosophy can help us consider the aesthetic qualities of these prehensions.

In a posthumously published letter Simondon coins the term techno-aesthetics. This term helps us think through the consideration of material potential that runs through the affective realm. The techno-aesthetic runs along a spectrum for Simondon and is not relegated to one specific kind of aesthetic sensation. He argues that any form of technology can be used in ways that differ from its original intentions. This "margin of liberty" surrounds each technical object (Simondon, 2012, p. 5). Simondon

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outlines several categories of the techno-aesthetic. He describes the "intercategorial fusion" of technical achievement that is also beautiful. He offers the Eiffel Tower and the Garabit viaduct as two examples. Each object is a technical achievement, while also being beautiful (Simondon, 2012, p. 2). However, the Eiffel Tower, according to Simondon, had no function when it was originally built. In time, antennas were added to the structure, adding to its techno-aesthetics. The Garabit viaduct is beautiful due to its technical form and function, but also due to its placement in nature. There is a certain functional understanding to this category of techno-aesthetics. Simondon also examines tools from this perspective. Excellent function, form, or fit to one's hand is also examples of this fusion of function and beauty.

However, the techno-aesthetic is not caught up in contemplation, he argues, "It's in usage, in action, that [techno-aesthetics] becomes something orgasmic, a tactile means and motor of stimulation"(Simondon, 2012, p. 3). Simondon continues to describe the tactile and sensory qualities of working with tools. Simondon quickly follows up with examples of artists working with tools, writing:

> Aesthetics is not only, nor first and foremost, the sensation of the "consumer" of the work of art. It is also, and more originally so, the set of sensations, more or less rich, of the artists themselves: it's about a certain contact with matter that is being transformed through work. One experiences something aesthetic when one is doing a soldering or driving in a long screw (Simondon, 2012, p. 3).

Simondon examines the ways in which technology can extend human sensation; there is a new kind of "aesthèsis" via technology. "When it's a question of detecting subtle, yet determinant phenomena that escape regular perception, one can only see the aesthetics of nature with the aid of the technical object" (Simondon, 2012, p. 5). The affordances of certain technologies allow humans to sense phenomena outside of their sensorial register. Electricity can be *sensed* through certain technological apparatuses that make it available to our "sense organs" (Simondon, 2012, p. 5).

Simondon's (2012, p. 3) techno-aesthetics provides a wide spectrum of potential aesthetic relations to technical objects. All technical objects have some kind of "aesthetic tenor". It can be in direct relation, as the sensorial aspect of driving a screw, or the more common understanding of aesthetic appreciation, as in the case of the Eiffel Tower or other technical objects. This latter category of techno-aesthèsis, the ability to use technology to sense beyond our own human register, opens up new terrain, especially in the consideration of interactive artworks, and our contemporary technologies. However, Simondon's writing would suggest that the aesthetic realm, though shifted via technology, is primarily for human consideration.

Biopoiesis is an interesting techno-aesthetic work because it features the range of aesthetic qualities Simondon discusses, and it challenges an anthropocentric reading of the work. It is technically interesting, fusing science and art in complex ways. Computer vision, sound detection and electro-chemical processes comprise the work, revealing the ways in which technologies can mediate human experience and natural processes. It is a work in action: it is a dynamic, emergent response to its milieu. Without environmental stimuli there is nothing for us to see, and the work 'does' nothing. It also prominently features the techno-aesthèsis that Simondon discusses – it senses the world in ways that exceed human understanding. *Biopoiesis* also allows us to shift from human to non-human aesthetic experience.

There currently exists an anthropocentrism inherent to the contemporary notion of human-computer interaction. The term interaction implies a human-centred relationship, and no doubt this makes sense in our consumer-driven and functional understanding of technology. We, humans, make technology to achieve our desires. This, I argue, is an impoverished view of technology. *Biopoiesis* challenges the common assumption of interaction prevalent in contemporary interactive art and the broader contemporary computing paradigm by opening up interaction to its milieu. By featuring a non-human electro-chemical sensorial experience that is emergent to the physical world around it, *Biopoiesis* asks us to reconsider what interaction means. The artists are well aware of this bias writing, "Few would dispute that digital computation has pervaded most aspects of our existence and transformed our very thought processes. New media artists sometimes make the implicit assumption that digital forms are the only avenues for exploration. The digital is often taken as a given" (Castellanos and Barnes, 2014). Indeed, the digital is taken as a given, just as interaction focuses on humans. As mentioned, *Biopoiesis* does not interact with humans per se, but with the sound and movement of its surrounding environment. These electro-chemical

processes are not simply part of a mad science experiment; instead they are forays into alternative forms of computing. At its heart, *Biopoiesis* challenges the digital, the discrete binary logic hidden underlying our contemporary technical condition.

Castellanos and Barnes describe their work as a "computational 'primordial soup'". It aptly describes the system, which has its own dynamic processes that are linked with the environment. They write,

> The dendrites are fluid and unstable, bifurcating and dissolving in seemingly unpredictable ways. Thread bifurcation and dissolution, in turn, leads to resistance changes that modify the flow of information (current) through the network. If a subset of electrodes in the electrochemical solution receive input from an environmental sensor (or via some other method), and the electrochemical output can affect that sensor (or otherwise influence the growth of threads), then the network may move towards a dynamic equilibrium with its environment (Castellanos and Barnes, 2014).

Biopoiesis displays internal responses to the world around it. It is dynamic matter. I want to return to one of Simondon's ideas from above, that is the difference between living and physical entities. Simondon stresses that living individuals respond internally, while physical individuals do not. However, *Biopoiesis* challenges this strict view. Dynamic is the key here, for there is plasticity inherent to this system. In fact, the artists claim that the system exhibits enough plasticity to indicate a kind of memory and learning:

The dendritic network [the crystals in metallic ion solution] also carries a decremental memory trace of its previous activities: when the environment changes, the system is perturbed but not immediately reset. Thus, the prior activity and configuration of the system affects how it handles a change in its environment. It can thus learn from its interactions. Furthermore, the system can be trained by providing reinforcement for certain sorts of conductance changes that are produced in response to a particular environmental perturbation (Castellanos and Barnes 2014).

Biopoiesis challenges simple notions of living and non-living. It encourages us to view the world as an ongoing, dynamic set of relations. It also implicitly challenges anthropocentric understandings of the world.

Conclusion

Our contemporary cultural moment is filled with sensor-laden technology, a trend that only seems to be growing stronger. Currently, the discussion of such technologies seems to vacillate between the potential of a greater understanding of ourselves (a la the quantified self movement) or toward concerns of privacy, big data and personal freedoms. I am in favour of both conversations, but I am also interested in shifting the conversation beyond what we, as societies and individuals, do, but what we engender. What potentials for dynamic emergence are possible in the aesthèsis of new technical individuals? What shifts if we consider our technologies to be feeling entities? What *feelings* may emerge?

James Ash suggests that we take "an object centered" approach to understanding technological affects. Following Simondon, Ash argues that to understand the affect of a given technology, one must understand the material elements of that technical object and the milieu in which the object operates. Thus, we are enabled to consider the potential affects this object may have in the world (Ash, 2014, p. 7). He describes technology as "inorganically organized objects" and offers a Simondonian mode of analysis for both the technical object and for its affects. He also draws attention to the ways in which these material affects may linger, as with ringing in the ears after a loud concert. Affects do not just occur and then stop. These are not discrete moments in time, but they continue on. Thus, Ash argues for an ecological analysis of technology, whereby affects are considered as organized bundles of material interactions, interactions with potentially lingering affects, which he calls "afterlives". "In other words, affects can have traceable points of emergence and traceable afterlives" (Ash, 2014, p. 6). Ash helps us consider a field of materially produced affects from a range of technologies that impact our experience. This, however, is not limited to our human experience.

We can push this idea further in a consideration of sensing and *feeling* technologies. Via Simondon's notion of technical aesthèsis, we may open ourselves to a cascade of affects from a plethora of technical

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objects. What afterlives affect us now? How are surrounding technologies affected? How can a technological milieu reveal, or trace, lingering affects? Works like *Biopoesis* help consider the creative potential of affects on a different sensorial register than our own. They may even extend our sensorial register into new domains.

Biopoiesis offers an interesting alternative to contemporary computational approaches, and does so by featuring a dynamic system that senses its surrounding environment. It is novel, featuring natural, electrochemical processes. That is to say, it highlights already existing potentials in our world. Gilbert Simondon's philosophy helps us understand that the processes of becoming are relational: milieus and individuals are co-emergent in the world. Thus, what surrounds us helps shape us. Further, Alfred North Whitehead helps us consider the world around us as an ongoing subjective experience – entities prehend, or feel, one another. Together, these ideas can help us reconsider the digital environs we currently live within. They help us understand being as excess; we are extended by our milieus, our prehensions. *Biopoiesis* shows that non-living systems are also in excess of themselves and can potentially help shift not just our anthropocentric tendencies, but also our tendencies to overlook the non-living as subjects. Castellanos and Barnes are cognizant of this as well. As they reflect on their work, they channel the core of both Simondon and Whitehead claiming, "Biopoiesis encourages us to view the world as full of co-emergent, co-evolving systems too complex to be fully apprehended or objectively explained. A world that is in a perpetual state of becoming, characterized and brought forth via emergent relations of complexity that adumbrate an experience of the world that we characterize here as open-endedly ambiguous" (2014).

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The birth of technology from the spirit of alchemy

Dan Mellamphy – Western University
melld166@newschool.edu

This essay briefly examines Simondon's use of, and reference to, alchemy in his articulation[s] of technicity, underscoring the interesting interrelations between the latter and the problem[s] this might pose for straightforward and straightforwardly modern interpretation[s].

(Prefatory) Foreword:

When I first saw Scott and Tom's call for this Special Issue of *Platform* devoted to "Situating Simondon", I forwarded it to some potentially interested scholars, posted the link up on *Twitter*, and sent them a digital thumbs-up, adding at the end of that minuscule missive a brief note on my part, noting that their call for papers' guiding questions ("*How might we situate the theories of Simondon within our contemporary media environment*? *Are they still relevant*? *Or are they too reliant upon outmoded principles and theoretical models*? *What lessons, both theoretical and practical, might researchers in the fields of communication and media studies take from Simondon's philosophy*? *How might we extend or update his work for the digital, networked society*?") are the same questions that have been asked of alchemy since the advent of modern chemistry, and that a rather unknown dimension of Simondon's work – unknown to the *anglophone world* at the very least – is precisely the latter's interest in, and references to, this ancient theory of transduction and transmutation. They replied with a very nice thank-you and asked if I might be able to contribute something on the topic of Simondon's interest in alchemy and its relation to contemporary media technology. Then (as a true sign of true editor excellence) they kindly reminded me of this much much later: a reminder which prompted me to write-up and send-off what follows – an admittedly rather cursory essay on "The Birth of Technology from the Spirit of Alchemy" (apologies in advance for its accursedly cursory nature).

In "The Birth of Technology" (1970),[1] Simondon argues that "scientific spirit" (the *lógos*, as such, of *technè*) developed in the West as a result of the meeting and mingling of Eastern, Near-Eastern, or Egyptian technics on the one hand and the [principally Greek] contemplative and theoretical sciences on the other (Alexandria – with its Ptolemaïc *Pharos*[2] – was an exemplary hub of this confluence between the technical and the theoretical).[3] Since it deals for the most part with what the ancient Egyptians called *al-khem* (the Arabic *al-khimiya*, the Latin *alkimia*, the French *alchimie* and the English *alchemy*, originally designating a fertile as opposed to a desert milieu: the generative "black earth" of *al-khem* as opposed to the deleterious "red earth" of *al-deshret*), "The Birth of Technology" could just as easily have been called "The Birth of Technology from the Spirit of Alchemy" (the title of the present essay).[4]

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[1] Gilbert Simondon, "La Naissance de la Technologie" in Gilbert Simondon, *Sur la Technique (1953-1983)*, Paris: Presses Universitaires de France, 2014: 120-178 – henceforth *Technique*.

[2] Alexandria's towering light-house: one of the seven technical marvels or "wonders of the world" in the time-period of classical antiquity (cf. http://en.wikipedia.org/wiki/Pharos_of_Alexandria).

[3] "*L'esprit technologique s'est développé en Occident à partir de la rencontre des techniques orientales*, *proche-orientales, ou égyptiennes*, *et de la science contemplative et théorique principalement grecque*. *Alexandrie a été un lieu exceptionnel de confluence entre théorie et technique*"; *Technique* 131.

[4] A similar statement will be made below (that is, further on in this essay) comparing and conjoining Détienne and Vernant's *Ruses de l'Intelligence* with Ménard and Miquel's *Ruses de la Technique* ("the title of Détienne and Vernant's study could just as easily have been that of the study by Ménard and Miquel"). Such titular repetitions and replications – indeed "repetitions and replications" *in general*, specifically in this essay* – bring us by a commodius vicus of recirculation to an ancient alchemical principle (that of the *ouroboros*) acknowledged in *footnote 51* below.

*["specifically" and "in general"] … An ouroboric excerpt from further in this short submission (as below, then, so above): "The reader of the present essay might at present note and notice the ouroboric operation at work in this paper: it recycles itself (returning, for instance, to the *detour*, the *aporía*, the *hydra*, *et cetera*) in the manner of that mythical monster to which Simondon himself refers in 'The Birth of Technology'".

Prior to the separation of science and technics or of technical and theoretical knowledge, alchemy was exemplary of their "unitary enthusiasm" explains Simondon – an "*enthousiasme unitaire*" that was torn asunder with the rise of those separate sciences which were the offspring of alchemical inquiry – namely *metallurgy*, *iatrochemistry*, and (later) *biology*.[5] "*L'alchimie postule l'unité des sciences et des techniques […] [et] l'unité des sciences les unes par rapport aux autres*," states Simondon: alchemy postulates the unity of science and technics, and the unity of the sciences with respect to each other[6] (*viz.* their inter-related undertakings and inter-communicative correlation[s][7]). This is one of the great appeals of alchemy for Simondon and for his theory of techno-individuation – one that Isabelle Stengers takes up in a conference paper she presented at the University of Saint-Étienne on "How to Inherit from Simondon".[8]

"The generalization of the notions of *germ* [and *germination*], of *metastability* and *energetic tension*," or of *transduction* and *transformation*, "allows the mobilization [in Simondon's work] of an ancient aesthetic associated with alchemy," explains Stengers.[9] "Alchemy plays an important role in Simondon's thought" – a thought that "mimes the alchemical treatises on transmutation" and shares with them "the conviction that the material *opus* which Simondon describes in terms of 'objective' individuation has a counterpart in and for the [individual and individuating] alchemist: namely, the spiritual *opus* which Simondon describes in terms of 'subjective' individuation" (this according to Daniel Colson in a paper presented at the very same conference as that of Stengers).[10] The intensive interrelation *et opus opificis* – of the *operator* and the *operation*, "*spiritualis et materialis*" – in any and every alchemicotechnical undertaking was also the key critical consideration of Giuseppe Del Re's essay on "Technology and the Spirit of Alchemy" (published in *Hylè: International Journal for the Philosophy of Chemistry*[11] and in modified form as the tenth chapter re: "Alchemy and Technology" of his monograph on *The Cosmic Dance*).[12]

Del Re concludes his essay on "Alchemy and Technology" with a statement the spirit of which is also (beyond the bounds of its alchemical analysis) altogether Simondonian and indeed (in addition) Stieglerian:[13] "those who develop technology without even a trace of the spirit of alchemy, i.e. without a parallel upgrading of their spiritual standards – particularly their sense of responsibility – may be contributing to the devastating ills of society [...] which no vaccine can prevent".[14] "The main spiritual philosophy of alchemy," he explains, "placed the search for the secrets of nature in the context of a path toward elevation beyond [individual or collective] ambitions and lust for power";[15] "as a condition for

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[5] *Technique* 135.

[6] *Technique* 135.

[7] "*Comme l'instauration de la méchanique suppose le tranfert d'efficacité d'un outil à un autre outil, l'alchimie suppose le tranfert d'efficacité d'un règne à un autre*"; *Technique* 135. Just as the inception of *mechanicity* (*viz.* "the mechanical") involves the transfer of efficacy from one *tool* to another, the inception of *alchemy* (*viz.* "the alchemical") involves the transfer of efficacy from one *kingdom* – one *field*, *domain* or *regime* – to another.

[8] Isabelle Stengers, "Comment Hériter de Simondon" in *Gilbert Simondon: Une Pensée Opérative* (ed. Jacques Roux), Saint-Étienne: Publications de l'Université de Saint-Étienne, 2002: 300-324; henceforth Stengers.

[9] "*La généralisation des notions de* germe [*et de* germination], *de* métastabilité *et de* tension énergétique" – "*la généralisation* transductive, [*en somme*]" – "*permet de mobiliser une esthétique ancienne, associée notamment avec l'alchimie*"; Stengers 309.

[10] Daniel Colson, "Crise Collective et Déssaisissement Subjectif" in *Gilbert Simondon: Une Pensée Opérative* (ed. Jacques Roux), Saint-Étienne: Publications de l'Université de Saint-Étienne, 2002: 156-161 – henceforth Colson.

[11] Giuseppe Del Re, "Technology and the Spirit of Alchemy" in *Hylè: International Journal for the Philosophy of Chemistry* Vol. III, 1997: 50-64; "Alchemy and Technology: *From Wisdom to Know-How" in The Cosmic Dance: Science Discovers the Harmony of the Universe*, Philadelphia: Templeton Foundation Press, 2000: 246-274. Henceforth "Technology and the Spirit of Alchemy"; "Alchemy and Technology".

[12] "In general, all practical operations have this dependence on the experimenter's [...] attitude," he explains ("Alchemy and Technology" 271). "If we consider technology developed in view of applications, then the role of the virtue of the operator is even more important" (*ibid.*).

[13] See *footnote 70* below, re: Stiegler.

[14] "Alchemy and Technology" 271-272.

[15] "Alchemy and Technology" 260: "that view of man, that respect for nature, that sense of responsibility, which would prevent [technicians and technocrats] from giving priority to their whims, power and glory" (272).

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making matter proceed toward its ultimate perfection, *the operator* [in any and every alchemical undertaking] should tread the same path [as *the matter* s/he is modifying and manipulating]".[16]

Daniel Colson's observation with respect to the alchemical dimension of Simondon's thought – that "the material *opus*" and "the spiritual *opus*" are consistently correlated and trans-individuated in it – leads him to observe furthermore that "once one has recognized it" one can discern "constant reference to alchemy" ("discrete" but *ongoing* and "fundamental") throughout Simondon's work".[17] "Without this reference to alchemy," he maintains, "one would miss the aim of [Simondon's] project, which is to interlink and to foster intercommunication between the spontaneous geneses of nature on the one hand and of the artificial geneses of technics on the other".[18]

The spontaneous and the technical, the natural and the artificial, are in alchemy "analogous" one with the other (and here one might recall the very last pages on *L'Individuation à la Lumière des Notions de Forme et d'Information*, where Simondon underscores the fundamental importance of analogy for the purposes of his allagmatic theory[19]). "This analogy present in Simondon's thought is the bridge that unites the study of individuation and that of the concretization of the technical object," explains Colson.[20] "One often forgets," Stengers reminds us, "that it is alchemy – haunted by the relations between the becomings of the living and those of [inanimate] matter – that has bequeathed to us a rich vocabulary associating mutations 'material' and 'spiritual' […], [e.g.] a spirit 'matures'; ambition 'corrupts'; irony is 'corrosive'; ideas 'germinate', 'precipitate', […] 'crystallize'".[21]

Alchemy thus conceptually conjoins and technically entwines what would otherwise be distinguished as the "natural" and the "artificial" – and, more radically still (i.e. more *transgressively* or transgressively *transductive*), the "living" and the "dead'; in this sense, as I have written elsewhere,[22] it operates along lines that can be characterized in [technically transgressive] terms of "the Simondonian *analógos*, the Deleuzian *antilógos*, [...] [and] the Nietzschean *phúsiológos*" all-at-once.[23]

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[16] "Alchemy and Technology" 267: "the history of alchemy suggests that the practical operations of science and technology require a total personal involvement of the operator – indeed are parallel to the progress of the operator in the renunciation of his or her ego in favor of nobler ideals" 270).

[17] "*Lorsqu'on l'a reconnue, la référence constante*" – "*discrète mais fondamentale*" – "*à l'alchimie contribue à la richesse de son œuvre*"; Colson 156.

[18] "*Sans référence à l'alchimie, on manque la finalité du projet qui est de relier et de faire communiquer les genèses spontanées de la nature et les genèses artificielles de la technique*"; Colson 157.

[19] Gilbert Simondon, "Théorie de l'Acte Analogique" in Gilbert Simondon, *L'Individuation à la Lumière des Notions de Forme et d'Information*, Grenoble: Jérôme Millon, 2005: 562-566.

[20] "*Cette analogie présente dans la pensée de Simondon est le pont qui relie l'étude de !'individuation et celle de la concrétisation de l'objet technique*"; Colson 157.

[21] Stengers 309. Both Stengers and Colson conduct us to that section of *L'Individuation à la Lumière des Notions de Forme et d'Information* where Simondon refers to the "corruption" *qua* "decomposition" of alchemical *melanosis* (the *nigredo*, *nigrefactio*, or *nescioquid* of *liquefactio*) from whence new forms can arise by the light of *leukosis* (the *albedo* or *albefactio* of the alchemical *quid novum*) as platforms* for further transformation and innovation – this by way of *iosis* or *eurythrosis*, which in Simondon's text is the *cauda pavonis:* the tell-tale "end", ever new and renewed, of alchemy's *magnum opus* (*L'Individuation* 551). In this process, writes Simondon at the end of his treatise (*ibid.*), "Jung discovers […] a translation for the operation of individuation" – as so does *he*, *Gilbert S.*, *n'est-ce pas* (a point emphasized by both Colson and Stengers, as well as by in *La Philosophie de Simondon*, Paris: Librairie Philosophique J. Vrin, 2003: 110-115, where he characterizes Simondon's work as an actual alchemical undertaking in itself, a work that "dissolves" and that "calcinates" its object of study … "*Il dissout, il calcine. Il pratique une 'œuvre au noir' sur la philosophie et sur un objet de la philosophie: l'individu*" … it dissolves, it calcinates, it puts into practice an alchemical *melanosis* – the blackening or decomposition – that leads to the *cauda pavonis* – the many-coloured tell-tale "end" qua brilliant "peacock's tail" – of [his] philosophical analysis; Chabot 111).

*(footnoted wink here to *Platform: Journal of Media and Communication*)

[22] See for instance "*YOU, the U–Bomb*, or *YOU–bomb goes Kabloom:* An Essay on Anonymity, Risibility and Quantum Subjectivity" (1994, published in *The Canadian Journal of Comparative Literature* XXIII.ii, 1996: 426-455; available online at academia.edu/4184544), "*Between Beckett & Bec:* The Mètic Hexis and Flusserian Flux of Vampyroteuthis Abductionis" (2012, forthcoming in *Marshall McLuhan's & Vilém Flusser's Communication & Aesthetic Theories Revisited*, eds. Thomas Kohut and Melentie Pandilovski, Minneapolis: University of Minnesota Press, available online at academia.edu/4185250), *&c.*

[23] Aaron Cheak (*ed.*), *Alchemical Traditions from Antiquity to the Avant-Garde*, Melbourne: Numen Books, 2013: 625 (also see 623-624).

In other words, alchemical operations are not strictly speaking "logical" or "*lógos*-centric" (for all of their articulated "analogies") but instead much more "mètic" – *mètis* and its mètic manipulation[s][24] "putting back into play"/*en cause*[25] what would typically be *separate*, *partitioned*, *distinct* and *divided* (re-uniting/re-mixing "[supposedly] radical separation[s]" such as those "between the human and the animal, between rational and irrational beings – those living without *lógos*, the *alógia zóia* – [*et cetera*]"[26]), proceeding by *aporia* in the words of Samuel Beckett's *Unnamable*,[27] proceeding by *detours* in the words of Marcel Détienne and Jean-Pierre Vernant,[28] proceeding not in a "straight-ahead" manner but rather in a manner that might appear "headless" ("acephalous"[29]) or indeed "hydra-headed" ("polycephalous"[30]), so as to *fold-in*, *mediate* and *manipulate* "uncertain" and "unstable" conditions, allowing for cunning coordination with-and-in these conditions, as Détienne and Vernant explain on the last page of *Les Ruses de L'Intelligence: La Mètis des Grecs*.[31]

This "ruse de l'intelligence" is indeed definitive (for all its ambiguity[32]) of technics in the Simondonian sense: technicity prior to its "logocization" – lifting the latter word from *Les Ruses de la Technique: Le Symbolisme des Techniques à-travers l'Histoire* (a study by Guy Ménard and Christian Miquel).[33]

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[24] "The Greek term *technè* is often translated as "skill", "art" or "craft", and in the ancient texts it is associated with such activities as carpentry, navigation and weaving. In one sense, *technè* is described as "knack" or as "pure technique", explains Robert Johnson in his book on *User-Centered Technology*, Albany: SUNY Press, 1998: 51-52. "Like the navigator of the ship mentioned by Plato's 'Athenian stranger'," a technician or technical operator "has, through *technè*, the knowledge [or rather, the *know-how*] to overcome the potentially inevitable consequences brought-forth by domineering and determining forces. […] In this scenario we get a glimpse of what is probably the most unexplored, yet possibly the most powerful, aspect of [the technical know-how which I call] 'user knowledge' – [that is,] the concept of *mètis*. *Mètis*, or what is also called 'cunning intelligence', is the ability to act quickly, effectively and prudently within ever-changing contexts. Related to and sometimes described as a component of *technè*, *mètis* derives from ancient Greek mythology, as the word itself was the name of Zeus's first wife," who the Chthonic embodiment of the cunning Greek *mètis* just as Zeus was the Olympic embodiment of commanding Greek *lógos* (*ibid.* 52-53). An overarching *lógos* might work well on the lofty heights of Mount Olympos, but as Stephen Gaukroger maintains in *The Genealogy of Knowledge: Analytical Essays in the History of Philosophy and Science*, in the more mundane world – i.e. here on *earth*, on the *ground* or (in Greek) upon the *chthonos* – things move and mutate too much ("Earth is a place of becoming and change," writes Gaukroger, and "in overcoming an adversary – whether this be in hunting, fishing, racing or in working resistant materials such as metals – there are only two routes open: either the stronger will win, or, by the power of *mètis*, one reverses the natural course of events through cunning, disguise, quick-wittedness or whatever"; *The Genealogy of Knowledge: Analytical Essays in the History of Philosophy and Science*, Ashgate Publishing, 1997: 295). This explains why in Greek myth Zeus devoured Mètis: that is, to gain (or embody) her *mètis* and thus have Olympian – or as Nietzsche would say, "*Apollonian*" – control and command on the one hand, Chthonic – or as Nietzsche would say, "*Dionysian*" – cunning and craftiness on the other.

[25] Marcel Détienne and Jean-Pierre Vernant, *Les Ruses de L'Intelligence: La Mètis des Grecs*, Paris: Éditions Flammarion, 1974: 305); henceforth Détienne *&* Vernant.

[26] Détienne *&* Vernant 305.

[27] This is the situation, the condition, at the beginning of *The Unnamable:* "What am I to do, what shall I do, what should I do," asks the narrator; "in my situation, how [am I to] proceed? By *aporia*"?, he asks ("I say *aporia* without knowing what it means," he admits on the flip-side of the novel's first page); Samuel Beckett, *The Unnamable*, New York: Grove Press, 1958: 3-4. For further correlations between Beckettian aporia and Simondonian alchemy, see my contribution to Aaron Cheak's anthology, *Alchemical Traditions from Antiquity to the Avant-Garde*, Melbourne: Numen Books, 2013: 548-638 – 'Alchemical Endgame: Checkmate in Beckett and Eliot', written and published prior to my having read "La Naissance de la Technologie" (indeed prior to the publication of Simondon's anthology *Sur la Technique*).

[28] Détienne *&* Vernant 306.

[29] cf. Georges Bataille, Pierre Klossowski, Roger Caillois *et.al.*, *Acéphale: Revue Trimestrielle*, Paris: Éditions Guy Lévis-Mano (GLM), 1936.

[30] In Karen Pinkus's *Alchemical Mercury: A Theory of Ambivalence* (Stanford University Press, 2010: 55) this would be the titular "ambi-valence" which multiplies and/or redoubles given "valences" ("In the mid-1800s," she explains, "valence theory began to be used to signify the normal number of bonds that a given atom can form with other atoms – a register that links valence with philosophical materialism, matter and Epicurianism. In recent scientific work, valence refers specifically to the number of electrons in the outermost shell of atoms. It is not provisional or essential to the atom; valence *is* atomicity. It defines a given chemical element, perhaps not in its essence, but in its capacity to combine with other elements – its potentiality"; *ibid.*).

[31] Détienne *&* Vernant 306.

[32] For all its ambiguity or (again) "ambi-valence"; see the previous footnote (above) re: *Alchemical Mercury: A Theory of Ambivalence*.

[33] Guy Ménard and Christian Miquel, *Les Ruses de la Technique: Le Symbolisme des Techniques à-travers l'Histoire*, Montréal: Éditions Boréal, 1988: 101; henceforth Ménard *&* Miquel.

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> Hélène Védrine – *Les Ruses de la Raison* – has aptly underscored the "ruse" that is characteristic of Greek technical reason, which we must be careful to understand [and to keep in mind] across the prism of our own conquering technical reason [*a.k.a.* its "logocization"[34]]. She shows, in fact, that from Hermès (the god of ruses) and Mètis (wife of Zeus and herself the incarnation of ruses) to that Ulysses "of-a-thousand-ruses" so vaunted in Homer's *Odyssey*, Greek thought has always been "a thought of the ruse" with things. It is this fundamental schema which, according to numerous authors, dominates the case of Greek technics.
>
> Jean-Pierre Vernant – *Mythe et Pensée chez les Grecs* – thus shows that the Promethean ability which founds their technics, up to and including the very gesture of stealing the gods's sacred fire, is more on the order of a ruse than of a conquest (which is without doubt its most common interpretation; for more on this, see Marcel Détienne and Jean-Pierre Vernant, *Les Ruses de L'Intelligence: La Mètis des Grecs*, in which they take cunning intelligence as a paradigm of Greek thought). Dominique Janicaud – *La Puissance du Rationnel* – similarly defines Greek technics as a technics of the ruse. […]
>
> Georges-Hubert de Radkowski – *Les Jeux du Désir: de la Technique à l'Économie* – insists for his part on the fact that between primitive technics, which amounts to "composing with nature", and the modern technical attitude, which imposes upon it a novel order, the whole space of "a game with nature" is deployed, implying that we deform it minimally without unduly mutilating it; "technics", he writes, "is the fruit of this game [with nature]". It is ruse itself, daughter of the imagination'. Referring finally to the interpretations of Gilles Deleuze and Félix Guattari – *Mille Plateaux* – […] technics are used to capture and divert natural energies without dominating or otherwise altering the latter. Whatever the privileged perspective, the paradigm of the "ruse with nature" appears fundamental [to Greek technics].[35]

Védrine, Vernant, Détienne, Deleuze, Guattari, Janicaud and Radkowski – the authors mentioned by Ménard and Miquel in this paragraph of their study – explore in their respective works the complex complicities of technics as a matrix "*en marche en avance de* […] *sa logocisation*",[36] unfolding and/or underway well before its technologi[ci]zation, prior to its articulation in straightforwardly "logical", "logocentric" terms (hence "without tacitly presupposing its hierarchical subordination to science" – stealing a sentence from Andrew Goffey[37] – and again "refus[ing] to privilege *epistèmè* over *tèchnè*"[38]).

In the very first footnote of *Les Ruses de L'Intelligence*, Détienne and Vernant explain that prior to publishing their study "one of us had already demonstrated the importance of *mètis* for the analysis of technical thought (cf. Jean-Pierre Vernant, "Remarques sur les Formes et les Limites de Ia Pensée Technique chez les Grecs", *Revue d'Histoire des Sciences*, 1957: 205-225, reprinted in *Mythe et Pensée chez les Grecs*, Paris: Éditions Maspero, 1974: 44-64),"[39] and indeed throughout their co-authored work they note the inextricability of *mètis* and *technè* in Greek thought ("We find the same collection of words – *dólos*, *mechanè*, *technè* [and the like] – to describe the intrinsic characteristics of this type of cunning

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[34] *viz.* "sa première 'logocisation', au sens d'une première tentative de la faire parler" (its first "logocization", in the sense of a first attempt at making sense of it, working and wording it out): Ménard & Miquel 101.

[35] Ménard & Miquel 101-102 (my translation).

[36] "*Il y a toujours une pointe de puissance qui est en avance sur le savoir*" – Émile-Auguste Chartier, quoted in Ménard & Miquel 31: *there is always a potent point that is ahead of knowledge*. "*Dès ce moment*" (*le moment de sa* "*logocisation*") "*commence à se former, par laïcisation* […] *et par son objectivation sur des objets techniques concrets*, *le second glissement*, *qui conduit à penser que l'histoire technique est signe de progrès*, signe de la marche du peuple élu vers son idéal" – Ménard & Miquel 157 (101): from this moment onward there starts to form, by [what could be conceived as its] secularization and by its objectivation [qua objective projection] onto concretized technical objects, a second slippage which suggests that the history of technics is a sign of progress, evidence of the march of privileged people toward their ideal[s].

[37] Andrew Goffey, Introduction to Isabelle Stengers and Philippe Pignaree, *Capitalist Sorcery: Breaking the Spell* (trans Andrew Goffey), Basingstoke: Palgrave Macmillan, 2011: *xix;* henceforth Goffey.

[38] Goffey *xix*.

[39] Détienne & Vernant 7.

intelligence";[40] mètic manoeuvres, mètic operations, are what the Greeks called a "*dóliè technè*":[41] the tricky technicities and technical tricks of *l'intelligence rusée et technique*[42]).

The title of Détienne and Vernant's study (*Les Ruses de l'Intelligence*) could just as easily have been that of the study by Ménard and Miquel (*Les Ruses de la Technique*):[43] technics are tricks "with nature",[44] pulling protocols from the natural context – the context of nature, of natural forces/operations – and turning this text (the context of nature) into what could cunningly be considered a veritable *hypertext*, with its crafty conjunctions/correlations and attendant/tangential "detours".[45] Hypertexts are, after all, allagmatically and alchemically – indeed *al[leg]chemically* and *allegorithmically*[46] – analogical asseverations: they are ways of proceeding by *aporía*,[47] by *detour*,[48] in a manner that might appear "headless" ("acephalous")[49] or again "hydra-headed" ("polycephalous")[50], so as to fold-in, mediate and manipulate an otherwise unwieldy, unworkable, unwordable and/or unnameable field or "milieu" of associations.

The reader of the present essay might note and notice the ouroboric operation[51] at work in this paper: it recycles itself (returning, for instance, to the *detour*, the *aporía*, the *hydra*, *et cetera*) in the manner of that mythical monster to which Simondon himself refers in "The Birth of Technology". "*On comprend ainsi que l'opération technique* […] *ne tend pas vers un état terminal qui l'arrête*," he explains; "*la technique, opération de l'homme avec la nature – arte et natura –* , *s'engendre elle-même et renaît d'elle-même*, *comme le dragon* Ouroboros *de l'ancienne alchimie qui se mord la queue*":[52]

> In this way we understand that the technical operation […] does not tend toward a terminal condition at which point it stops; technics, the operation of man with nature – *arte et natura* – , regenerates and renews itself like the *Ouroboros* of ancient alchemy, the dragon that bites its own tail; instead of being a medium that *comes to completion* and *comes to be forgotten* in the end, the technical operation *resumes itself*, *multiplies itself*, like the distillation that takes up the product of a prior distillation to take it further.[53]

Technical – like alchemical – operations are ouroboric, and in this sense both *hyper- (über-)* and *hypo- (unter-)* textual, i.e. bounding beyond apparent aporias only so as to bite that which would block it (which of course inextricably involves "it" itself) in the back. A given context, condition or situation is carried or extended "further" than would normally be the case in these cases, and seen somewhat obscenely – *behind the scenes*, so to speak (with a wink here to Deleuze's critical tactic[54] of "taking an author from behind and

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[40] Détienne *&* Vernant 52.

[41] Détienne *&* Vernant 63, 70, 109-111, 150-151 (also 287).

[42] Détienne *&* Vernant 217.

[43] See *footnote 4* above and *footnote 51* below, re: such repetitions/replications.

[44] Ménard *&* Miquel 101.

[45] Ménard *&* Miquel 102.

[46] Here playing on the algorithmic allegories *a.k.a.* allagmatic "allegorithms" of Ken Wark and Alex Galloway (see Alexander Galloway, *Gaming: Essays on Algorithmic Culture*, Minneapolis: University of Minnesota Press, 2006: 91-91, McKenzie Wark, *Gamer Theory*, Cambridge: Harvard University Press, 2007: 30-50, and *footnote 71* below).

[47] Samuel Beckett, *The Unnamable*, New York: Grove Press, 1958: 3-4.

[48] Détienne *&* Vernant 306 once again.

[49] Georges Bataille, Pierre Klossowski, Roger Caillois *et.al.*, *Acéphale: Revue Trimestrielle*, Paris: Éditions Guy Lévis-Mano (GLM), 1936 once again.

[50] Karen Pinkus, *Alchemical Mercury: A Theory of Ambivalence*, Stanford University Press, 2010: 55.

[51] The *ouroboros* is the self-consuming *serpent*, *dragon* or *worm* symbolic of any alchemical operation (and at the heart of an essay on alchemy in the most recent issue of *Collapse: The Journal of Philosophical Research and Development* – Volume VII, 2011: the "Culinary Materialism" issue; cf. Dan Mellamphy and Nandita Biswas Mellamphy, "Ec[h]ology of the Désêtre", pp.412-435).

[52] *Technique* 156.

[53] *Technique* 156-157.

[54] (His notion with regard to Kant's *Critiques*)

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giving him a child that would be his own offspring, yet monstrous" – "monstrous […] because it resulted from all sorts of slipping, shifting, dislocations and hidden emissions"). [55]

The carriage, the carrying, of this carrying-or-extending-"further" (i.e. of this "further"ing definitive of what is *hyper-*) hinges on the hyperlink, which is linked not only to what is *hyper-* but also to the *hypo-*, i.e. to the underscored text qua current context; in this way the current is conjoined to a condition and situation both beyond it and technically linked to it (appropriating a term from a different section of Simondon's collection *Sur la Technique* and using it for different purposes, one might call this "the halo effect" of alchemical/technical operations)[56]. This is the "tour"[57] – the "ruse", "trick", or "turn"; the cunning, canny *encompassing* and/or *outmanoeuvring* – i.e. the deviant yet definitive "detour" of mètic machinations (hence the "trick" of "technics" as such … *Les Ruses de la Technicité*): "The technical object is not used to master nature," explain Ménard and Miquel, "but to turn it [in other directions, *i.e.* as a kind of 'detour'/*détournement*]" ("*à la manière des machines hydrauliques qui détournent les eaux d'une rivière de leurs cours normal […] pour un but autre que celui fixé par la nature lui-même*").[58]

Ruse rather than "mastery"; cunning co-ordinations or re-orderings (rings round and round) rather than "control': these are the tractics/tacticities of technicity. From this perspective "what is important is not strictly speaking the evaluation of more or less [logical and] successive 'stages'," for instance those of the alchemical *melanosis* (*nigredo*/*nigrefactio*), *leukosis* (*albedo*/*albefactio*) and *cauda pavonis* outlined at the end of *L'Individuation à la Lumière des Notions de Forme et d'Information*;[59] rather, and more specifically, the importance lies "in the link between technics and the movement [perhaps highlighted most brightly in the Olympic Games of antiquity][60] that resides at the heart of Hellenic culture," explains Jean-Claude Beaune in *Le Balancier du Monde: La Matière, La Machine et La Mort*.[61] This movement, of course, is both *hypo-* and *hyper-*, pivoting on a particular point so as at once to *[de]part* from it and be its oblique *partenaire;* hence the intimate interrelation of mètic machinations (the Greek *mètis*) with incarnated inductions (the Greek *hexis*) and split-second decisions (the cut of the Greek *kaïros*).

But *mètis* and (indeed *as*) the interrelation of *kaïros* and *hexis*, i.e. of decisive – never mind deceptive – *moments* and *movements*, is difficult to track: this by dint of always being oblique to straight lines of inquiry and analysis. That might be one of the reasons why the ever-interesting Michel Tibon-Cornillot found himself somewhat frustrated in a session of the aforementioned University of Saint-Étienne conference on Gilbert Simondon (January 2011): … Responding to Étienne de Banville's paper, "Une Philosophie de la Technicité en Acte",[62] Tibon-Cornillot admitted that he "had a lot of difficulties reading *On the Mode of Existence of Technical Objects*[63] and establishing links between [nonliving] technics and [living] bodies the likes of which one finds, for example, in Leroi-Gourhan"[64] (or, for a more recent

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[55] Gilles Deleuze, *Pourplarlers*, Paris: Éditions de Minuit, 1990: 15; *Negotiations* (trans. Martin Joughin), New York: Columbia University Press, 1995: 6.

[56] I lift this term from "L'Effet de Halo en Matière Technique": the title of a conference-paper delivered to the *Institut de Science économique Appliqué* in 1960, published in *Cahiers Philosophique* 43 (June 1990) and in *Technique* 279-294.

[57] cf. translate.google.com/#fr/en/tour for a set of connotations via machine-translation.

[58] In the manner of hydraulic machines that divert the waters of a river of their normal course [...] for a purpose other than that set by the nature itself (Ménard and Miquel 101).

[59] *L'Individuation* 551.

[60] Here we touch on a topic of special interest to Debra Hawhee – cf. her *Bodily Arts: Rhetoric and Athletics in Ancient Greece*, Austin: University of Texas Press, 2005.

[61] Jean-Claude Beaune in *Le Balancier du Monde: La Matière, La Machine et La Mort – Essai sur Le Temps des Techniques*, Seyssel: Éditions Champ-Vallon, 2002; henceforth Beaune.

[62] Étienne de Banville's, "La *Perruque:* Une Philosophie de la Technicité en Acte") in *Gilbert Simondon: Une Pensée Opérative* (ed. Jacques Roux), Saint-Étienne: Publications de l'Université de Saint-Étienne, 2002: 92-108; henceforth Banville.

[63] cf. academia.edu/4184556 for our English translation (2010; alas: stopped short).

[64] Michel Tibon-Cornillot in Banville 104.

example, in works such as Debra Hawhee's *Bodily Arts: Rhetoric and Athletics in Ancient Greece*)[65]. "With respect to the relations between technical objects and the body," he noted, "there are endless zones of obscurity in [the work of] Simondon. And with respect to the question of *compromise*, *détournement* [and the like]" – questions posed by Banville in his paper – "one would [indeed] have to examine them in the light of the concept of *mètis*, this attitude so well analyzed by Détienne and Vernant":[66] a comment that must have pleased Colson and Stengers, whose papers at that particular conference did so, if only briefly (i.e. in passing).

The *mètis* here, and the mètic *métissage* (*q.v.*), is *hermetic* rather than *hermeneutic* (hence Tibon-Cornillot's difficulties in decoding it): as Simondon himself says in "The Birth of Technology", it is rather unfair to ask modern workers – including modern scholars, *nota bene* – to grasp in a feat of *kaïrote* (my term for *kaïros*-centric karate) the intricate and altogether inextricable net of relations[67] which those who have been initiated into the intensive and interdisciplinary *mètissage* (*mètis* and mètic *métissage* here fused in one word) of hermetic manipulations maintain – and oft maintain *poorly*, sometimes to a *fatal* (*self-defeating*) degree.[68] "*L'hermétisme est lié à un très haut niveau de compétence*, *de savoir et de savoir-faire*," writes Simondon:[69] the hermetist's high level of cross-disciplinary competence, both abstract and applied, demands the kind of knowledge and know-how that Bernard Stiegler, for instance, laments as one that is fast disappearing in our hyper-industrialized/hyper-synchronized consumer society, even in its tangle of hypertexts and with its myriad "web-savvy readers and writers".[70]

(Concluding) Afterword:

Perhaps only machines and machinic operations demonstrate in this day the kind of mètic *kaïrote* I've just mentioned[71] – which recalls (that is, calls-to-mind) a blog-post by Christian Fauré on "La *mètis* de Google",[72] wherein the internet is likened to a chthonic chaos and/or the traps of Tartarus ("*le web a les caractéristiques du Tartare de la mythologie grecque*," he suggests): "even the most seasoned sailors of its

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[65] Debra Hawhee, *Bodily Arts: Rhetoric and Athletics in Ancient Greece*, Austin: University of Texas Press, 2005. Also see Beaune 40, 62, 75 ("La question du *kaïros* [et] de la *mètis* demeure posée: question qui relève de la ruse et de la mesure, […] de l'action aussi. […] *Chronos*, *Aïon* et *Kaïros:* éternelle retour, immobilité du premier moteur"; *ibid.* 75. The issue of *kaïros* and *mètis* remains open: it is a matter that involves calculation and cunning – and action as well. *Chronos*, *Aïon* et *Kaïros:* eternal return – immobility of the initial *impulse*, *impetus* or *motor*).

[66] Michel Tibon-Cornillot in Banville 104.

[67] "Grasp" here in the sense suggested in Greek antiquity by Heraclitus in the tenth of his fragments ("Grasping wholes and not wholes" – *( )holes* – at once "convergent [and] divergent, consonant [and] dissonant"; cf. Charles Kahn in *The Art and Thought of Heraclitus: An Edition of the Fragments with Translation and Commentary*, Cambridge: Cambridge University Press, 1979: 85); Marcovich translates this as "connexion" – which resounds of a network *nexus*, *n'est-ce pas?* (cf. Miroslav Marcovich, *Heraclitus: Greek Text with a Short Commentary*, Merida: Los Andes University Press, 1967: 105); Heraclitus's word is *syllapsis*, which shares the same herme[neu]tic heritage/cross-connexion[s] as *synapses*.

[68] The death of alchemists was quite common, remember (death by alchemical *iosis*/poisoning).

[69] Hermeticism is linked to a very high level of competence, knowledge and know-how (*Technique* 146).

[70] See for instance, Bernard Stiegler, *The Decadence of Industrial Democracies: Disbelief and Discredit, Volume One* (trans. Daniel Ross and Suzanne Arnold), Cambridge: Polity Press, 2011 (henceforth Stiegler), and an essay on the latter by Yours Truly, originally written for the 2015 special "Bernard Stiegler" issue of *Boundary 2: International Journal of Literature and Culture* at the invitation of its Guest Editor, forthcoming in the next issue of *Parrhesia: Journal of Critical Philosophy* (Dan Mellamphy and Nandita Biswas Mellamphy, "*Mort à Discrédit:* Otium, Negotium, and the Critique of Transcendental Miserablism"; rough-draft online at academia.edu/4184488). N.B.: the phrase "web-savvy readers and writers" (which was the last one that I wrote as I drafted this paper) turns out, after a web-search, to have been written beforehand – as all phrases turn out to be, *naisse-pas?* – by Sarah Cypher (which is the author's *actual*, not only her *virtual*, name) on her web-log at *sarahcypher.com/2011/10/03/social-media-for-authors-week-4-of-4* (hence the quotation marks).

[71] This is the argument I present, along with my partner Nandita, in an essay we submitted just yesterday (end-of-July 2014) for a forthcoming special-issue of *Fibreculture* on "Apps and Affects" (since our *Apps and Affects* conference-paper had already been published in *The Imaginary App* anthology at the M.I.T. Press), and one that Nandita outlined in her contribution to *The Funambulist Papers, Volume Two;* cf. Dan Mellamphy and Nandita Biswas Mellamphy, "*An Algorithmic Agartha:* Post-App Approaches to Synarchic Regulation" as well as Nandita Biswas Mellamphy, "*Ghost in the Shell-Game:* On the Mètic Mode of Existence, Inception *&* Innocence" (available online in rough-draft form at academia.edu/7671616 and academia.edu/5277020).

[72] Christian Fauré, "La *mètis* de Google" (blog post), *christian-faure.net/2008/09/06/la-metis-de-google*.

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netscape often lose themselves within all the web-pages and the multiple tabs that are open, or by following links that lead nowhere".[73]

Today "Google has become a major *techmar* (i.e. 'benchmark') of the web – a compass, a star, a beacon[74] to 'guide' us on the web-waves – and it even goes so far as to offer us the option of having it be the rudder of our embarkations with the release of its Chrome web-browser".[75] Fauré's foray into ancient Greek myth in this blog-post goes back – via Détienne and Vernant – to the myth of Zeus and Mètis wherein the lord (and *lógos:* the ruling, commanding and controlling "word") of Olympos and of the Olympian gods devours the ancient embodiment of pre-Olympian cunning and of chthonic craftiness – the titaness Mètis – in order to supplement what Nietzsche would have called his "Apollonian" aspect (his Olympian *lógos*) with Mètis's more "Dionysian" dimension (her Pelasgian *mètis*).

"Zeus was not content with uniting himself to Mètis by mere *marriage*," explain Détienne and Vernant at the outset of their study; "by *devouring her whole* he managed to make himself entirely *mètic*" in addition to being *logocentric* (i.e. in addition to being the *lógos* of Olympos);[76] "henceforth [therefore] no ruse can take place in the universe without being spirited by way of Zeus himself, [i.e. passing through Zeus]".[77] "By imposing its index as the navigation-lighthouse [qua Ptolemaïc *Pharos*[78]] of the web, Google has, in the likeness of Zeus swallowing Mètis, swallowed-up the ruse and intelligence of the internet," Fauré proposes; in this way "*Google alone* has [and/or would have] a handle on the web's myriad links and multiple practices, which permit it in turn to link and to bind" – *de lier et d'encercler* – "all those who would mount expeditions to conquer the web. Just like Zeus, then" (that is, Zeus in the wake of the devoured Mètis), "Google can anticipate the future and see in advance the strategies that could undermine its reign. Its web-crawlers have therefore done much more than just 'browse the web'," he astutely observes; "they have absorbed it in order to appropriate the intelligence of the web" (i.e. they have "consumed" it in order to "corporealize" and "incorporate" this intelligence), "which is in keeping with the proper sense of *ligere* as a 'linking together': by swallowing-up the web-links of the internet, Google has ['woven' or] 'linked together' the web through one of those 'ruses of intelligence' which the ancient Greeks called *mètis; mètis*, which alone could elicit such mid-boggling results".[79] Perhaps only such a web-crawling apparatus can manage this kind of mètic *métissage* – this kind of cunning *world-wide-web*-weaving – today (in which case "alchemical operations" would incontestably be "machinic technics").

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[73] Christian Fauré, "La *mètis* de Google" (blog post), *christian-faure.net/2008/09/06/la-metis-de-google* ("*le web a les caractéristiques du Tartare de la mythologie grecque*": the web has the characteristics of the Tartarus of Greek mythology).

[74] cf. en.wikipedia.org/wiki/Tekmor_%28mythology%29#Etymology re: *techmnar*/*tekmar*.

[75] Christian Fauré, "La *mètis* de Google" (blog post), *christian-faure.net/2008/09/06/la-metis-de-google*.

[76] Détienne *&* Vernant 20.

[77] Détienne *&* Vernant 20.

[78] See *footnote 2*, above.

[79] "*En avalant les liens du web*, Google *a lié le web par une de ces ruses de l'intelligence que les grecs nommaient mètis*, *qui seule pouvait provoquer des retournements stupéfiants*"; Christian Fauré, 'La *mètis* de Google' (blog post), *christian-faure.net/2008/09/06/la-metis-de-google*.

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Deregulating the struggle: Network organisation and party organisation

Kim Doyle – University of Melbourne
doyle.k@unimelb.edu.au

Since the global revolts of 2011, there has been a wave of tweeting, blogging and theorising regarding the "network effect" on revolutionary movements. This article will critique Manuel Castells' claim that horizontal networked forms of organisation were responsible for the Egyptian revolution in 2011, and that autonomous mass self-communication, facilitated by social media, represents a new model of individual freedom, focusing upon the Egyptian revolution, given its pivotal role in the Arab revolutions. The article argues that the timing of the Egyptian revolution can only be fully understood through a political economy analysis of neoliberalism and capitalist crisis. Equally, the role of traditional social actors and political parties cannot be ignored. Rather than being made redundant by the "network society", traditional collectivist organisation, such as political parties and trade unions, have been essential characters in the Egyptian revolution. Likewise, traditional print media has also played a role in the revolutionary process in Egypt. This article attempts to reorient theoretical discussion to the communicative tools best suited at a particular juncture in the social struggle, rather than fetishizing particular technologies or social formations.

The past thirty years have been marked by a neoliberal economic discourse. This article will employ David Harvey's definition of neoliberalism as an ideology proposing that human wellbeing can best be achieved by empowering individual entrepreneurial freedoms through institutional frameworks that guarantee strong private property rights, free markets and free trade (Harvey, 2005, p. 2). As Terry Flew aptly summarises, neoliberalism is an often invoked, but ill-defined concept (Flew 2012, p. 3; Mudge, 2008, p. 703). Although Flew has a number of criticisms of Harvey's approach (2012, pp. 20-21), he affirms that Harvey's definition of neoliberalism, as a fundamentally economic discourse, is employed consistently. Harvey argues that advocates of free markets now occupy positions of ideological influence in universities, "think tanks", the media, in governments and other key state institutions (2005, p. 3) and that, consequently, neoliberal thinking has become hegemonic.

The Left has so far failed to challenge this hegemony. The fall of the Berlin Wall in 1989 corresponded with a crisis in the radical Left. While the collapse of so-called communist states provided a space for the genuine radical Left, it also demoralised many and led to a barrage of propaganda by the Right insisting that there is no alternative to capitalism (Fukuyama, 2012). The degeneration of the Left caused by the last three decades of neoliberalism has led many radical thinkers to theorise new methods of struggle that promote various forms of autonomous horizontal organisation (Hardt and Negri, 2000; Virno, 2004; Holloway, 2010; Shirky, 2008).

Networked individualism is the latest vogue in autonomous organising and has been popularised by mainstream discourse on the "Arab Spring" of 2011, which widely hailed the revolutions as social media uprisings (Ramadan, 2014, p. 5). This article will focus on a critique of networked individualism, as espoused by Manuel Castells, though an examination of the Egyptian revolution, as Castells (2012, p. 178) claims that this new form of organisation originated from experiments in Egypt and Spain and then spread globally through the Occupy movement. Networked individualism rejects formal leadership structures and any form of "vertical authority" (Castells, 2012, p. 179).

This article considers Castells' theories as primarily based on a new conceptualisation of determinism – "network determinism" – introduced by Castells in *The Network Society* (2010): "networks constitute the new social morphology of our societies and the diffusion of networking logic substantially modifies the operation and outcomes in the processes of production, experience, power and culture" (p. 469). For Castells, this new morphology has made the organisations and political parties of the industrial age redundant (2007, p. 250).

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This article employs a political economy approach to argue that the Egyptian revolution that overthrew Hosni Mubarak in 2011 was not the product of new horizontal networks of organisation and that, far from being redundant, traditional organisations such as political parties and trade unions played a significant role in the revolution. Furthermore, unions and political parties have traditionally accommodated network structures, such as strike committees and campaign groups. However, they also utilise "vertical authority" or representative structures of formal leadership and majority rule, such as national conferences and the passing of formal motions, for instance. This article argues that vertical structures are necessary, especially when facing a highly centralised state machinery, such as the Mubarak regime, for democratic decision-making and coordinated action.

Theorising the struggle

Castells believes that the rise of globalisation, along with the rise of information and communication technologies, has fundamentally transformed capitalism, decentralising power and leading to the rise of networks of power. Thus, culture and society is now characterised by network logic. This is the foundation of Castells' (2010; 2004; 2000) seminal trilogy on the network society. Although this article cannot make a comprehensive intervention into debates about whether capitalism has been fundamentally transformed by neoliberalism, globalisation, technology, or numerous other facets of post-modernity, it is important to acknowledge these controversies as necessary background to Castells' network determinism.

Castells is certainly not the first, or even the most famous theorist to envision a discontinuity with the industrial society of the twentieth century. Alain Touraine (1971), who was Castells' doctorial supervisor, is best known for being the originator of the term the "post-industrial society". Many other well-known theorists have also made significant contributions (Bell, 1973; Deleuze and Guattari, 1988; Foucault, 1998). As Frank Webster (1995, p. 267) points out, the hypothesis of a fundamental discontinuity between industrial capitalism and modern society has an ideological character. It concurs with the view, characteristic of neoliberal ideology, that we can do nothing about change and must adapt to existing political realities. Castells (2007) employs the language of computing to describe how citizens can "reprogram" the network society from within by connecting networks of "counterpower". Castells (2012, p. 2) argues that the Internet needs to be understood as an autonomous space of communication beyond the control of governments and corporations; a "crack" in which to organise alternative spaces under capitalism. Castells' (2012, pp. 230-231) definition of autonomy is "the capacity of a social actor to become a subject by defining its action around projects constructed independently of the institutions of society, according to values and interest of the social actor". Other theorists stress the *continuity* of capitalism in modern society (Schiller, 2000; Fuchs, 2012; Harvey, 1989; Webster, 1995). This article argues that theorists who centre capitalism at the core of their critical approach are better placed to analyse modern society.

According to Flew, Castells has been "the most significant social theorist of new media in the last two decades" (2008, p. 60). His ideas also have authority beyond academia, within the new social movements themselves, in part because he was a "marginal" participant in the *Indignatos* movement in Spain (Castells, 2012, p. 18). He has released a book on the global uprisings entitled *Networks of Outrage and Hope* (2012). His ideas have also had an influence on prominent commentators of the recent global revolts. Journalist and former BBC economics editor Paul Mason has written extensively on the global rebellions and, like Castells, has been an active participant in them. Beginning as a series of blog posts on his website, Mason's *20 Reasons Why It's Kicking Off Everywhere* became popular enough to be transformed into a book: *Why It's Kicking Off Everywhere: The New Global Revolutions* (2012). In the book, Mason states that Castells:

> ...foresaw that the combined impact of the social network and the individualistic self would facilitate a clear break with the old forms of organization, including parties, unions and permanent campaigns (Mason, 2012, p. 138).

In the context of dominance of neoliberal discourse, the idea that old forms of organisation and resistance needs to be "deregulated" appears commonsensical. Journalist and activist Laurie Penny states in the

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Guardian in 2010 that "Thatcher, Reagan and Blair deregulated oppression. In order to be properly effective, rebels have to deregulate resistance". Penny explains, "deregulating resistance will mean deregulating the organisations that control resistance, making them more anarchic, more inclusive and more creative". Many theorists, popular commentators and participants in the revolts have repeated this prediction (Penny, 2010a; 2010b; Shirky, 2008; Sennett, 2006; Standing, 2011), with similar statements that closely resemble the language of individualism. Given the popularity and influence of these ideas, it is important to understand their most influential and articulate advocate.

In his new writings on the global revolts, Castells applies theoretical framework previously formulated in his work *Communications Power* (2009). The main themes that constitute this framework are: communications power is the central form of power today; the Internet allows the construction of communicative autonomy; and that contemporary social movements online, and offline, are socially networked movements, for which social media are of crucial importance. What underlies this framework is Castells' (2012, p. 230; 2009, pp. 116-136) belief that a "cultural transformation", arising from the social movements of the 1970s, has changed human behaviour. While Castells (2012, p. 230) rejects liberal individualism, he labels this trend "individuation", which he claims is distinct from individualism because it can be geared towards collective goals and action. Power in the network society is "multidimensional" and "organized around networks programmed in each domain of human activity according to interests and values of empowered actors" (Castells, 2012, p. 7). Power is exercised in the network society by network programmers (media companies, public institutions, publishers, technicians) and "switchers", such as media moguls who connect media, cultural, political and financial networks (Castells, 2009, p. 429). Consequently, counterpower is exercised by reprogramming networks around alternative interests and values. According to Castells (2007, p. 248), reprogramming is made possible by the rise of a new form of autonomous social communication: mass self-communication. This communication is "self-generated in content, self-directed in emission, and self-selected in reception" (Castells, 2007, p. 248). This means that "social movements exercise counterpower by constructing themselves in the first place through a process of autonomous communication" (Castells, 2012, p. 9). Castells (2007, p. 250) believes the autonomy afforded by mass self-communication has facilitated "a clear break with the traditional forms of organization of parties, unions and associations of the industrial society", seeing this as a positive development, insofar as it increases the autonomy of the individual.

This is the basic theoretical framework that Castells (2012) employs in his analysis of the recent global revolts. From the outset, subtitling *Networks of Outrage and Hope* "Social Movements in the Internet Age" explicitly focuses the analysis on technology. Using terms such as the "Internet Age" or "digital age" advances a media and technology centrism. Castells could equally have subtitled the book: Social Movements in the Age of "Neoliberalism", "late-Capitalism" or "Global Crisis". Although choosing the technology and communication-centric option ignores the multidimensionality of society, this article does not consider Castells a technological determinist; despite the claims of a number of his reviewers (see Garnham, 2004; Webster, 2004; 1995). Castells argues that it is network logic that primarily produces social determination at a higher level, rather than technology – thus, he can be better understood as a network determinist. For Castells, the causal power of network flows becomes *more* important than the content of networks and the particular interests they represent. Castells calls this preference "the pre-eminence of social morphology over social action" (2010, p. 469). This pre-eminence causes Castells to privilege form over content, which I argue limits his analysis of the Egyptian revolution. Instead, it is important to see the dialectical relationship between the organisational form and the political content of an organisation or permanent campaign group. Neither form nor content is deterministic; both operate in a dialectical relationship with the other, as well as with other external social entities. In constructing an analysis of a social movement or political party, internal organisational mechanisms must be weighed against ideological currents within the entity, as well as external ideological pressures from other organs of society. Networks are not homogenous, nor are they autonomous from broader capitalist social relations.

Castells (2012, p. 229) conflates social relations with the communications tools that *facilitate* mediated communication:

> the fundamental form of large scale, horizontal communication in our society is based on the Internet and wireless networks... it is through these digital communications networks that the movements live and act.

However, it is important to acknowledge here that Castells (2012, p. 222) does allow for interaction between mediated and face-to-face communication by conceptualising a dialectical relation between the online "space of flows" and the offline "space of places", envisaging the "space of movements" as a hybrid space made up of the interaction between online and offline spaces. Castells (2012, p. 222) calls this hybrid of cyberspace and urban space the "space of autonomy"; this space is "the new spatial form of networked social movements". Castells (2012, pp. 10, 81) does strongly argue that power is unequally distributed in these "spaces" and "flows", because capitalist corporations are more dominant. He states that it is essential that movements "build public space by creating free communities in the urban space", yet; it is the networks formed in cyberspace, the "space of flows", which extends these movements into the urban space. Thus, it is digitally networked relations that inform offline social relations. On the contrary, even a completely mediated society where all relations are fully realised in media networks, and social and media networks are equivalent, networks would still be based on bodies, minds, rules and resources of all kinds (van Dijk, 1999, p. 133). Media networks cannot exist without resources from technology, the economy and society. Furthermore, individuals' values and interests are *socially* constructed and shaped by the institutions of society. Individuals cannot construct meaning autonomously. Observations of virtual communities show that members of online groups bring with them, as a kind of baggage, all strictures, identities and mental states they have learned in offline groups (Mantovani, 1996; Lea and Spears, 1992; van Dijk, 1997). Jan A.G.M. van Dijk (1997) also privileges the network form; however, he does not go as far as Castells in claiming that networks are the basic units of modern society, arguing that networks increasingly link units, but these units are still individuals, groups, organisations and communities. Networks are not the content of society, nor are network relations equivalent to society.

The context in which the communications "revolution" has taken place is the Cold War and neoliberalism. The Internet is a product of militarism and imperialism. Its infrastructure and content are also owned and controlled by corporations and capitalist states. Yet, the Internet is, simultaneously, something that is used by millions in the struggle to resist the logic of neoliberalism. Therefore, virtual networks and technology are embedded in the pre-existing, antagonistic relations of social actors. It is not the "morphology of communications networks" that creates society and social change, but human actors embedded in antagonistic and contradictory economic, political, ideological and technological structures. This does not deny human agency. In fact, subjective political intervention and political leadership are crucial.

Leadership

Network determinism assumes that politics will inevitably flow from organisational form. Due to structures of overlapping networks, Castells (2012, p. 221) believes that movements "do not need a formal leadership, command and control centre, or a vertical organization to distribute information or instructions". The role of the Internet in this development "goes beyond instrumentality: it creates the conditions for a form of shared practice that allows a leaderless movement to survive, deliberate, coordinate and expand" (Castells, 2012, p. 229). Even at a cursory level this formulation is problematic. Who decides what instructions to issue and who has the authority to issue them? Castells does acknowledge that some individuals may become more influential than others by dedicating themselves full time to a movement. But he asserts that they are only accepted in this role as long as they do not make major decisions by themselves (Castells, 2012, p. 225), despite the fact that there is no mechanism for accountability. An empirical study conducted by Paolo Gerbaudo (2012) in his book *Tweets and the Streets: Social Media and Contemporary Activism* challenges the supposition of Castells and others that the Internet creates leaderless movements. Gerbaudo (2012, p. 139) finds that although contemporary social movements claim to be leaderless networks, there are "soft leaders" that make use of social media for choreographing protests. In most cases, "a handful of people control most of the communication flow" (Gerbaudo, 2012, p. 135). This shows that the rejection of vertical, hierarchical structures does not create leaderless movements. In fact, only hierarchical structures can make dominant voices answerable to the ideas they

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proselytise. At worst "leaderless" movements are exclusive and undemocratic, at best, in practice; they are a recipe for inertia.

A contemporary example of decisive, democratic leadership within hierarchical structures, which also accommodates network structures, comes from modern Egypt. The Egyptian Independent Tax Collectors' Union was formally founded in 2008 from a national network of delegates from locally elected strike committees built up by activists in local committees in the Property Tax Authority (Alexander, 2012, pp 101-125). Its first general assembly was attended by approximately 4000 delegates (Alexander 2012: 101-125). It was one of the first independent non-government unions under Mubarak. Its example was important in laying the groundwork for the growth in independent unions during and following the revolution. A leadership of elected, accountable delegates allows democracy and speed of action. Obviously, this is the ideal and not the norm. But it illustrates the efficacy of political organisation. Rank and file democratic structures are organisational forms that have always had to be argued for politically within the trade union movement. They also combine grassroots network structures within vertical structures of representative democracy. This demonstrates the essential connection between content and form.

Consciousness

The interaction between what might be termed "consciousness" and social action is very complex. Castells reduces human consciousness to overly simplistic, pseudo-scientific equations. Anger is a "triggering" emotion and fear is a repressor. Fear is overcome by identifying with others in the process of communicative action:

> Enthusiastic networked individuals, having overcome fear, are transformed into a conscious, collective actor. Thus social change results from communicative action that involves connection between networks of neutral networks from human brains stimulated by signals from a communication environment through communications networks (Castells, 2012, p. 219).

For Castells (2012, p. 237), "the more the movement is able to convey its messages over the communications networks, the more citizen consciousness rises". This view of consciousness is too prescriptive. It is highly problematic to posit a direct proportional relationship between the level of availability of information and the level of consciousness. Egyptian activists, both on and offline, had for at least a decade been organising and spreading revolutionary ideas, but it seems it is only at particular moments that large numbers of people become open to these ideas and are prepared to act on them. I argue, it is economic and political crises that create these moments. Castells does acknowledge that the revolutions are connected to economic, political, military, ideological and cultural contradictions of power (2012, p. 12; also see p. 79). However, in stressing the subjective aspects of individual consciousness, he negates historical and economic analysis by merely listing objective conditions, rather than exploring their impact on the political terrain in which individuals socially develop their ideas.

To address the political situation requires a thorough, multidimensional theory of capitalist crisis. Thus, a comparison between Castells' analysis of the global crisis and David Harvey's model is particularly instructive. Harvey and Castells are the "two leading writers in urban analysis" and have "both been strongly influenced by Marx" (Giddens, 2006, p. 900). Harvey's theory of crisis is multidimensional. He envisages seven dimensions: the economy, nature, culture, the state, consumption, technology and organisation. These "moments" are all integrated *via capitalism* and advance an overall crisis of capitalist accumulation that feeds back into the other levels (Harvey, 2010). Harvey comments that theorists tend to take one of these "moments" and use them as a "silver bullet" that causes all change (2010). This includes technological determinists, such as Tom Friedman; daily life determinists, like Paul Hawken; labour process determinists, "autonomistas" such as Nergi and Virno, and so on (Harvey, 2010). This article argues that network determinists such as Castells should be added to this list.

The strength of Harvey's analysis is that he re-centres, rather than decentres, capitalism in his critical approach. He situates the global crisis as a crisis of capitalism, both *economic* and political. In contrast, Castells (2011, pp. 45-59) plays into neoliberal ideology by separating the two aspects; "this is not an economic crisis. This is a political crisis". Moreover, Harvey (2010) writes that groups that rule out all forms

of hierarchy abandon "any prospect whatsoever for democratic response not only to the problem of the global commons but also to the problem of continuous capital accumulation". Accordingly, the anti-party sentiment that is widespread in the new social movements is understandable, given the political legacy of Stalinism, but can only lead the movements into a cul-de-sac. This article rejects the idea that the network structure is a panacea for the problems that social movements face, but it also recognises the abuse of concepts such as Lenin's "democratic centralism" to justify repressive and anti-democratic one-party dictatorships in Russia, China and elsewhere. Network and hierarchical structures do not have to be counterpoised. As long as there are democratic structures in place, some forms of hierarchical organisation can facilitate democracy by holding leaders to account. As has been shown, lack of leadership structures can lead to undemocratic unofficial leadership.

Castells (2012) focuses on the global social movement of 2011 as primarily political struggles for democratic reform. Focusing on democratic reforms, rather than economic rights, is entirely compatible with neoliberal discourse. Marxism points out that one of the ways that capitalists rule, ever since the classical economists discovered the "economy" in the abstract, is by emptying capitalism of its social and political content and perpetuating a strict conceptual separation between politics and economics. Castells' theories strengthen, rather than challenge, this conceptual division. Accordingly, this article will briefly outline the economic and political context in Egypt before proceeding to an analysis of the role of vertical organisation, such as political parties, unions and permanent campaign groups, during the revolution.

Political economy

The policy of the Mubarak regime in the 1980s and 1990s was the selective adoption of free market principles that favoured its creditor states and the International Monetary Fund (El-Sayed El-Naggar, 2009, p. 36). These reforms included measures such as reducing the average tax on imports to 9 per cent in 2004 (El-Saied El-Naggar 2009, p. 40), while simultaneously under-investing in infrastructure. The contradiction between the speculative economy and under-investment in the means of consumption, as well as attacks on living standards, proved a volatile mix when the Global Financial Crisis hit in 2008. Neoliberalism made Egypt highly dependent on exports to Europe, tourism revenues and imported foodstuffs, such as wheat (Naguib 2011, n.p.n). It also made the country more vulnerable to crises by increasing inequality and undermining any mechanism for the government to shield the economy from global crises, such as the dramatic rise in world food prices. Politically, the Global Financial Crisis could not have come at a more politically inopportune moment for the regime. However, Castells (2012, p. 220) is right to point out that "social movements do not arise just from poverty or political despair". Not only was there mass resentment to neoliberal policies, but in the decade leading up to the revolution there had been a bold return to street protests by Egyptian activists.

Indeed, the 2011 revolution was prepared for by a decade of social movements. These "cycles of protests" (El-Mahdi, 2009) in solidarity with the second Palestinian Intifada and against the Iraq War, and for democratic reforms within Egypt, culminated in a strike wave that began in 2004, but continued well into 2008 (Benin, 2009, p. 77). This wave of industrial militancy was described by former Director of Middle East Studies and Professor of History at the American University in Cairo, Joel Beinin, as "the largest social movement Egypt has witnessed in over half a century" (2009, p. 77). Over 1.2 million workers and their families engaged in some form of action (Beinin, 2009, p. 77). I argue that this momentum had an impact on what appeared to be an entirely spontaneous explosion of rage on 25 January 2011.

"The people want the downfall of the regime!": Organisation during the uprising

In 2011, Christopher Wilson and Alexandra Dunn conducted a survey called *The Tahrir Square Project* (2011). The survey shows that face-to-face interaction (93%) was the most important form of protest communication during the 25 January revolution, followed by television (92%), phones (82%), print media (57%), SMS (46%), Facebook (42%), e-mail (27%), radio (22%), Twitter (13%) and blogs (12%). Although Wilson and Dunn did discover some promising applications for social media as tools for protest, they surmise that the most immediate conclusion that could be drawn from the data was "that digital media was not as central to protester communication and organization on the ground as the heralds of Twit-

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ter revolutions would have us hyperbolize" (2011, p. 1263). These figures are important because Castells (2012, p. 56) claims it was "spontaneous, largely leaderless, multimodal networks that enacted the Egyptian revolution". Castells (2012, p. 54) states, "most prominent among these initiatives was the network created around the Facebook group 'We are all Khaled Said'". Given the importance that Castells, Mason and others place on this Facebook page, it is appropriate to examine its origins and political trajectory in some detail.

"We are all Khaled Said" was set up and chiefly administered by a Google executive named Wael Ghomin. It was one of the first groups to release a call for the 25 January protests, along with the April 6 Youth Movement, a youth movement formed in 2008 in solidarity with textile workers in Muhalla al-Kubra who were planning a strike for that date (Shehata, 2011). The page was set up to bring justice to Khaled Said, a man who was brutally beaten to death by Alexandrian police on 6 June 2010. The page organised a number of "Silent Stands" in solidarity with Khaled Said. Participants in the "Stands" congregated at various locations around Egypt to hold hands in symbolic and silent disapproval of the state's treatment of ordinary Egyptians. The first Silent Stand on 18 June 2010 was a modest success; however, it was not as large as a previous confrontational demonstration held for Khaled Said outside the Interior Ministry, organised by seasoned activists from the April 6 Youth Movement and other groups (Ghomin, 2012, pp. 78). Where the Silent Stands were most successful was in transferring virtual activism into real-world action. Importantly, these actions did not take place in a digital vacuum, but in the context of the politically charged atmosphere in Egypt at the time, including: upcoming elections in November 2010, the investigation into Khaled Said's death and the anniversary of the 1952 revolution (Ghomin, 2012, pp. 97-98). The second Silent Stand was organised on 25 June, this coincided with a pre-existing demonstration coordinated by several political organisations; including Kefaya, an important pro-democracy group that emerged in 2004; the National Association for Change; the Youth for Justice and Liberty, and the April 6 Youth Movement (Ghomin, 2012, p. 93). Ghomin (2012, p. 79) acknowledges that "it is true that movements and organizations like Kefaya, the April 6 Youth Movement, the Muslim Brotherhood, and others were the first to mobilise people on the street". Kefaya played an important role in reinvigorating Egyptian street activism (Brownlee, 2007, p. 149). This suggests that offline activism and the external political terrain were crucial to the modest success of Internet initiatives.

The self-immolation of Tunisian street vendor Mohamed Bouazizi and the unfolding Tunisian revolution had a significant impact on the political environment in Egypt. On 13 January, Tunisian President Zine al-Abidine Ben Ali gave his now famous speech acknowledging that Tunisians would no longer tolerate humiliation (Ghomin, 2012, p. 131). This is when Ghomin decided to publish coverage of the Tunisian revolution. Before Ben Ali's flight to Saudi Arabia, Ghomin deleted a post about the Tunisian protests by his fellow administrator Abdel Rahman Mansour. Any mention of Mubarak had also been off-limits on the page (Ghomin, 2012, pp. 122-123; also see p. 142). Less than three weeks later, with the toppling of Ben Ali and the mounting anger of Egyptians, Ghomin (2012, p. 136) changed the name of the planned 25 January event from "Celebrating Egyptian Police Day" to "January 25: Revolution Against Torture, Poverty, Corruption, and Unemployment". Ghomin (2012, p. 136) admits "this was ironic, given that I had clearly stated on more than one occasion that I was not a revolutionary".

The networked communities around the page "We Are All Khaled Said" provided an important space of dissidence for those angered by the regime (Aouragh and Alexander, 2011, p. 1348), but it was Egyptians frustrated by economic inequality, as exemplified by the core slogan of the revolution "bread, freedom and social justice!", who had been radicalised by political events within Egypt and inspired by the Tunisian revolution that gave the impetuous to the 25 January uprising. People's actions are not only determined by the ideas available to them, but also their political, social and economic environment. Thus, by focusing on communications morphology, Castells fails to adequately contextualise social change.

Offline organisation during the revolt

While Castells and Mason acknowledge that the majority of Egyptians did not find out about 25 January protests directly through Facebook campaigns (Castells, 2012, pp. 53-92; Mason, 2012, pp. 5-24), they ignore that most planning was also conducted offline. Malcolm Gladwell (2010) argues that physical meetings are better at facilitating "strong ties" between activists. The events of 25 January appear to bear

out this claim. Diverse activists from pre-existing organisations, including representatives from six youth movements, workers' rights groups and the Muslim Brotherhood, met daily for weeks in a cramped living room in Agouza on the west bank of the Nile in the lead up to the occupation of Cairo's Tahrir Square. These activists formed the core of the leadership of the Revolutionary Youth Movement who later stepped to the fore as representatives of the occupation in Tahrir (Coker and Levinson, 2011). Twenty protest sites were announced and published online by cyber-activists such as Ghomin. However, the activists did not tell anyone of their plans for an undisclosed twenty-first protest site in Bulaq al-Dakrour. It was these seasoned activists from political organisations that were responsible for amassing what appeared to be a spontaneous mobilisation of slum dwellers from Cairo's western edge that congregated in front of a neighbourhood sweet shop and caught security forces flatfooted (Coker and Levinson, 2011). It was this mobilisation that broke through the security cordons to Tahrir. Egyptian security forces were specialists in demobilising protests and dissuading ordinary Egyptians from spontaneously joining them. It took meticulous and centralised planning to succeed where so many demonstrations had failed. Days before 25 January, the activists' organising committee sent small reconnaissance teams to walk the protest routes at various speeds to synchronise how the separate protests would converge at the meeting point, Hayiss Sweet Shop (Coker and Levinson, 2011). On 25 January, security forces predicably mobilised at the advertised locations. Meanwhile, four field commanders chosen from the organisers' committee dispatched activists in groups of ten. Only one person per group knew their destination. In these small groups, the protesters amassed a crowd of 300 at the sweet shop. Organisers knew that if they failed to attract ordinary working-class Egyptians en route they would be easy prey for security forces. The protesters, unmolested by security forces, attracted hundreds of the working-class and poor residents of Bulaq al-Dakrour. By the time security forces had redirected officers to the surprise location the crowd was large enough to overwhelm them (Coker and Levinson, 2011). None of the other marches organised at mosques or around the city succeeded in reaching Tahrir through the maze of pre-planned security cordons (Coker and Levinson, 2011). The Bulaq al-Dakrour mobilisation occupied Tahrir for several hours until midnight. This short-lived occupation emboldened people to join the protests the following Friday that retook Tahrir and stayed there until the overthrow of Mubarak.

The brief occupation of Tahrir on 25 January was a "tipping-point". Had activists decided to focus their attention online and not carry out the difficult and dangerous work of leafleting, hours of conversations with locals in working-class areas without Internet connection, testing out potential locations and routes for protests, 25 January would most likely be a footnote in history books. It seems clear that the 25 January occupation was not organised by networks ignited by any Facebook page, but by experienced activists who were centrally organised and members of traditional campaign groups and political parties.

The great social experiment: Disconnecting the internet

Castells (2012, p. 66) acknowledges that the Mubarak regime's disconnection of the Internet did not negatively affect the mobilisations. In fact, shutting down the Internet from 27 January to 2 February had two outcomes that positively affected mobilisation. First, it infuriated many who felt it was time to take a stand and forced some who had so far only engaged in cyberspace to join the street protests (Alexander and Aouragh 2011, pp. 1350-1351). It also revealed unexpected opportunities, as blogger Haisam Abu-Samra (2011) testified: "it removed distraction and gave us a singular mission to accomplish". Social media played a role in informing the world of the events in Tahrir (Ghomin, 2012, pp. 235-236), but it played only a very minor role in the events themselves. Even if the Internet had been blocked before 25 January, there is nothing to suggest this would have changed the course of the revolution. During the Tunisian revolution there was heavy government censorship, so much so that bloggers named the mysterious Internet censor "Ammar 404" after an error message (Ben Mhenni, 2009; 2008). Higher levels of Internet censorship did not save Ben Ali. Castells (2012, pp. 61-66) goes into great detail about how a minority of activists managed to circumvent the Internet blackout by various technical means. However, as the *Tahrir Square Project* documented: "disaggregating altered media behaviors shows that respondents consistently turned to traditional media such as Satellite TV, telephone, and live communication in the face of all information blockages" (Dunn and Wilson, 2011, p. 1262).

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During this phase of the Egyptian revolution, when the Internet and mobile phone networks were blocked, the primary channels of mobilisation were predominately unmediated. Participants testified to being unaware of what was happening elsewhere in the city until they returned home to watch Al-Jazeera (Alexander and Aouragh, 2011, p. 1354). The turning point in each area came when activists in the streets were able to persuade enough local people to join them in order to overwhelm security forces (Alexander and Aouragh, 2011, p. 1354). This appears to have been achieved by attracting locals to march through chanting and face-to-face communication at Friday prayers, where activists intervened to encourage the announcement of a call to march (interview with Alexander and Aouragh, 2011, p. 1354). Prominent blogger and member of the Egyptian Revolutionary Socialists Hossam El-Hamalawy (interview in Alexander and Aouragh, 2011, p. 1354) recalls how this process unfolded in Nasr City on 28 January: "it was like an advancing army, you know, we were taking one square after the other, clashing with the police".

Finally, it was the intervention of the organised working-class on 10 and 11 February, which complemented the Tahrir protests with a huge strike wave, that convinced the Egyptian military Generals that they had to sacrifice Mubarak to save the system. There was a wave of mass strikes by workers in the week before the resignation of Mubarak on 11 February that brought key sections of the economy to a standstill, such as the Suez Canal, textile, steel and transport workers, and even the Generals' own factories (Naguib, 2011, n.p.n). The strikes disorganised the power of the government and felled Mubarak; however, the independent trade union movement that was just beginning to form in Tahrir was too immature to impact the character and direction of the revolutionary movement post-Mubarak (Alexander, 2012, pp. 101-125).

Castells (2012, p. 67) acknowledges that "some reports indicate that fear of the movement extending to the industrial labor force was a factor in influencing the business-wary Army generals to sacrifice the dictator on the altar of their own profits". But ultimately Castells suggests that people overcame their fear of previous decades because online social networks brought them together. This, coupled with the positive inspiration of the Tunisian revolution, Castells argues, was enough to topple a thirty-year dictatorship. Castells (2012, pp. 80-82) does also identify disunity in the ruling elites as a factor. All of these aspects are true *to a certain degree*. But only political economy can adequately explain the timing of the revolts and the cause of the disunity and fragility of the regime. Castells (2012, p. 80) states that the revolution happened "without warning or strategy" and that the initial calls for the protests "were not different from those that took place in previous years, only to be easily dissolved by thugs and the police". Again, Castells ignores the cycles of protests in the decade leading up to the revolution and the meticulous planning and organisation of traditional actors that made the occupation of Tahrir possible.

Conclusion

In June 2013, while watching tens of thousands stream towards Tahrir Square, Egyptian cartoonist Andeel wryly commented: "What we are witnessing today is a defeat of Facebook and Mark Zuckerberg and a thunderous triumph for Xerox!" (Iskandar, 2013). A lot has changed in Egypt since 2011 when media pundits could declare the triumphant of Facebook and Twitter revolutions. Today, we are faced with a far more complex equation. Communicative tools should not be abstracted from their political and economic context. Networks of cyber-activists organised via social media did not ignite the 30 June, 2013 protests in Egypt, which have been estimated as the largest protests in history (within a single country). They were organised by activists in the Tamarod (Rebellion!) Movement, frustrated with the Muslim Brotherhood's failure to implement the demands of the revolution post-Mubarak (Iskandar, 2013). Launched in April 2013, the movement called for early presidential elections via the collection of *paper* signatures by grassroots volunteers that canvassed universities, city and town squares, villages on foot to amass 22 million signatures (Iskandar, 2013). Mahmoud Badr, co-founder of the movement and official spokesperson, began his political activism as a coordinator of Kefaya. He announced the movement's intentions to form a political party on his official Facebook page in 2014 (*Aswat Masriya*, 2014). The success, in terms of mobilisations, suggests the enduring relevance of old media and traditional organisation, despite the bloody military coup that followed and the Tamarod movement's subsequent accommodation to the military.

This demonstrates that form does not necessarily determine the politics of an organisation; whether networked, vertical or otherwise.

Castells' network determinism and search for a single new social morphology leads him to fetishize one mode of communication and one set of communicative tools. This only hamstrings social movements. Egyptian activists during the 2011 revolution shifted between digital and non-digital tools, as the circumstances dictated (Aouragh and Alexander 2011, p. 1346). It is worth considering whether different audiences are more engaged and activated by different communicative tools. The Tamarod movement suggests that traditional print media still presents some interesting possibilities. Different organisations need different communicative tools. The types of tools employed are also contingent on objective conditions. For example, organisations operating under conditions of illegality, such as the Muslim Brotherhood under Mubarak, have to employ very different organisational forms and communicative tools to student union activists in Britain. As well, more attention needs to be paid to the risks of social media as activist tools. They are, equally, surveillance tools in the hands of security forces. For instance, Ghomin was forced to delete the Facebook event for 25 January because state security was using the attendees list to arrest people (Ghomin, 2012, p. 190). It is important that activists around the world are aware of the duality of communicative tools.

Traditional print media are still powerful communicative tools for turning awareness into activity. Some evidence from the Egyptian revolution also points to the potentialities of social media platforms in conveying information to an international audience during a protest movement (Dunn and Wilson, 2011) and as spaces for collective dissidence (Aouragh and Alexander, 2011, p. 1348). This article suggests that in the Egyptian experience at least, the main task of activists was to build cross-organisational links between tradition oppositional forces, which could be considered a form of networking within the framework of traditional organisations, and focus on on-the-ground organisation. In these tasks, social media is not a sufficient organisational tool in itself. Face-to-face communication and traditional organisations were essential in building the necessary trust and homogeneous organisation necessary to overthrow Mubarak.

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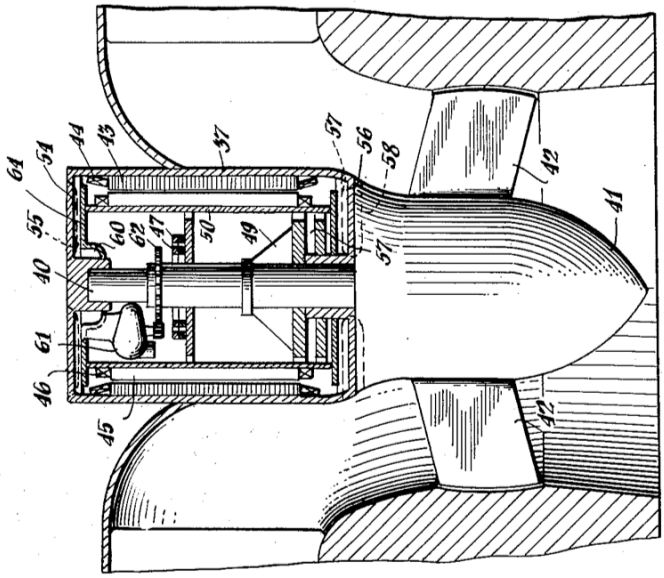

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