Gilbert Simondon

Causality, Ontogenesis & Technology

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Abstract

This PhD thesis focuses on the elucidation, development and application of Gilbert Simondon's realist philosophy of individuation. In particular the thesis has three main goals:

First, to provide a developed account of Simondon's ontology. Second, to develop a coherent account of causality in line with Simondon's theorization of individuation. Third, to give a full account of Simondon's philosophy of technology and evaluate its relevance for the contemporary technological state of affairs.

To answer the third of these questions it is necessary to address the others. A realist, non-anthropological account of technology necessarily requires the development of a robust ontology and a suitable theorization of causality.

In this thesis this is achieved by developing the key concepts involved in Simondon's theory of individuation such as transduction, metastability and pre-individuality. Before developing an account of transductive operation in the three regimes of individuation which Simondon stipulates (physical, vital and psycho-social) we argue for Simondon's account of *allagmatics* (theory of operations) as consistent with and in some ways superior to some contemporary powers based theories of causality.

Having established the broad scope of Simondon's axiomatic use of individuation it is then utilized in order to fully examine his philosophy of technology. This is achieved by bringing together Simondon's theorization of individuation in multiple domains (e.g. the image-cycle, transindividual) in relation to that of technology. In doing this we also develop other important aspects of Simondon's philosophy such as aesthetics, epistemology and ethics.

By necessity the thesis has a broad scope in order to reflect the encyclopedic ambition which Simondon had for his genetic philosophy and without which his work is prone to be misunderstood. As such it describes a novel encounter between cybernetics, phenomenology and energetics.

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Introduction

'To become moral and human once again, it seems we must always tear ourselves away from instrumentality, reaffirm the sovereignty of ends, rediscover Being; in short, we must bind back the hound of technology to its cage.' (Latour, 2002: 247)

'Gilbert Simondon is the only philosopher I would trust to mend my television set.' - David Roden (@turingcop)

We have some sympathy with Latour's statement, in the quotation above, that in its dealings with technology philosophy often ends up defanging it in order to re-focus on the human. Or if the hound cannot be caged, such as with Ellul at his most pessimistic, then it seems that technology's role is to use its fangs to de-humanize the scene. Whether considered as a means or considered as an end what we often find in so much philosophy of technology is the human at centre stage.

However, in the final analysis, even with his 'Copernican counter-revolution' (Latour, 1993: 79) which aims to track the adventures of non-human quasi-objects, Latour also only offers an anthropological account of the technological despite his best intention to restore it to its 'ontological dignity' (Latour, 2002: 252).

The goal of this thesis is to take seriously the idea of the 'ontological dignity' of technology by beginning our investigation not with technology but with ontology. To this end it explicates the ontology of Gilbert Simondon. Although currently best known in anglophone philosophical circles for his philosophy of technology, as laid out in *The Mode of Existence of Technical Objects,* the full import of this work cannot be understood unless it is situated within his broader philosophical project.

The simplest description of his project is that it is a philosophy of individuation which describes a genetic method for the becoming of being. As such its subject is also Nature where this is understood, following Anaxamander as *apeiron*, as 'the first phase of being', or as pre-individuality with the capacity to 'fall out of phase with itself' (Simondon, 2010b: 6). From his theorization of being as phasic Simondon develops a novel account of ontogenesis which is universal and axiomatic such that it applies to all levels of being. This is Simondon's theory of transduction which involves a re-theorizing of information theory with thermodynamics.

However, our investigation can't just involve applying the transductive method to technological examples. It is also necessary to understand Simondon's broader ontology regarding the various transductively constituted regimes of individuation (physical, vital and psycho-social) such that we can understand technology's relations with these. It is only through doing this that we will be able to grasp Simondon's ambitions for a genetic encyclopedism and new form of humanism which are the underlying motivations for his technological philosophy. As such this thesis has a necessarily broad scope ranging from the individuation of crystals, to that of life processes and mentation through to technology and aesthetics. Although such a scope entails a certain dilution it is required in order to comprehend the full import of Simondon's philosophical project.

The rationale of this thesis is to explore Simondon's axiomatic theory of ontogenesis in order to understand how it is able to produce a coherent philosophical project including an ethics, epistemology, aesthetics and technical philosophy. What this involves is an investigation into the nature of causality which transduction entails, for Simondon's is a realist ontology which is concerned with what things *do* by way of their operation. It is because of this realism that Simondon is able to avoid an anthropological account of

technology. To understand the manner in which the thesis develops a brief overview of the rationale for the chapters of the thesis is necessary.

It is in order to theorize the nature of causality that the thesis begins by considering the problem of natural purpose that troubled Kant in *The Critique of Judgment*. In 'The Antinomy of Teleological Judgment' Kant is concerned by his inability to understand the purposiveness of organisms by determinative judgment alone. That is to say that such purposiveness cannot be subsumed under the mechanistic principle of causality which Kant maintains as a principle for judging as far as possible, nature as the sum of total appearances. This inability, in turn, leads to Kant's consideration of regulative principles developed through reflective judgment, such as teleological explanations, to help *guide* the understanding of purpose in organisms.

Kant's discussion of the tension that holds between mechanism and teleological explanation is the background from which the account of causality which is developed in this thesis emerges. In Chapter 2 we undertake an overview of cybernetics and the development of the theorization of teleological mechanisms, which are actual auto-regulative systems that operate via informational feedback. Philosophically this development is significant as it resolves Kant's antinomy by positing teleological causality as both real (and thus not merely reflective) and non-deterministic and therefore not strictly mechanistic. In addition to the interest Cybernetics holds for its account of teleological mechanisms it is also extremely important as one of Simondon's main influences. Simondon appreciated the universality of the notions of information and feedback mechanisms and the synthesizing potential this entailed. However, in these notions he also understood Cybernetics as repeating some of the same errors he vehemently opposed regarding Aristotelian hylemorphism and atomism. These errors also led Cybernetics into making poor analogies, such as that between animals and machines, which required countering.

In Chapter 3 an account of the key components of Simondon's ontology begins by investigating his theorization of the transductive operation of the individuation of physical being. In doing this it will also be explained how Simondon builds on Cybernetics by transforming the notion of information and coupling it with the thermodynamic concept of the phase-shift. Additionally Simondon's account of individuation will be contrasted to some contemporary explanations of phenomena given in complexity theory.

By this stage of the thesis we will have developed a detailed description of Simondon's account of individuation as a reworking of Cybernetic teleological mechanisms. In Chapter 4 we'll deepen this account by fully interrogating it as a metaphysical account of causation. This is achieved by contrasting Simondon's theory with some contemporary powers metaphysics. Not only is this a valuable exercise in testing the consistency and coherence of Simondon's relational account of being as causal but in addition we can understand how Simondon's work can extend powers metaphysics. Namely, we will argue that Simondon's focus on operation provides both a more fundamental as well as more productive schema for understanding causality than through powers. This is due to the importance that structure plays for Simondon's operational ontology, a notion that, we argue, is under-theorized in the powers theories we examine.

This capability of Simondon's *allagmatics* to think causality through the interplay of operation and structure is evident in the importance that topology plays in his account of vital individuation in Chapter 5. As well as theorizing the importance of the role of topology we'll also look at the role of some other core Simondonian concepts such as order-of-magnitudes and levels which deepen yet further Simondon's accounts of ontogenesis. In doing this we'll also consider the similarities Simondon shares with the biologist Stuart Kauffman's work and how Simondon provides a way to critique some of the residual Aristotelian tendencies this thinker has.

In Chapter 6 the development of Simondonian ontology progresses with two theories that are vital for understanding the later theorizing of technology which are of psychic and collective individuation and the theory of the image-cycle. The individuation of mentation is understood as a furthering of vital individuation and we contrast Simondon's description of this with that undertaken by Merleau-Ponty in his later work who also sought an ontogenetic account by which consciousness emerges from organized embodiment. What Simondon's description makes apparent is that there is a gradation of development from the sensual towards perceptual consciousness which indicates the possibility for a politics of sensibility which could partially undermine or at least complement the politics of intelligence proposed by Bernard Stiegler. That is to say that Simondon considers the gradations of sensual and affective experience which condition phenomenological consciousness rather than concentrating predominantly on the operation of an already fully constituted phenomenologizing subject. The individuation of the psychic is inseparable, for Simondon, from that of the collective and due to the way the modality of collective individuation can be affected by technology this becomes another core part of Simondon's philosophy of technology. It is in this respect that Simondon's phasic notion of social individuation and the transindividual becomes important for the thesis.

One of the fundamental features of Simondon's conception of individuation is the importance it places on invention. As described in chapter 3, transduction, as an informational theorization of the phase-shift, describes a productive process which involves leaps between levels of being. It is this axiomatic application of transduction to all levels of being which informs Simondon's account of the progressive development of the image as a site for epistemo-genesis in the organism through a recursive process culminating in exteriorisation as the invention of an image-object. This connection of ideation to invention in a recursive material process is another important way that

technology and humankind are operationally related. It is important that this process is not only productive of technical objects (and other artefacts), but also and reciprocally, technical schemas of thought, that is epistemes, by which the world is understood.

Having now detailed the comprehensive scope of Simondon's ontology Chapter 7 involves a more fully informed account of his philosophy of technology. As stated at the beginning of *The Mode of Existence of Technical Objects* the main concern of that study is to address the problem of culture being out-of-step with technology which creates a situation of alienation. What is found is that in addressing this problem a tension is developed in Simondon's work between, on the one hand, the productive and inventive causality of individuation, and on the other, the importance placed on regulative values such as that of magical-unity and techno-aesthetics. In this tension we are returned to a similar problem to that which troubled Kant regarding teleological judgment and with which we began the thesis. The resolution to this problem will be found in the nature of regulative causality which Simondon develops from Cybernetics.

The aim of the final chapter is to outline some of the possible ways that Simondon is useful for thinking about the contemporary technological situation, especially regarding digitally networked technology. We begin this chapter by analyzing two significant contemporary thinkers of technology, Bruno Latour and Bernard Stiegler. Latour, as we mentioned earlier, is interesting due to his intentions regarding ontology although we will argue he remains too much of an anthropologist to fulfil his promise of restoring technologies ontological dignity. As a thinker who significantly borrows from Simondon's work and whose focus is also on technology, Bernard Stiegler's work is of obvious interest to this thesis. However, like Latour, we find his work too anthropological and his account of technology as tertiary retention too limited.

The thesis ends with some indications of how the ontology that has been developed might be useful for thinking the contemporary technological situation. In particular, and in response to Stiegler, we consider the possibility of a politics of sensibility. This idea, inspired by the work of Mark Hansen, requires the development of an aesthetically nuanced politics which necessarily has to take into account the full breadth of the operational reality of the human sensorium and its individuation (unlike Stiegler's restricted focus on memory).

In some respects this thesis can be seen as the setting down of a foundation on which to build future explorations. It is an attempt to develop a coherent and robustly realist account of causality which is married to a particular understanding of being. In doing so it manages to provide a consistent and non-anthropological account of technology. Additionally the account of causality developed herein is, we argue, because of its commitment to a specific account of being, more applicable to the theorization of actual phenomena than those powers metaphysics we explore.

Simondon's philosophical lineage

Given Simondon's goal of developing an axiomatic encyclopedism it should be no surprise that his work touches on a number of disciplines and draws on a wide range of influences. In turn, despite still being relatively unknown, his work has been significantly influential for a number of thinkers.

Although one of the main aims of this thesis is to give a broad overview of Simondon's work it has simply not been possible to detail all of the influences or those influenced by his work. Such an undertaking would itself be substantial and would divert us too far from our other proposed goal of investigating Simondon's thought regarding causality and technology.

As such it was a requirement of this thesis to attempt to understand Simondon's project as he developed it and not as interpreted through the lens of other thinkers. Until very recently (see secondary literature section below) Simondon's project has predominantly been filtered into the English speaking philosophical world through the work of other thinkers, notably Gilles Deleuze and Bernard Stiegler. Inevitably the result of such a reception has been, to some extent, to blend his work with that of the thinkers interpreting it. To avoid any confusion it was decided at an early stage of the development of this thesis to attempt an unalloyed understanding of Simondon's work. Although I do cover Stiegler's use of Simondon towards the end of the thesis it is mainly with the intention of targeting the divergence of his position from Simondon's rather than attempting to understand Simondon through him.

On page 70 I make the claim that Simondon's work 'could perhaps be understood as the encounter between first-order cybernetics and phenomenology which Jean-Pierre Dupuy (2009: 102) argues had been missed'. Although this is broadly true the matter is actually more complicated and my claim was made to indicate that Dupuy himself had missed, in his otherwise fine book, where just such an encounter had in fact occurred: namely in the work of Simondon. In this section I want to briefly describe Simondon's relation to some other currents of thought, including phenomenology, which aren't covered in more detail in the thesis as well as remark on this omission.

To begin, it is too easy to claim that Simondon's work is the outcome of a confluence between cybernetics and phenomenology. Such a statement glosses over Simondon's significant engagement with the philosophical question of the individual that is described in some detail in his *History of the Notion of the Individual,* which appears as a complement to his main thesis of 1957. In this text the historic philosophical engagement with the idea of the individual is described in some depth, predominantly throughout Greek

philosophy but also in some modern western philosophy, notably Descartes, Leibniz and Malebranche.

This engagement is not covered in this thesis but it is worth mentioning as it illustrates the depth of Simondon's interest in the philosophical notion of the individual which bolsters his critical assessment of hylemorphism, atomism and Gestalt theory, which is covered in chapter 2.

It is well documented that Georges Canguilhem and Maurice Merleau-Ponty supervised Simondon's doctoral thesis, a propinquity which places him in the traditions of French epistemology and phenomenology. Due to the focus on technology and causality in this thesis, Simondon's reinterpretation of cybernetics is our main concern. As such Simondon's position within the tradition of French Epistemology is not detailed at any great length. However I will briefly outline the importance of this lineage for Simondon's thought, as it is undoubtedly influential for his reformulation of cybernetics.

Despite their many differences the influence of the philosophy of becoming developed by Henri Bergson can be felt across much of Simondon's project. Notably Simondon shares Bergson's refusal of the reductive thinking of becoming to being, that is that becoming can be *properly* thought through fully individuated objects. For both thinkers what is fundamental is an ontogenesis that must occur prior to thinking or intentionality. Thus both share a position opposed to both Kant and Husserl. For Bergson, contra Kant, our knowledge can reach the real but unlike Husserl intentionality is not seen as fundamental.

Bergson navigates a path between mechanism and vitalism through a durational 'spiritualist' philosophy that understands novelty and indeterminism as central properties of becoming. This notion of becoming is used to counter traditional quantitative science, which Bergson holds spatializes that which is properly durational. An exception to this is the biological sciences which Bergson argued expressed 'something that is genuinely posed or "intended" by

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nature' (Gutting, 2005: 57) as opposed to the quantified sciences which he understood as constructed.

We can thus see how important Bergson is for Simondon in that he also eschews an ontology of substance for one of becoming and also adopts a strictly non-reductive, non-mechanistic positon as well as a strong interest in the biological and the complex (as we describe in chapter 5).

However where Bergson's is an ontology of 'forces' or 'tendencies' (Gutting, 2005: 56) Simondon's is one of operations.

Despite these similarities Simondon does utilize the physical sciences to move away from the more spiritualistic aspect of Bergson's thought. Where Bergson never really escapes from vitalism due to his retention of an *elan vital*, Simondon makes a clean break by rooting his ontogenetic approach in a pre-individual based in thermodynamics.

Another significant Bergsonian concept which undoubtedly influenced Simondon is his concept of the image. In section 6.3 we investigate Simondon's theory of the imagination. This theory holds that the imagination genetically develops within the organism from a 'pre-conscious fund of images' whose existence, like Bergson's notion of the image, is independent from any consciousness.

As well as these Bergsonian influences Simondon also develops on some themes from the work of Gaston Bachelard and Georges Canguilhem.

Bachelard's interest in how modern physics enables the overcoming of the philosophical notion of substance in favour of that of relation is something that is of obvious concern to Simondon. His influence can also be felt through the concept of *phenomenotechniques* which holds that science isn't merely a descriptive enterprise but is actually productive of new phenomena, especially through the implementation of technology. This constructivism is also

epistemically productive in that the use of technology in science directly leads to new knowledge and ways of thinking. A similar theory is developed by Simondon who is clear about the role technology plays in producing new potentialities as well as its role in epistemology with his notion of technical mentality. The latter can also be connected to Bachelard's famous notion of epistemic breaks which Simondon can be interpreted as ontologizing with his theory of the cycle of the image, which describes the genetic development of the imagination such that it leads to the invention of new mental models (see 6.3).

The historical development of knowledge (scientific knowledge in particular) is also a central concern of Canguilhem's although, unlike Simondon, he does not propose an ontology to underpin it. Another possible area of influence Canguilhem may have had is through his work on the history of the concept of the milieu, which is a central concept for Simondon, although Merleau-Ponty and Von Uexküll are also obvious connections here.

One key figure within the tradition of French epistemology that is discussed within the body of the theses is Maurice Merleau-Ponty. As de Bestigui (2005) notes, although there is a scarcity of evidence that there was any dispute between the two philosophers it is undoubtedly the case that they shared a 'common ambition' in as far as the later work of Merleau-Ponty sought to move away from its Husserlian foundation toward an ontological one. It is worth noting that although Simondon is sometimes described as a phenomenologist, the work of Husserl held little interest for him as he saw the foundational place of intentionality misplaced given that he understood it as arriving quite late on the scene genetically.

An unpublished working note to his 1959 course provides some evidence that toward the end of his life Merleau-Ponty was himself influenced by Simondon:

'Simondon's point of view is trans-perceptive: perception is for him on the order of the inter-individual, unable to account for the true collective - There is something true here: for all of the problems in terms of perception, it is still the phenomenological attitude in the sense in which Fink critiques it. We do not constantly perceive, perception is not coextensive with our life - Nevertheless, one no longer knows what one is talking about if one places oneself in the meta-perceptual.' (Merleau-Ponty, 2005)

It is evident here that although Merleau-Ponty is in agreement with Simondon to the extent that the phenomenological attitude provides a problematic foundation he is still questioning of the move beyond the sensible and broaching the subject-object dualism in the direction of ontology in the manner Simondon proposes.

Despite this area of difference between the two thinkers it is clear that they shared much of the same background, in particular in their interest in scientific developments, particularly phylogenesis, Riemannian geometry and microphysics. This is covered in more detail in Chapter 6.

From this brief survey of Bergson, Bachelard, Canguilhem and Merleau-Ponty we can see that Simondon must be understood as working in the tradition of French Epistemology even though his approach is more ontological in nature. He undoubtedly inherits a Bachelardian influenced epistemological outlook which he develops though his notion of invention in his genetic ontology.

There wasn't room in this thesis to explore all of the connections that Simondon's work has across the different areas of philosophy and science outlined above. Due to the focus on technology and ontology it was decided that a clear understanding of cybernetics as well as the relation with biology were the key areas requiring explication. The latter is partially undertaken

through an exploration of some of Merleau-Ponty's later work, which as we have seen connects Simondon to the French Epistemological tradition, but a more complete exploration of this connection is beyond the scope of this thesis's core concern.

One final influence worthy of mention is that of Pierre Tielhard de Chardin whose notions of personalisation and phase for the theorising of the individuation of the social were also influential for Simondon's theory of the transindividual.

Looking beyond Simondon's influences a decision was made to deal with only a selection of those directly influenced by Simondon. Notably the work of Latour, Hansen and Stiegler is examined here for its use of Simondon's philosophy. The reason these were chosen was again because of their use of Simondon for thinking through questions of technology and ontology.

The main absence in the thesis is that of Deleuze, who not only utilizes some of Simondon's key notions but also belongs to the same tradition of French Epistemology described above. The decision for this omission from this study was deliberate and twofold:

First, the initial reception of Simondon's work to an anglophone audience was via Deleuze's use of his work. An aim of this thesis was to present an unalloyed account of Simondon's philosophy. As such we sought to bypass prior readings of Simondon's project which might be nuanced and distort it; for example the use Deleuze makes of Simondon to support a notion of the virtual which is not found in his work. It decided that to follow Deleuze's implementation of Simondon's work would really be to say more about Deleuze than Simondon, which although a worthy exercise is not one we have the time or space to develop here.

Second, and as has already been made clear, the goal of this thesis is to think about causality and technology through Simondon's work. Although Deleuze produced work in both of these areas it is not strictly influenced just by Simondon and is not a necessary extension of his work. Where Stiegler openly uses Simondon's work in a clear manner, especially in relation to technics, which can be assessed as such, Deleuze's work draws from such a broad number of influences that it can't be clearly approached as Simondonian. Thus to engage with Deleuze in this thesis would be to significantly muddy the water.

As Toscano (2009) describes it the main areas Simondon is important for Deleuze is the use of the notion of individuation for helping him distinguish the virtual and the actual, for the development of a theory of the pre-individual singularity and for his critique of hylemorphism. To this we would add that Simondon also develops a theory of the problem, a notion which is also developed by Deleuze in a not unrelated manner. Although these are all significant developments they are not necessary to the goal of this thesis.

Secondary Literature

As mentioned above the development of interest in Simondon's work in anglophone philosophy has been slow to emerge. This is perhaps unsurprising given that his work was also neglected in his native France until relatively recently with his principle thesis not being republished there until 1995.

Simondon's work has received scant coverage in English, other than via his influence on Deleuze and Stiegler, until extremely recently. Other than a translation of the introduction to *L'Individu et sa genèse physico-biologique* published in an edition of *Incorporations* in 1992 the only other significant translation of his work available has been a bootlegged scan of a 1980

translation of the first part of *Du mode d'existence des objets techniques* made available online.

Although recently there has been an increasing interest in Simondon, with some journal issues devoting space to his work (most notably Chiasmi and Parrhesia), the publication of book length explorations of his work in English came too late to receive more than cursory mention in this thesis.

Of the three books in English now published on Simondon's work the earliest was the edited collection *Gilbert Simondon: Being & Technology*. This book was developed from a conference held at the American University in Paris, at which the author presented a paper, and along with some new work republishes several of the papers already published in the Parrhesia issue on Simondon cited in this thesis.

The first English monograph on Simondon's work was a translation of Muriel Combes excellent *Gilbert Simondon and the Philosophy of the Transindividual* published early in 2013 just as I was finishing this thesis. On the whole Combes covers a lot of the same material as I do in this thesis explaining Simondon's core concepts, although we make different connections in doing so. However her work on Simondon's ethics is particularly insightful and I draw on this in the conclusion of chapter 7.

Finally, the publication of the translation of Pascal Chabot's *Simondon's Philosophy : Between Technology and Individuation* (2013) came too late to receive consideration in this thesis. Although Graeme Kirkpatrick kindly sent me the late proofs for this work I received these just prior to submission and thus its inclusion in this thesis is extremely limited. This text is certainly worth reading and, for me, was particularly interesting for its exploration of Simondon's work on psychology (which he taught at the Sorbonne) and his connections with Jung and Eliade (whose names can be added to the list of influences listed above).

Chapter 1: Kant and the problem of Natural Purposes

1.1: The Problem of Natural Purposes

This chapter will provide a survey of some of the core issues in modern philosophy relating to causation beginning with a discussion of the problem of natural purposes for Kant. The aim of this discussion will be to provide the theoretical ground for the thesis' further discussion of cybernetics, self-organization and powers metaphysics.

As a philosopher of the *transcendental* Kant was precisely interested in the conditions of possibility for knowledge as well as how to legitimate metaphysical speculation.

As Pluhar explains, for Kant, metaphysics 'consists in the discovery of truths (true propositions) about the world that are not empirical (dependent on experience) in which case they would be contingent, but are necessary and hence *a priori* (knowable independently of experience)' (Pluhar, 1987: xxx).

It was Hume's phenomenalistic claim that propositions about the world can only be empirical and contingent which famously awoke Kant from his dogmatic slumber. As a strict empiricist Hume accepted only sense impressions (properties and bundles of properties) and ideas (which are merely 'faint copies' of sense impressions) as the basis of what we can know. As such Hume argues against the possibility of *a priori* knowledge in favour of *synthetic a posteriori* knowledge that is always rooted in experience. However *synthetic a posteriori* knowledge is open to skepticism as he demonstrates in his account of the problem of induction. Here Hume argues that causal prediction is based on nothing more than inference from past experience and thus has nothing *necessary* about it: although we have seen one billiard ball hit another and cause it to move in a certain way a hundred times this in no way necessitates that the

next time we see this occur the same thing will happen again. For Hume the claim made for necessary causal relationships is a case of mistaking my past experience as understood by my imagination as more than what it really is, which is merely *constant conjunction*. Thus the claim for causal necessity is based on nothing stronger than habit. One response to this is that we do *see* actual order in the world however because this is based on nothing more than empirical evidence it can never attain the status of necessary *a priori* knowledge, for such evidence can always be counterfactually undermined.

As the Pluhar quote above states, Kant wished to rescue both causation and *a priori* knowledge from this contingency.

Another aspect of Kant's project was to undertake what he describes as a Copernican revolution regarding the status of our knowledge of the world from one where it 'must conform to the constitution of the objects' (CPR Bxvii) as is found in Locke's representative realism, to one where 'the object (as an object of the senses) conforms to the constitution of our faculty of intuition' (CPR Bxvii).

Locke's epistemology holds that our ideas represent objects in the world and thus founds knowledge empirically. As we have seen Hume undermines this foundation and Kant also dismisses this empirical route to knowledge in favour of a transcendental one:

> 'In that case, while presentation in itself does not produce its object as *regards existence* (for the causality that presentation has by means of the will is not at issue here at all), yet presentation is a priori determinative in regard to the object if *cognizing* something *as an object* is possible only through it.' (CPR B125)

Kant maintains that all experience of the world is transcendentally structured and we can only discover the form of this structure via transcendental reasoning and thus obtain *a priori* knowledge for the conditions of our experience of the

world. By doing so we can come to know the limits of human experience and hence the limit of metaphysical speculation. Kant is aiming here to give metaphysics a more certain footing, similar to the status he understands mathematical knowledge has (CPR B8), by establishing the possibility of some knowledge as *a priori*.

In *The Critique of Pure Reason* Kant describes how experience is structured. Prior to the application of the categories of the faculty of understanding raw intuition is structured by the faculty of sensibility. For Kant this faculty coheres the sensations provided by the various senses into a unified temporal and spatial phenomenon populated by objects. Such objects are however only objects for sensible intuition as they are phenomenal objects and not things-in-themselves:

> '. . . we cannot have [speculative] cognition of any object as thing in itself, but can have such cognition only insofar as the object is one of sensible intuition, i.e., an appearance.' (CPR Bxxvi)

A sensible intuition is one that is necessarily spatially and temporally structured and Kant maintains that both space and time are *a priori* structures that must precede any experience.

> 'Therefore the following is not merely possible-or probable, for that matter-but indubitably certain: Space and time, as the necessary conditions of all (outer and inner) experience, are merely subjective conditions of all our intuition. Hence in relation to these conditions all objects are mere appearances, and are not given to us in this way on their own. And that is why much can be said a priori about these objects as regards their form, but not the least can ever be said about the thing in itself that may underlie these appearances.' (CPR B66)

It is upon the spatially and temporally unified sensible intuition that the *a priori* twelve categories of the Faculty of the Understanding operate and enable the production of knowledge.

These categories are necessary for our knowledge of the world and are also determining of all experience. It is important here to elucidate this move a little more as it is key and is one which will inflect the sense of the whole discussion regarding natural purposes.

As part of his Copernican revolution Kant argues that the world we experience is structured by the categories of the understanding which 'underlie objective experience and make it possible' (McFarland, 1970: 7). Therefore, the world which we attempt to understand and reflect upon is one that is necessarily already structured by our structuring intuition of it. Thus when Kant discusses the world it must be understood that he is not referring to a world that is *real* and exists separately from our perceptions but is phenomenal in nature and cannot be understood apart from this categorial conditioning.

This is not to say that there is no *real* or *supersensible* world - indeed as we will see this is an important part of Kant's system – just that we can't know what the nature of this *noumenal* world is. Our experience of the world is such that access to the supersensible (at least in the first *Critique*) is closed to us; it is, for our knowledge, undetermined and thus incomprehensible.

One of the categories that Kant argues transcendentally conditions experience is causality. That is, the world as we experience it, is transcendentally determined to be causal, and it is this fact that enables it to be intelligible. If experience was not conditioned as causal (as argued by Hume) then it would be arbitrary and we would not be able to make sense of it.

It is the *synthetic a priori* status of the categories that enables Kant to argue contra Hume that we are able to have knowledge of the world such as

that pertaining to its causal nature (although it must always be remembered that by world is meant the experience of a structured intuition).

The necessarily causal structure of experience enables Kant to develop what he calls a *pure natural science*. By this Kant means a form of scientific inquiry that is based on an *a priori* set of principles, that is truths about experience, which are not empirically dependent and thus open to Humean style contingency.

This *pure natural science* is the foundation on which an *empirical natural science* can be established, and also determines the limits of valid empirical investigation. As McFarland states:

> 'Empirical natural science . . . is Newtonian mechanics, and the categorial principles are . . . the principles of that science.' (McFarland, 1970: 11)

Although an empirical science is possible, for Kant it must be founded by the pure *a priori* principles of the categories, which include an adherence to mechanistic efficient causation.

There are a couple of issues of interest here that relate to the central concerns of this thesis. First, Kant's insistence on Newtonian mechanics as being the primary way to understand nature and the problems this will cause him in the third *Critique*; second, how this move to enable the development of a valid empirical natural science relates to Kant's wider goal of developing a system. In these two concerns we have, in germ, the objects of the coming conflict between causal mechanism and final ends that Kant will attempt to resolve in the third *Critique*.

The construction of a scientific system that Kant attempts cannot rest on the application of mechanical causality alone. A system also requires the

idea of systematic unity towards which science can aim, which acts as a regulatory principle for scientific investigation.

> 'If we survey our cognitions of understanding in their whole range, we find that what reason decrees and tries to bring about concerning them - as a goal quite peculiar to reason - is the systematic character of cognition, i.e., its coherence based on a principle.' (CPR B673)

By aiming for such coherence the aim is to create a systematically consistent body of knowledge that makes 'our ordinary empirical knowledge scientific' (McFarland, 1970: 13).

Unlike the categories which condition intuitions, the principles for systematic scientific knowledge are not determinative, but regulative in that they cannot be given 'a proper transcendental deduction' (Mcfarland, 1970: 29).

However, these three principles ('transcendental ideas' (CPR B392)) of the thinking subject (psychology), the world as a whole (sum of all appearances) and God indicate a systematic body of knowledge which could be seen as asymptotic in that it can be approached but never reached. As such each idea can be used to regulate the systematizing of knowledge *as though* the principle were known. This is what Mcfarland calls the 'unity at which reason aims' (Mcfarland, 1970: 32).

As we will see this idea of a regulative principle is also important for Kant's explanation of natural purposes. This problem is discussed in the *Critique of Judgment* and concerns the difficulty with understanding (via the category of causality alone) organic products (organisms) which are experienced as being self-organizing (*CJ* Ak.V, 374).

As discussed above, Kant's account of cognition, as given in the *Critique of Pure Reason*, delineates the necessary transcendental conditions for experience and understanding. In the third *Critique* Kant concedes that the

conditions given in this account of *pure natural science* are, however, inadequate for understanding self-organizing individuals.

Kant stipulates that there are only two kinds of causation; these are efficient causation and final causation, the former he calls *real* causation and the latter *ideal*, a distinction that will be returned to throughout this thesis.

For something to be classed as a natural purpose it must meet two conditions; first that 'the possibility of its parts (as concerns both their existence and their form) must depend on their relation to the whole' (*CJ* Ak.V, 373). Second, to be a *natural* purpose the parts of the thing must also 'combine into the unity of a whole because they are reciprocally cause and effect of their form' (*CJ* Ak.V, 373). In this definition it is clear that a natural purpose can't be understood by efficient mechanical causation alone but requires the notion of formal cause because the parts that the whole consists of are determined by the *idea* or concept by which the whole is purposive.

From these two conditions a natural purpose can be defined as '*both cause and effect of itself*' (*CJ* Ak.V, 370) and it follows that as such it cannot be determined by the *a priori* laws that condition intuition. As Pluhar indicates;

> '[S]ince the matter in an organism is organized and forms a whole that is a natural purpose, its form is *contingent* in terms of mechanism and hence cannot be judged by understanding alone, on which mechanism is based: a concept of reason (the concept of a purpose) must come in as well.' (Pluhar, 1987: lxxviii)

That an organism holds within itself a self-conditioning principle means that it cannot be understood by or subsumed under any of the *a priori* categories necessary for Kant's transcendental understanding, including the causality of mechanistic physics, which he adheres to with the category of causality.

Given this impossibility Kant recognizes that natural purposes are a serious problem.

Although self-organizing individuals can be cognized in the same way as any other object what Kant's system cannot account for is their unique causal constitution 'which first hence give natural science the basis for a teleology, i.e., for judging its objects in terms of a special principle that otherwise we simply would not be justified in introducing into natural science (since we have no a priori insight whatever into the possibility of such a causality)' (*CJ* Ak.V, 376).

If self-organizing individuals cannot be fully accounted for by mechanism it follows that some other form of explanation is required.

Kant considers idealistic and realistic interpretations of natural purposes that have previously been provided. He uses Spinozism as an example of an idealistic interpretation as he claims Spinoza's system 'appeals to something supersensible (*CJ* Ak.V, 391)' and therefore unintelligible. As such, however, it cannot give an explanation satisfactory for understanding.

With regard to a realistic interpretation of natural purposes Kant considers hylozoism which he describes as 'where that life is either in the matter, or due to an inner animating principle' (*CJ* Ak.V, 392) however, Kant argues, this explanation can only be circular as the only evidence we have for such animated matter is from the phenomenal experience of the organized beings we are trying to explain by it (*CJ* Ak.V, 394).

Kant thereby holds that matter is lifeless and inert and wants to maintain a commitment to mechanism despite the problem self-organizing beings pose for it.

Due to these stipulations the cause for the organization we find in nature must be external to it and also therefore requires a regulatory principle that can guide our understanding of it.

This is not to say that Kant is jettisoning the idea of mechanism. As we have established this form of causal understanding is at the heart of his system. However, mechanism cannot give us an adequate understanding when it comes to natural purposes. Therefore another form of understanding is also required. Kant proposes that the required explanation might reside in the concept of *purpose*. That is, if we cannot understand an organism via mechanistic causality alone then we might be able to discern some teleological purpose that is guiding the organism from without.

For Kant the concept of purpose is arrived at using reflective judgment. Therefore, it is not a determining concept, or to put it in more Kantian terminology, it is not a universal principle (such as causality) under which particulars can be subsumed and determined. Reflective judgment can provide us with *maxims* only to *guide* our search for universal principles, it cannot give them. But because they are rationally achieved, Kant argues we can use these maxims to *guide* our investigation of organisms, in order to gain a *subjective* understanding of them. Therefore the notion of teleological purpose is a reflective one that might help us understand organisms in a non-determinative way, or that should *regulate* our understanding of self-organizing beings in general, and not only in the life sciences.

1.2: The Antinomy of Teleological Judgment

It is with the antinomy of teleological judgment that Kant attempts the resolution of the tension between these two accounts of causality (mechanism and teleological purpose).

Kant begins by expressing the antinomy in the form of two maxims:

> *The first maxim* of judgment is this *thesis*: All production of material things and their forms must be judged to be possible in terms of merely mechanical laws.

> *The second maxim* is the *antithesis*: Some products of material nature cannot be judged to be possible in terms of merely mechanical laws (Judging them requires a quite different causal law — viz., that of final causes.) (*CJ* Ak.V, 387)

As such these maxims do not create an antinomy because as *regulative judgments* they are available only to guide any investigation of nature, they are not of the status of 'constitutive principles' (*CJ* Ak.V, 387) determinately describing the objects under consideration and therefore susceptible to contradiction. In order to create an antinomy Kant then negotiates a shift from regulative maxims to constitutive principles so the final antinomy reads:

> *Thesis*: All production of material things is possible in terms of merely mechanical laws.

> *Antithesis*: Some production of material things is not possible in terms of merely mechanical laws.
> (*CJ* Ak.V, 387)

As principles these are clearly contradictory.

In the pages immediately following the development of this antinomy Kant returns to the notion of reflective judgment, and the initial maxims developed, for assistance. This step is taken as 'we cannot have a determinative a priori principle for the possibility of things in terms of merely empirical laws of nature' (*CJ* Ak.V, 387).

What Kant means by this, and an indication of how he will resolve the antinomy, is fleshed out at the start of the next section where he states:

'We are quite unable to prove that organized natural products cannot be produced through the mere mechanism of nature. For we have no insight into the first inner basis [responsible] for the endless diversity of the particular natural laws, because they are contingent for us since we cognize them only empirically; and so we cannot possibly reach the inner and completely sufficient principle of the possibility of nature (this principle lies in the supersensible).' (*CJ* Ak.V, 388)

The argument then is that our limited empirical access to organic purposes does not allow us to rule out that they operate within the confines of mechanism. Even if we cannot see for ourselves that an organism operates mechanistically, due to the work done in the first *Critique* we must exhaust this line of inquiry as far as we can before looking for other, purely regulative, explanations. McFarland makes clear the reasoning behind this:

'We are free to adopt any methodological principles we like in approaching nature but the only principles which will result in objective (genuinely theoretical) explanations are the mechanical principles founded on the categories.' (McFarland, 1970: 120)

Kant will not relinquish that understanding via mechanistic causality is the only way we could determinatively understand natural objects; but that is not to say we cannot utilize other methods of enquiry, namely reflective judgment. These alternative methods may enable us to gain a different understanding but this can only be subjective and therefore, not determinant. Thus although we can suggest teleological explanations of natural purposes these explanations must not contradict those of determinative judgment, namely mechanistic explanations.

Pluhar also agrees with this reading, that it is only if we accept that the antithesis is not determinative, and therefore not contradictory, can we get beyond the antinomy. As he states:

'A merely seeming contingency that is in fact a necessity does not conflict with the necessity implicit in *mechanism*. Hence "objectively too" it is at least possible to reconcile the mechanistic principle with the teleological.' (Pluhar, 1987: xciii)

Of importance here, as well as for McFarland, is the word *possible*. Like McFarland (1970: 121), Pluhar maintains that Kant solves his antinomy 'by invoking the supersensible' (Pluhar xci), which is to say that due to the limitation of our knowledge, as set out in the first *Critique*, we cannot know for certain that teleological explanations are valid but at the same time we cannot assert that they necessarily contradict the established mechanistic principle of causality. We simply cannot prove organisms develop mechanistically, that is not to say that they do not. Or as McFarland writes: 'the antinomy is such for our understanding but maybe would not be for a higher supersensible one' (McFarland, 1970: 127). Thus it requires a God like understanding or an understanding of the world-as-a-whole to verify if this is just a *seeming* contingency but as Kant maintains such *ideas* must always remain as just regulatory principles as they can never be empirically available for us.

'In terms of the universal [supplied by the understanding] the particular, as such, contains something contingent. And yet reason requires that even the particular laws of nature be combined in a unified and hence lawful way. (This lawfulness of the contingent is called purposiveness.) Therefore, unless the power of judgment has [its own] universal law under which it can subsume the particular, it cannot recognize any purposiveness in it and hence cannot make any determinative judgment about it. [Differently put:] It is impossible to derive the particular laws, as regards what is contingent in them, a priori from the universal ones [supplied by the understanding], [i.e.,] by determining the concept of the object.' (*CJ* Ak.V, 404)

Kant argues that although the principles of mechanism are determining, and although we cannot always see how, we must accept its priority over other forms of causal explanation, whatever the contrary empirical evidence. This then is an epistemological argument the conclusion of which is not to assert what we can know but, as we often find in Kant, to delineate what we could possibly know.

There is then an analogy between how determinative and reflective judgment operate in constructing and organizing knowledge and how mechanism (real causality) and teleology (ideal causality) aim to explain natural purposes.

Just as determinative judgment provides us with knowledge and reflective judgment of the transcendental principles is required to attempt the systematic organisation of that knowledge so the *idea* of teleology, as a self-conditioning principle, is required as formal cause in relation to the mechanistic nature of a natural purpose.

According to Guyer the ultimate resolution of *The Antinomy of the Power of Judgment* for Kant is to fall back to a form of theism as an explanation for how organisms can be self-caused yet still not contradict the principle of mechanism. We are then presented with what Guyer terms a 'two-leveled, transcendental idealist solution' (Guyer, 2006: 572) where a transcendent power (designer) who 'existing outside of the appearances of nature' (Guyer, 2006: 572) (necessarily as we have no empirical experience of it) causes its design via the mechanistic principles we can perceive.

Given that Kant has already rejected theism alongside his dismissal of hylozoism a better understanding would be that Kant's regulative principle of formal cause (teleology, ideal cause) is better understood in relation to practical reason than determinant judgment and theoretical reason.

As already described Kant describes formal cause as an *ideal* causality which is not available to us empirically but is more akin to the way practical reason utilizes regulative concepts such as *happiness*.

'Hence our reason, whose concept of causality is greatly restricted if reason has to specify it a priori, cannot possibly tell us whether nature's productive ability, which is quite adequate for whatever seems to require merely that nature be like a machine, is not just as adequate for [things] that we judge to be formed or combined in terms of the idea of purposes, [or] whether things [considered] to be actual natural purposes (which is what we must necessarily judge them to be) are in fact based on a wholly different kind of original causality, namely, an architectonic understanding, which cannot at all lie in material nature nor in its intelligible substrate.' (*CJ* Ak.V, 388)

We therefore reach a situation where although organisms may appear to be self-purposive we must accept they are both mechanistic and governed by a final cause which is given by a possible transcendent power we cannot cognize but can only reflect upon as present or use, in accordance with purpose as thought practically, as a regulative idea, in order to maintain the system and deny matter any autonomous, organizing principle within itself.

Significantly, rather than allow for any possible credibility for an ontological approach to the question of organic kinds Kant always reins the discussion back to epistemological concerns.

It is this constant subsuming of the ontological to the epistemological that Alberto Toscano draws attention to when questioning Kant's move from the initial reflective maxims to the 'constitutive statements' of the final antinomy:

'Here lies the essential subreption that consists in going from epistemological necessity to ontological claim, from the 'must be judged'

(maxims) to the 'is' (principles). Whilst the conflict of maxims can still be resolved by referring us to the limitation of our knowledge, its ontological conversion cannot.' (Toscano 2006: 37)

It is as though we are trapped in a gestalt-switch diagram where our concern with the organic changes from epistemological to ontological and back again depending on our standpoint. From the Kantian standpoint the organic cannot be accepted as being ontologically *real*. Therefore the conversion to an epistemological frame is required before the resulting antinomy can be tamed (by the invocation of the supersensible).

However, by entertaining the antinomy of natural purposes, the ontological aspect of the gestalt-switch diagram is allowed to become visible, and with it the possibility of a philosophy founded on the *ontological* self-organization of natural purposes. As part of the investigation of this thesis, for example, we will consider the possibility of understanding teleological causes (Kant's *ideal* causes) as *real*.

This is not to say that the presence of the ontological conversion renders Kant's response unintelligible but it does create a space for an alternative approach. What's more the limitation which Kant's system places on what can rationally be known means that even within his system reflective judgment must be used if we are to investigate the empirical in any practical or meaningful way.

The need for this alternative ontological approach becomes pressing with later scientific developments that disrupt the validity of using mechanism as one half of the construction of the antinomy of teleological judgment.

To give one example Heisenberg claims that Kant's 'central concept of the "synthetic judgments a priori" has been completely annihilated by the discoveries of our century' (Heisenberg, 2000: 48). As well as an understanding of Space-Time via Einstein which is incompatible with the *a priori* Kantian

notion of space and time as given in intuition Heisenberg also asserts that '[t]he law of causality is no longer applied in quantum theory and the law of the conservation of matter is no longer true for elementary particles' (Heisenberg, 2000: 49).

One line of development in response to this attack on Kantianism was a neo-Kantian philosophy that both nullified the problem of the antinomy of teleological judgment and moved beyond the eternal structure of the categories to theories of knowledge that took into account sciences historical development. For example Brunschvicg accepted that Einsteinian relativity disproved Kant's commitment to Newtonian mechanism but retained his idealism, conjoining it with historical scientific developments as regulatory for epistemology.

This approach was developed further by Gaston Bachelard who held that the 'categories the mind constructs are relative to this historical situation' (Gutting, 2005: 4). Although this sounds like social constructionism (itself another development we can understand as developing from Kantianism) Bachelard is better understood as having a realist leaning in that his concern is with how scientific knowledge can only ever *approximate* a complex reality. This is Kantian in that the thing-in-itself can never be fully known however this is not due to the necessary structure of the *synthetic a priori* but due to the complex nature of a world whose structures defy precise scientific measurement. As such any deterministic description, such as Newtonian mechanism, must be the result of approximated abstraction.

Bachelard clarifies what he sees as Kant's mistake in hypostatizing Newtonian mechanism (or indeed any other scientific theory) as providing the eternal structure of the categories. However where Bachelard focuses on scientific epistemology (he even talks of technology as 'theories materialized' (Gutting, 2005: 4)) the concern of this thesis will be with moving towards an ontological account which considers the actuality of self-organization.

1.3: A Brief Survey of Alternative Theories

Prior to embarking on an analysis of cybernetic theories of causation and Simondon's development from this, it will first be necessary to briefly survey some alternative theories of causality that will inform our investigation. As will become evident any discussion of causation will also require an account of the entities which are involved in a causal relationship.

1.3.1: Aristotle

Aristotle famously describes four different types of causation (efficient, formal, material, final). It would be a mistake to think that he thought these operated in isolation and even that he meant these to be understood in the same manner as modern event-based causation such as in Hume or Locke. Instead Aristotle's account is somewhat broader as it responds to the various ways we can understand the question of what makes something the thing it is. Thus we could give a description of how a table is constituted using the four causes:

> 1. The efficient cause of the table is a carpenter because he makes the table.

> 2. The formal cause of the table is that it has four legs that support a horizontal surface.

> 3. The material cause of the table is that it is made from wood.

> 4. The final cause of the table is that it is used for sitting at for functions such as eating, writing or other activities.

Aristotle also argues that each of these four causes, including final causes, can be applied to natural organisms. He develops a hylemorphic account of

entities in that for something to be a thing it must be comprised of both matter and form, the combination of which constitutes the substance of that thing. Although the formal cause is understood to be the more important cause, as it is that which necessitates the kind of substance that the matter will become, the account remains hylemorphic as both form and matter are necessary.

The role of the final cause in the Aristotelian account of natural organism is not so much the purpose of the organism but its *telos*, that is that at which the developing organism aims to become.

> 'Moreover, among the seeds anything must come to be at random. But the person who asserts this entirely does away with nature and what exists by nature. For those things are natural which, by a continuous movement originated from an internal principle, arrive at some end: the same end is not reached from every principle; nor any chance end, but always the tendency in each is towards the same end, if there is no impediment.' (*Phy.*: II. 8. 199b 14–18)

Thus the telos of an acorn is an Oak tree, and so the final cause of the Oak tree corresponds to its formal cause. As such Aristotle introduces an essentialism into his account in that the essence (for an organism the formal cause also contains its function) of an organism is that at which the final cause aims. Importantly this final cause is not extrinsic to the organism, such as we find in Kant, but is immanent to it. Simultaneously the final cause of an organism is also its efficient cause as it is that which it is *moved* towards, and therefore must also be self-moving. Thus we can see why Aristotle writes that:

> 'Now, the causes being four, it is the business of the student of nature to know about them all, and if he refers his problems back to all of them, he will assign the 'why' in the way proper to his science—the matter, the form, the mover, that for the sake of which. The last three often coincide; for the what and that for the sake of which are one, while the

primary source of motion is the same in species as these.' (*Phy.*: II. 8. 198a 22-32)

Like all essentialisms Aristotle's is susceptible to the problem of the distinctiveness of the essence in question. That is, what aspects of the entity in question are essential and which are merely accidental in that they are the result of external or accidental causes? We will also find this problem when we turn to look at the kind of essentialism that is often associated with Locke.

Further, Aristotle's account also has difficulty with explaining how essences might evolve under a theory such as Darwinism and also has problems in respect of priority which Simondon will take issue with. We will bracket these concerns until we meet them once again further on in the thesis.

1.3.2: Locke & Powers

Where Aristotle's essentialism concerns the formal cause of an entity as that which it aims towards behaviorally as a substance, the essentialism found in Locke refers to an entity's *atomic* constitution.

Again, for the purposes of this thesis we are not concerned with the finer details of Locke's ontology whose exposition is contested. Rather I wish to outline how Locke's theory can be developed into other ontological positions which have import to the position we shall be developing later.

Fundamental to Locke's theory is the distinction between the primary and secondary properties which an object possesses. The primary qualities of an object are those properties which an object possesses independently of it being perceived. The kind of properties that Locke has in mind here are such things as extension, motion and texture. An object's secondary qualities are the qualities which perceivers perceive an object has by virtue of the act of perceiving the object. Here Locke seems to have in mind such qualities as

colour, taste and smell. Although there is some question regarding how Locke ultimately decides which qualities of an object are primary or secondary the key point is that for him an object has some properties that are intrinsic to it.

Locke is not attributing these properties to a substance in the Aristotelian sense but holds an atomistic theory of the constitution of objects. That is he holds that the essential nature of a material object is its inner structure. What Locke is generally understood as meaning by this is that an object's inner structure is atomistic and it is this which provides the causal properties of the object. However this picture is made more complex in that for Locke atomic structure is not like that which we understand in today's chemistry. Indeed Locke's atomism is speculative and he ultimately claims that what the substance is that ultimately underpins or coheres qualities together is unknown. As Roy Wood Sellars (2008 :14) writes:

> 'As is well known, Locke formulated his position in such a way as to leave substance, or matter, a hidden core supporting adjectival entities called primary qualities.'

From using this simple outline of Locke's ontology we can begin to draw out some further ontological positions (in contrast to Aristotle's, Hume's and Kant's) which will concern us in the course of this thesis.

1.3.3: Reductionism / Essentialism

In his atomism Locke comes very close to a *real essentialist* position where ontological reality is found in *real essences*. In Locke's case the *real essence* would be the atomistic internal structure he claims objects have. As we will see when we turn to look in more detail at Powers metaphysics this has some similarity to the position held by Brian Ellis. As such Locke's can be understood as a reductionist position if one takes the position that it is only the primary

qualities that objects have that possess real causal power and these primary qualities are dependent on such *real essences*. The claim could then be made that secondary qualities are not fundamentally real but merely supervene on a more primary *reality*.

The reductionist move is one that can commonly be found in modern science and different theories will concern what it is that is seen as the primary reductive unit of importance (E.g. Dawkins' selfish gene, string theory etc). This will be something that will also concern us later in the thesis.

1.3.4: Somaticism

If we were to allow that the properties of objects emerge not just from the properties of individual atoms but also from groups of atoms, that is the bodies which emerge from the grouping of atoms in different ways, then a somatic ontology can be developed from Locke's basic building set.

There are a number of ways such a position could be developed, depending on particular nuances. Examples include the theorizing of actants such as found in Actor Network Theory and the ontological prioritization of objects as found in Object Orientated Philosophy. When examining these positions we will necessarily have to question how relations are theorized as well as how objects identities cohere temporally.

Another related position is that of teleonomy where purpose-directed entities are understood as being understood only *as though* they have purpose but in reality such seeming purposiveness can always be reduced to a functional account. There is more than a touch of Kantianism about this and it is something which will concern us in our forthcoming discussion of cybernetics.

1.3.5: Nominalism

Given the reductionism described above where secondary qualities are discerned as not being real in the sense that they don't exist unless perceived there is clear room here for the development of a form of nominalism. For example, there might be no necessity that phenomenal objects need correspond to real essences, especially as Locke describes them, if these essences are not discernible.

1.3.6: Powers

In *Process & Reality* Alfred North Whitehead proposes that Locke's metaphysics may also describe a form of Powers metaphysics given its assertion of active and passive powers.

> 'He also holds that powers' are to be ascribed to particular existents whereby the constitutions of other particulars are conditioned. Correlatively, he holds that the constitutions of particular existents must be described so as to exhibit their capacities' for being conditioned by such powers' in other particulars.' (Whitehead, 1978: 147)

In making such a development the claim would be that what Locke terms primary and secondary properties are real causal powers that act in the world. As we'll see when we turn to describing Powers later there is dispute about the need for essences in such an ontology with essentialists like Brian Ellis claiming there is a need and dispositional monists like Stephen Mumford arguing otherwise.

1.3.7: Conclusion

In this thesis we take as our starting point the problem of natural purposes for Kant's philosophy. As we have noted Kant was writing in response to the

extreme contingency of Hume's philosophy but by basing his categories on Newtonian mechanism he was limited by a mechanism which was unable to account for the self-organization of natural purposes.

In looking to move beyond Kant's position and be able to take account of more contemporary scientific positions regarding the dynamic and productive nature of being we propose an ontological investigation. As a precursor to this investigation we have briefly outlined some of the significant ontological positions we will engage with over the course of our exposition of Simondon's philosophy for it is the work of Gilbert Simondon that we will explore as a response to both Kant's problem of teleology as well as an alternative to those positions just sketched.

In the next chapter we will explore the development of cybernetics which developed an account of teleological causation which is an important pre-cursor to Simondon's philosophy of ontogenesis.

To recap, some of the core concerns that have emerged in this chapter which will be explored in the following chapters are:

1. The possibility that being is not passive and inert, but is dynamic and productive. However, we will not be looking for a scientific account of matter but for a metaphysical account that is not incompatible with scientific accounts. It will be in relation to this that we will eventually look to Powers metaphysics as well as Simondon's theory of the pre-individual and transduction.

2. The productive nature of being thus necessitates that ontology be considered primarily as ontogenesis, rather than as already constituted by discrete entities. This will have implications, as we shall see, for the ontological positions outlined above as well as for logic and identity based reasoning.

3. The nature of causality and what constitutes a relation. Given the primacy of ontogenesis it will be necessary to explicate afresh the nature of

what constitutes an individual. In doing so we will take into account causal theories from cybernetics and powers theory and their relation to Simondon's own conception of Nature.

4. As well as the genesis of individual entities a rethinking of how time and extension, those *a priori* aspects of Kant's faculty of Sensibility, are also individuated. Such ontological considerations will also have significant implications for the development of an associated epistemology.

Chapter 2: Simondon & First-Order Cybernetics

'Cybernetics is the science of defensible metaphors.'
Gordon Pask (as quoted in von Foerster, 1995)

2.1: Introduction to the Chapter

In the previous chapter a case was made, given certain insufficiencies in Kant's account, for an ontological enquiry into the nature of causality and ontogenesis. In this chapter we will outline cybernetic teleology and some of the problems that arise from it which will be of concern throughout this thesis such as, whether purpose should be theorized via analogy or as immanent to productive process, whether it points to an isomorphism between man and machine and what is the nature of information. All of these questions are of central importance for Simondon. At the end of the chapter we will turn to his criticisms of first-order cybernetics by way of an introduction to his philosophy.

As a caveat it cannot be stressed enough that to actually stipulate that there was a coherent first-order cybernetics programme in itself, is problematic. The range of thinkers generally accepted as being first-order cyberneticians offered a range of perspectives that were not always harmonious.

Despite this heterogeneity there are some core concerns which all the cyberneticians accepted (to varying degrees) or at least developed in new directions. Rather than give a detailed account of any one cybernetician's work I will attempt to present this core set of conceptual tools, with which all these thinkers engaged, in order to contrast and illuminate Simondon's project. Although this approach may be of some historical interest the aim of this chapter is to locate Simondon's thought in the context of an encounter between cybernetics, French epistemology and phenomenology.

2.2: Cybernetics

Cybernetics is an interdisciplinary science whose core concern, at least in its first phase, was the study of the principles of organization and control in complex systems.

The focus of cybernetic study is with the principles that functionally guide systems and how these principles can be applied to interpret other types of system. As such it is possible to divide authors between those who hold that although cybernetics can account for purpose in machines it can only be applied to organisms by analogy and those who hold that there is an isomorphism (in some cases even an identity) between machine and organism to the extent both can be explained via cybernetics.

For the first group cybernetics is not concerned with systems from a material perspective, that is with what they consist of, but rather with their formal elements which can be used *analogically* to explain a broad range of systems. There is thus a Kantianism here. For the second group cybernetic explanation proposes that all systems literally operate cybernetically, that is that both machine and organisms actually operate using the same principles.

Cybernetics is interdisciplinary in nature in that its goal is to use its core principles to account for systems hitherto subsumed under separate disciplines, such as biology, technology, psychology and sociology.

Of all the sciences, due to its affiliation with engineering (via Wiener) and mathematics (via Shannon), cybernetics is most closely allied to physics. However cybernetics' goal is to be a general science which can account for phenomena described by all the other sciences using the new tools of information, modeling and control. As we will see, although also interested in engineering and information, Simondon's significant interest in biological science gives him some distance from much cybernetic theory.

2.3: Teleological Mechanisms

To tease out several of the key concepts important for understanding cybernetics we will begin by looking at several of its foundational statements starting with Rosenblueth, Wiener and Bigelow's article 'Behavior, Purpose and Teleology', published in 1943. This article outlines many of the central concerns of cybernetics in embryonic form, namely; teleology, technology and the behaviour of organisms.

In this paper the authors reassess the importance of the notion of purpose by critiquing behaviourism for investigating its objects solely from the perspective of inputs and outputs and thus providing explanations so broad that behaviour comes to mean 'any change of an entity with respect to its surrounding' (Bigelow, Rosenbleuth & Wiener, 1943: 18).

The authors then set about building a taxonomy of behaviours, beginning by distinguishing them as to whether they originate from input from outside the object (passive behaviour) or from within the object itself (active behaviour, where the object is the source of the output energy for the behaviour).

The taxonomy then develops by discriminating between active behaviours as being either purposeful or purposeless.

> 'The term purposeful is meant to denote that the act or behavior may be interpreted as directed to the attainment of a goal — i.e., to a final condition in which the behaving object reaches a definite correlation in time or in space with respect to another object or event.' (Bigelow, Rosenbleuth & Wiener, 1943: 18)

Teleological, purposeful, active behaviour, being 'directed', requires the involvement of negative feedback, that is when the object's behaviour is

controlled 'by the margin of error at which the object stands at a given time with reference to a relatively specific goal' (1943: 19).

Behaviour is deemed to be purposeful if it is guided by signals from the goal at which it is directed. Or to put it in more cybernetic terminology, a system of auto-regulation between an entity and its goal is developed where part of the output of the behaviour of the entity is returned to the entity as input.

This discussion of teleology is significant, not only because it introduces the concern with feedback, a core cybernetic concept, but also because the authors contextualize their position in relation to other notions of teleology and causality.

One reference point is Kant's concern with teleology and organism in *The Critique of Judgment*. For Kant the problem was how to resolve the antinomy between a universe governed by Newtonian causal mechanism and the seemingly indeterminate, yet purposive, behaviour exhibited by organisms.

The resolution Kant gave to this problem (see chapter one) was to attempt to reconcile Newtonian, efficient causality in phenomenal nature with the thinkability and actionability of final causality in the free behaviour of finite, rational beings.

The authors of this paper demonstrate an awareness of this prior wrangling between final and efficient causality and claim to have avoided the pincers of Kant's antinomy by redefining teleology as an activity which is neither subsumed under a final cause yet also evades strict subsumption to mechanical causality.

This last point is crucial for it claims that teleological purpose is simultaneously congruent with causality, yet also non-deterministic, as it is

positioned in a new 'realm' both immanent to, and emergent from, the actual system in which it occurs:

> 'According to this limited definition, teleology is not opposed to determinism, but to non-teleology. Both teleological and non-teleological systems are deterministic when the behavior considered belongs to the realm where determinism applies. The concept of teleology shares only one thing with the concept of causality: a time axis. But causality implies a one-way, relatively irreversible functional relationship, whereas teleology is concerned with behavior, not with functional relationships.' (Bigelow, Rosenbleuth & Wiener, 1943: 22)

Here we can already discern how complexity and systems theory are nascent in cybernetics (even before it was called cybernetics) with the description of an emergent realm that escapes strict determinism and which is established via feedback mechanisms within systematic structures (this is further developed in second-order cybernetics regarding how the behavioural terminology of input and output get transformed into discussion regarding the inside and outside of systems).

Once the realm of teleology has been established as having explanatory force another significant aspect of cybernetic thinking is established; that it can be used to explain the behaviour of both machines and organisms.

The authors make a brief comparison of the failed attempt of a human patient with a damaged cerebellum to drink a glass of water with that of the operation of a machine with an 'inadequately damped' feedback mechanism. From this they conclude:

> 'The analogy with the behavior of a machine with undamped feed-back is so vivid that we venture to suggest that the main function of the cerebellum is the control of the feed-back nervous mechanisms involved

in purposeful motor activity.' (Bigelow, Rosenbleuth & Wiener, 1943: 19)

Through *analogy* is developed the possibility of an *isomorphism* between machine and organism in terms of teleology (understood as negative feedback).

The extent of this isomorphism was by no means agreed upon amongst all the attendees of the Macy conferences[1], but what is of concern to us here, is that a physicalist account is being established to explain the behaviour of both machines and organism via purpose rather than behaviourism, dualism or finalism.

2.4: Physicalism & Complexity

Whilst Wiener held there was merely an analogous relationship between organisms and machines, that is, that the study of teleological mechanisms in one may be instructive when studying the other, Warren McCullough went beyond mere analogy and insisted on an identity between them. For him, organisms were machines, just very complicated ones, and should be described in the same manner.

In an article co-published with Walter Pitts (also 1943) called 'A Logical Calculus of the Ideas Immanent in Nervous Activity', another aspect of the general cybernetic project received impetus which aimed to account for the physical mechanisms which were responsible for mind.

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[1] The Macy conferences were a series of 10 conferences that took place between 1946 and 1953 and were so called because they were sponsored by the Josiah Macy Jnr Foundation. The participants came from a wide number of disciplines including computer science, psychiatry, anthropology, mathematics and sociology. The aim of the conferences was to found a general science of the human mind and cybernetics was the result. According to Dupuy (2009: 120) Simondon read the transactions of these conferences.were so called because they were sponsored by the Josiah Macy Jnr Foundation. The participants came from a wide number of disciplines including computer science, psychiatry, anthropology, mathematics and sociology. The aim of the conferences was to found a general science of the human mind and cybernetics was the result.

Once again it must be pointed out that there was some disagreement between the members of the cybernetic group regarding the place of mind in the description of organisms. Some of the group, such as Rosenbleuth and Wiener, were eliminativist[2] in that they held that folk descriptions of mind shouldn't have a place in accounts of behaviour which should be described in terms of control mechanisms and feedback.

McCullough and Pitts, however, had a more reductionist approach which they described as the neurons of the brain embodying 'propositions' in a logical calculus. Broadly, McCullough and Pitts were defending the position that the brain was a logical calculating machine which operated using a binary neuronal mechanism. In their description the teleological behaviour that Wiener had described in his paper was situated at the level of the neuronal activity of the brain.

Von Neumann (1966) introduced the notion of complexity into this account by acknowledging that the model developed by McCullough and Pitts could logically be used to explain a great deal of behaviour, but that complex systems also exhibited behaviour that could not be explained logically and therefore by this model.

However, that is not to say that these behaviours could not emerge from this system, just that their emergence would be too complex to be easily accounted for:

> 'Now this threshold of complexity, he supposed, is also the point at which the structure of an object becomes simpler than the description of its properties. In the usual case, which is that of simple machines, it is less complicated to describe in words what the automaton can do than

[2] Eliminativism is the reductionist view that a more precise account of the mind can be given through scientific description of its physical basis (e.g. at the neuronal level, via feedback mechanisms) than via folk descriptions (such as beliefs & desires). In its more extreme form such as that proposed by the Churchland's folk descriptions are viewed as simply mistaken and having no foundation.

to reproduce the structure of its wiring. For complex automata, the opposite is true: it would be simpler - indeed, infinitely more simple - to describe the structure of the automaton than to completely specify its behavior.' (Dupuy, 2009: 141)

2.5: Purpose, Randomness & Information Theory

Another central component of cybernetic theorizing concerns the notion of information. This concept became prominent with Claude Shannon's paper 'A Mathematical Theory of Communication' (Shannon, 1948) which was later popularized (along with the informational theories of Wiener and others) by Warren Weaver in his 'Recent Contributions to The Mathematical Theory of Communication' (Weaver, 1949). Although developed to describe the problem of communication from an engineering perspective, the theory also became prominent in certain areas of communication, media and cultural studies as well as having a significant impact in the biological sciences. [3]

Shannon's theory of information is a development of Boltzmann's method of statistically calculating entropy in a thermodynamic system, applied to the context of communication. For Shannon, entropy in this context becomes the measure of uncertainty surrounding the communication of a message.

As such, this theory is mathematical and is not concerned with whether what is being communicated has any semantic content. As Weaver points out:

'In fact, two messages, one of which is heavily loaded with meaning and the other which is pure nonsense, can be exactly equivalent, from the present viewpoint, as regards information.' (Weaver, 1949)

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[3] Although there is some evidence that Shannon was interested in applying his theory to living organisms, Wiener maintained that this was his idea (See: Mirowski, 2002: 70).

The 'present viewpoint' is one where communication is described by statistical probability.

There are two aspects to Shannon's theory which are worth analysing; the first is the definition of information as statistical probability and the second is the concept of noise.

Shannon's initial work on communication was in cryptography and it is easy to see how this influences his theory of information in that what it describes is the probability of one string of symbols in a message occurring instead of another.

The measure of information is calculated by realizing that all messages occur via selection from a set. As a set is finite, the probability of any message occurring, especially when taking into account any previous communication, is thus calculable.

This calculating operation was likened to the working of a transducer: 'a device capable of decoding and recoding strings of symbols as inputs and outputs, one that "may have an internal memory so that its output depends not only on the present input symbol but also on its past history"' (Shannon & Weaver, cited in Mirowski: 71, 2002).

It is not difficult to see how such an operation could be useful both for mathematical operations in cryptography as well as describing a way to measure information.

For such a statistical operation to occur, as well as communication, there must be a system in place that consists of a sender and receiver which both use the same set of possible messages. As Ashby writes:

'Communication thus necessarily demands a set of messages. Not only is this so, but the information carried by a particular message depends on

the set it comes from. The information conveyed is not an intrinsic property of the individual message.' (Ashby, 1957: 124)

Information is therefore a relation between a message and redundancy (the range of unselected messages in the set or code). In Shannon's mathematical theory this relationship is strictly non-semantic in character and refers to the possibility of there being content in any communication.

From an engineering standpoint this statistical measure of information was extremely useful in overcoming the problem of noise; that is, it solved a problem as to how a message from a sender may accurately be sent to a receiver without any distortion introduced by the channel along which the message passes.

As well as enabling a message to be distinguished from noise the theory of information also enables the ability to disguise a message within noise as occurs in cryptography. These are, as it were, two sides of the same coin and involve information as a statistical measure of probability within a code.

Although Shannon's focus was on applying his theory of information to problems of communication in engineering (Terranova, 2004: 29) the significant leap for cybernetics was that taken by Wiener in considering information as negative entropy in other domains outside of engineering such as biology and social systems (Wiener, 1989).

Ashby explains the importance of this leap through the example of the role of information in the growth of a rabbit ovum. From the informational perspective the analysis of the growth of an ovum using energetics does nothing to answer the question why this ovum develops into a rabbit rather than some other form. In the same way that information theory measures the probability of the selection of a single message from the set of all possible messages:

'Cybernetics envisages a set of possibilities much wider than the actual, and then asks why the particular case should conform to its usual particular restriction . . . So no information or signal or determining factor may pass from part to part without its being recorded as a significant event. Cybernetics might, in fact, be defined as the study of systems that are open to energy but closed to information and control — systems that are "information-tight."' (Ashby, 1957: 3)

In this case the selection relates to which form the ovum will take as it develops. This selection is seen to be a function of information and, as such, is mathematically calculable, just as a message is calculable given its code using information theory.

Thus the thermodynamic notion of entropy informing a definition of information is then fed-back to provide an explanation of negentropy in physical systems. The notion of information has thus migrated from being a measure of statistical probability in the transmission of messages to a causal input within a system, and as such must also have a material reality. As Terranova notes:

'This notion that information was somehow related to anti-entropic or negentropic forces is at the basis of the informationalist perspective that identifies information with a kind of form determining the material unfolding.' (Terranova, 2004: 31)

For cybernetics, therefore, it is evident that there is a close connection between information and the production of form (including behaviour) via the link with entropy.

As Mirowski observes, there is a relationship here between the idea of Maxwell's famous demon as theorized in thermodynamics, Wiener's anti-aircraft weapon and the notion of negentropy in nature:

'[A] demon taught to neutralize the devious codes of the Enemy now trains his strategic knowledge on Nature to defeat the forces of dissolution and disorder.' (Mirowski, 2002: 73)

Where Wiener begins his study of teleological mechanisms with the study of developing a machine to track and destroy an enemy by increasing the accuracy of prediction within a system he ends by asserting that it is this same mechanism of information which allows organisms to not only produce their own teleology but to actually develop in the face of the second-law of thermodynamics in the first place.

2.6: Organism & Machine

It is perhaps unsurprising that cybernetics developed a long-standing fascination with automata and machines given that Wiener developed his teleological theory from the operation of a machine (the anti-aircraft gun).

The development of a mathematical theory of information was also a boost to the linking of organism and machine in cybernetic theorizing. What this proved was that logic could be instantiated in a machine, a proposition that we have seen McCullough took very seriously.

Although Wiener only understood machines and organisms as analogous (and not identical) in that they both operated using the formal operation of feedback it is worth pointing out that what both cyberneticians were interested in was this formal operation of feedback and how these operations could be implemented. As Ross Ashby states:

'Cybernetics, too, is a "theory of machines", but it treats, not things but ways of behaving. It does not ask 'what is this thing?' but 'what does it do?' (Ashby, 1957: 1)

Unsurprisingly, the types of machines that most interested the cyberneticians were those whose operation involved some form of self-regulation via feedback loops. Some of the more famous examples are Claude Shannon's maze-negotiating mouse, which could actually remember how to navigate a particular maze once it had solved it; Ross Ashby's Homeostat which was a machine that purportedly demonstrated how a system could maintain homeostasis within a changing environment and, of course, Von Neumann's work on natural automata, which led to the development of the modern computer.

It is the formal operations or behaviours of systems which interested cybernetics and as we have seen these rely not on mechanistic determinism but on feedback mechanism. That is, cybernetics is concerned with 'forms of behaviour in so far as they are regular, or determinate, or reproducible' (Ashby, 1957: 1).

One outcome of this concern was the development of modeling behavior (comprehended using the theories of feedback and information) though constructing physical or mathematical models of operation. As Dupuy concisely explains:

> 'To abstract the formal properties of phenomena and in this way identify isomorphisms between different domains of phenomena is precisely what modeling is all about - even science itself. The attempt to propose a unified theory of machines and living creatures with reference to the category of purpose, conceived in mechanistic terms and rebaptised as teleology represented a spectacular increase in the extension of science, hardly a rupture with it.' (Dupuy, 2009: 47)

2.7: Vitalism & Mechanism

Wiener argued that it is this extension of science that enabled a new way of understanding the operation of purpose in organisms which avoided both vitalism and Newtonian mechanism.

The overcoming of this dualism was achieved through the development of new types of complex mechanisms which are able to act without recourse to folk psychology and consciousness. As Wiener triumphantly proclaims:

> 'Vitalism has won to the extent that even mechanisms correspond to the time-structure of vitalism; but as we have said, this victory is a complete defeat, for from every point of view which has the slightest relation to morality or religion, the new mechanics is fully as mechanistic as the old.' (Wiener, 1965: 44)

There are two attitudes that cyberneticians tend to have regarding consciousness and psychology, both of which stress the transcendental priority of the material to mental phenomena. The first attitude is reductionist (like McCullough's) where mental phenomena are viewed as inconsequential epiphenomena produced by complex material mechanisms; the second attitude allows significance to consciousness but only because it is a consequence of mechanism and thus it is the mechanism that is of fundamental interest (there is a sense that structuralism emerges from this line of thinking).

Both attitudes share the same basis however, which is that what is primary is mechanistic thus that consciousness and meaning are fundamentally underpinned by mechanisms of control and communication.

This perspective can still be aligned with Kantianism to the extent that what has been added is only the contention that there is a mechanistic explanation for the emergence of the structuring of experience and understanding.

It is in this sense that Dupuy (2009) argues that what cybernetics, and cognitive science after it, are doing is not so much trying to emulate the mind using machines but to make the much bolder move of claiming that the mind *is* a machine. Such an identity is clearly evident, for example, in W. Ross Ashby's *Design for a Brain*, in which he attempts 'to deduce from the observed facts what sort of a mechanism it [the brain] must be that behaves so differently from any machine made so far' (Ashby, 1954: v). The opening of the third chapter called 'The Animal as Machine' makes explicit this assumed identity:

> 'We shall assume at once that the living organism in its nature and processes is not essentially different from other matter. The truth of the assumption will not be discussed.' (Ashby, 1954: 29)

As such we can see that the history of cybernetics undertook a shift from merely comparing animals with automata analogically to making the much stronger claim that animals *are* machines.

A whole series of activities emerged from this mechanizing cybernetic movement, including: second-order cybernetics with its subsequent development into systems theory and neurophenomenology; artificial intelligence, which moved beyond behaviourism to theorize mental states and the nature of how a mind could be instantiated machinically; microbiology which theorized genes as informational units; cognitive science which viewed cognition as a form of information processing.

In conclusion to this section, and with some generalization, we have seen that cybernetics claims purposeful behaviour and finality in organisms and machines can be explained in terms of physical laws. However, these physical laws are not those of the deterministic kind as found in Newtonianism, but consist of the operations of feedback augmented by information.

Additionally, the quantitative nature of information means all behaviour can potentially be modeled mathematically and organic behaviour should be

able to be reproduced mechanically, as it is the form of behaviour which is important and not the material in which that behaviour occurs. This final point is an important one as it enables cyberneticians to claim identity between machine and organism, something that Simondon strongly disputes.

2.8: Simondon & Cybernetics

Undoubtedly Simondon was heavily influenced by cybernetics but there are several aspects of his work that distinguish it from the main currents of the early cybernetic project described above.

That Simondon was involved with the cybernetic movement is evidenced by the fact that in 1964 he organized a conference in Royamount, entitled *The Concept of Information in Contemporary Science*, with Wiener as an invited speaker. As John Hart notes in his preface to the 1980 translation of *On the Mode of Existence of Technical Objects,* at this meeting Simondon compared cybernetics to the work of Newton due to its universal ambition:

> 'In fact, historically, cybernetics appeared as something new directed to achieving a synthesis; in sum, we find ourselves brought back to the time of Newton, or to the time when the great philosophers were mathematicians or scientists in the natural sciences and inversely. This is doubtless the context in which it is now possible to listen to what Professor Wiener has to present to us.' (Simondon quoted in: Hart, 1980)

Simondon is not critical of the synthesizing ambition of the cybernetic project, in fact his own axiomatizing project (which he calls Allagmatics (Simondon, 2005: 559)) has a similar encyclopedic ambition which is to be achieved via a revision of cybernetic theory. In the following section we will look at some of Simondon's criticisms of cybernetics in order that we can more clearly describe his own project of reformation.

2.9: The Critique of Hylemorphism & Atomism

Where cybernetics is predominantly concerned with behaviour, Simondon focuses on operation. The operation on which he focuses is always one that prioritizes the process and nature of individuating relation and how terms come to be constituted. Indeed, it is cybernetics' reliance on describing mechanisms from the perspective of already constituted individuals which is one of Simondon's prime criticisms of it. For Simondon, that a message always travels between a sender and a receiver begs the question of how these individuals came to be established in the first place. It is this question, essentially one of ontogenesis, that drives Simondon's entire philosophy. In order to understand this we must first understand Simondon's arguments against those theories that prioritize the individual and identity.

For Simondon, an account of ontogenesis (the process of becoming of entities described as individuals) is fundamental. By denying it we are eliding the key issue of what an individual is and how it comes into existence.

In his critique of theories that fail to give an account of this process Simondon argues the idea of individuation has been undertaken 'either before or after the individuation has taken place, according to whether the model of the individual being used is a physical one (as in substantialist atomism) or a technological and vital one (as in hylemorphic theory)' (Simondon 1992: 299).

By this he means that these principles of individuation do not explain how individuation occur but, by beginning their account from the already constituted individual, assume it already has. Subsequently the actual process of individuation 'is seen as something that needs to be explained, rather than as something in which the explanation is found' (Simondon 1992: 299).

As Simondon notes, this approach to describing individuation is actually individuation in reverse as it '*accords an ontological privilege to the already constituted individual*' (Simondon 1992: 298) rather than starting with the process of individuation which, if taken into account, would affect our account of the individual.

Simondon argues that neither substantialist atomism or hylemorphism offers a suitable description of individuation because neither gives an actual description of the process of individuation itself but rather affirm a principle prior to and separate from any individuating process.

Simondon criticizes substantialist atomism because the theory already roots a principle of individuation in the pre-existence of atoms as individual units themselves which are held together by 'cohesive forces' to create more 'complex individuals'. Thus the principle of individuation in atomism is already given with the existence of pre-existing individuals (atoms), which then somehow come together to create more complex individuals. As such the actual process of the individuation of these individuals is left unexplained.

With hylemorphism, such as that found in Aristotle, Simondon's criticism is that rather than being located in the individuation process 'the principle is thought to be contained either in the matter or the form, because the actual process of individuation is not thought to be capable of *furnishing* the principle itself, but simply of *putting it into effect*' (Simondon 1992: 299). So again we see that a principle of individuation is asserted prior to the actual process itself and that the principle tells us nothing about the operation of the individuation process in itself.

Simondon understands hylemorphism as a schema that has been developed from technical operation and which has been poorly applied by analogy to other types of operation. As he makes clear, the technical origin of the scheme does not invalidate it as long as 'the operation which is the basis for

the formation of the concepts used passes and is expressed entirely without alteration in the abstract scheme' (1995: 28). Simondon uses the example of the forming of a brick to test the validity of the hylemorphic schema. He argues that the hylemorphic account of the formation of a brick by the action of a mold on clay misses key aspects of the individuation process. In particular the account misses the preparatory aspects of the process, such as the manufacturing and preparation of the mold (coating its surface to prevent clay sticking to it) as well as the preparation of the clay so it is ready for molding as well as the subsequent drying process. In short, Simondon points out the many processes of both micro- and macro-physical mediation that must occur throughout the entire brick making process. Thus he claims 'the real dynamism of the operation is very distant from being represented by the form-matter pairing' (Simondon, 1995: 28). Therefore the operation that forms the basis for the hylemorphic schema is not 'expressed entirely' as 'the form and the matter of the hylemorphic scheme are abstract form and matter' (Simondon, 1995: 28) which are insufficient to account for the 'real dynamism' of individuation.

A key reason Simondon opposes the hylemorphic schema is that he sees it as responsible for miring metaphysics in a substantialism which prevents an understanding of the becoming of being where form is generated through an operation that is immanent to being itself. Such a processual understanding of ontogenesis is denied if form is understood as something that is imposed on an abstract matter from without rather than involving inherent material processes.

2.10: Criticisms as Applied to Cybernetics

These criticisms of hylemorphism and atomism can both be applied to cybernetics because it focuses on the operation of already individuated systems without giving an adequate account of their genesis. For this reason Simondon disagrees with any prioritization of the importance of information *as message*

within an already individuated system. This is not to say that he contests information as it is theorized by cybernetics only that it is of primary importance. In a footnote (Simondon, 2010b: 15) he makes it clear that he sees cybernetic information as very much secondary and reliant on a more fundamental and primary operation which he calls 'primary information':

> 'This affirmation does not lead us to contest the validity of the quantitative theories of information and the measurements of complexity, but it supposes a fundamental state -that of the preindividual being - prior to any duality of the sender and of the receiver, and therefore to any transmitted message. It is not the source of information that remains of this fundamental state in the classic case of information transmitted as a message, but the primordial condition without which there is no effect of information, and therefore no information: the metastability of the receiver, whether it be technical being or a living individual. We can call this information "primary information."'

It is this 'primary information' which Simondon describes as transduction and which he offers as the foundation of his theory of ontogenesis that we will examine in depth in the next chapter. For the purpose of this chapter it is enough to note that the cybernetic understanding of information is susceptible to Simondon's critique.

Although Simondon's notions of individuation and information share the same thermodynamic heritage as the cybernetic notion of information, they are defined in a very different way. As we have seen, cybernetics engages with thermodynamics by reconfiguring the mathematical measure of entropy into the negentropic measure of information. Simondon's engagement with thermodynamics, however, involves the development of the role of

thermodynamic metastability but moves away from the cybernetic concern with quantifiable information.

Just as Simondon takes issue with the account of pre-constituted individuals between which information travels, so he also questions the quantitative theory of information as adapted from Shannon. For Simondon this account of information falls foul of his criticisms of both atomism and hylemorphism. The criticism of information as atomistic applies to the mistake of describing information as discrete quanta transmitted between relata with no account of how such information comes to be individuated. Additionally it also leaves unanswered how the terms between which such information is transmitted also come to be individuated. The cybernetic conception of information can also be understood hylemorphically as a source of form separate from the matter being formed, rather than form arising from the individuation process itself.

As we will see in the next chapter, for Simondon information is not to be considered as message between a source and receiver but describes an operation relating to the resolution of a disparity in being leading to the individuation of structure.

2.11: Analogy & Cybernetics

In the text 'Technical Mentality', Simondon (2009) discusses how, through the use of analogy and paradigm, technology has aided the development of different 'modes of knowledge'. He gives two examples of the development of such universal 'schemas of intelligibility'. In the first, the operation of simple mechanisms offers an analogy for how the rigorous logic of Cartesian mechanism operates (Simondon, 2009: 17). The implication is that the schema for the operation of thought, that is how the understanding operates, has developed analogically with the operation of machines. Thus in Cartesianism

both machines and thought are understood rationally and with an operation consisting of a 'transfer without losses'. Thus;

> 'the only domains that are accessible to philosophical reflection are those with a continuous structure. It will therefore be clear why one has wanted to consider living beings as machines: if they weren't machines ontologically, they would have to be so at least analogically in order to be objects of science.' (Simondon, 2009: 18)

As we have seen this is precisely the problem that troubled Kant in his third critique in attempting to understand natural purposes using Newtonian mechanism.

Cybernetics is the second example Simondon gives of a universal schema for the operation of the understanding developed from an understanding of technical operation. The key concept here is the regulatory feedback mechanism 'that allows for an active adaptation to a spontaneous finality' (Simondon, 2009: 18) which Wiener understands as teleological mechanism.

As Simondon observes this schema has proven useful when applied analogically to other phenomena:

> 'This technical realization of a finalized conduct has served as a model of intelligibility for the study of a large number of regulations - or of regulation failures - in the living, both human and nonhuman, and of phenomena subject to becoming, such as the species equilibrium between predators and preys, or of geographical and meteorological phenomena: variations of the level of lakes, climatic regimes.' (Simondon, 2009: 18)

As we have already seen, Simondon has criticized cybernetics from an ontological perspective for its presupposition of atomism and hylemorphism.

Another fundamental critique he makes is that regarding its use of analogy. This critique is important in that through it we can understand what Simondon considers a valid use of analogy as well as what is problematic for the two technical schemas just outlined.

In an important section of his thesis titled *Allagmatics* Simondon discusses the difference 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. Pseudo-scientific thought makes substantial use of resemblance, sometimes even the resemblance of vocabulary, but it does not make use of analogy.' (Simondon, 2005: 563)

For Simondon an analogy is only valid 'if it covers a world where beings are defined by their operations and not by their structures' (Simondon, 2005: 564), for an analogy based on structures does not in fact constitute an analogy for Simondon but merely a resemblance because it 'can't reach the whole reality of being'. Simondon's theory of knowledge is thus premised on his ontological account of the operation of being[4]. Thus for Simondon, Kant's theory of knowledge, as it focuses on the structure of being rather than its operation, is based on resemblance and therefore limited.

It is perhaps worth reiterating that cybernetic's prime focus is in looking at form, particularly 'forms of behaviour in so far as they are regular, or determinate, or reproducible' (Ashby, 1957: 1). Cyberneticians are interested in drawing analogies between phenomena which can be interpreted as enacting the same kind of behaviour though involving different types of system. For

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[4] This will be the subject of the next chapter.

example, analogies might be drawn between the working of the brain and a computer, or cellular automata and living organisms, or between games and the economy, as well as to applying the findings from one system to that of the other. It is in this spirit that analogies were often attempted between the behaviour of robotic automata and that of living beings.

It is clear then that, for Simondon, such analogies of form amounts to mere structural resemblance and are not valid analogies relating to operation. Although a cerebellum may cause the same kind of behaviour in an animal as a servo-mechanism does in an automaton this is just a resemblance and tells us little about their differing *operative* realities.

In a revealing paragraph Simondon further explicates the problem that analogy presents for a technical schema such as cybernetics when applied universally:

> '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. This transcategorical knowledge, which supposes a theory of knowledge that would be the close kin of a truly realist idealism, is particularly fit to grasp the universality of a mode of activity, of a regime of operation; it leaves aside the problem of the atemporal nature of beings and of the modes of the real; it applies to their functionings; it tends towards a phenomenology of regimes of activity, without an ontological presupposition that is relative to the nature of that which enters into activity. Each of the schemas applies only to certain regimes of each region, but it can in principle apply to any regime of any region.' (Simondon, 2005: 18)

Thus although the schemas of Cartesianism and cybernetics are valid in some domains and can, in principle, be analogically applied universally this application will be invalid in some instances as they neglect the ontological nature of that to which they are applied. This is the reason Simondon suggests that the use of such schemas '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 will be such an ontological presupposition that Simondon brings in to play as he seeks to both underpin and extend his own account of a schema of intelligibility.[5]

An interesting concept Simondon uses in the above quote is that of 'realist idealism'. By this is meant that technological operations provide the basis for the operation of knowledge. With hylemorphism, Cartesianism and cybernetics, as we've seen, the analogies are poor. However what Simondon is proposing is that such a technical mentality, although currently insufficient, can be developed further and more precisely. It will be with Simondon's analogy of the transductive operation of being with that of thought that he will try to navigate a path between reductive materialism and Kantian Idealism.

Thus Simondon's idealism is realist in that it is the operation of thought (rather than its structure) that is founded on the operations found in being. The rigid categories of Kant are replaced by schemas of knowledge that develop from the 'phenomenologies of regimes of activity'.

That the universalisation of these schemas can lead to invalid analogies is one of Simondon's criticisms of cybernetics. For example in *On the Mode of Existence of Technical Objects* Simondon writes:

'There is one element that threatens to make the work of Cybernetics to some degree useless as an interscientific study (though this is what

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[5] In the same essay Simondon describes this schema as being based on utilizing the notions of thresholds and networks. We will develop Simondon's account of these notions and his philosophy of technology over the coming chapters.

Norbert Wiener defines as the goal of his research), the basic postulate that living beings and self-regulated technical objects are identical. The most that can be said about technical objects is that they tend towards concretization, whereas natural objects, as living beings, are concrete right from the beginning. There should be no confusing of a tendency towards concretization with a status of absolutely concrete existence.' (Simondon, 1980: 41)

There is here, as there often is with Simondon, the repetition of the argument regarding the genesis of the individual. By stipulating that natural, living beings are 'concrete right from the beginning' he is pointing to the fundamental difference between the ontogenesis of living and technical individuals. A technical individual might be more concrete than a previous member of the same technical lineage but it could not achieve this development by itself, whereas 'a living being engenders other beings that are similar to itself or that can become like it after a certain number of successive reorganizations that occur spontaneously if the conditions are suitable' (Simondon, 1980: 61).

The full force of this argument only becomes apparent when we more fully understand Simondon's operational ontology and how it leads to a very different understanding between the individuation of biological organisms and the development of technical lineages via progressive concretizations.

Cybernetics' obsession with automata as a special class of technical objects imbued with a particular analogical power also strikes Simondon as mistaken in that the bad analogy not only leads to a mistaken conception of the organism but also to an impoverished understanding of what technology is:

'It would not even be right to found a separate science for the study of regulatory and control mechanisms in automata built to be automata: technology ought to take as its subject the universality of technical objects. In this respect, the science of Cybernetics is found wanting;

even though it has the boundless merit of being the first inductive study of technical objects and of being a study of the middle ground between the specialized sciences, it has particularized its field of investigation to too great an extent, for it is part of the study of a certain number of technical objects. Cybernetics at its starting point accepted a classification of technical objects that operates in terms of criteria of genus and species: the science of technology must not do so. There is no species of automata: there are simply technical objects; these possess a functional organization, and in them different degrees of automatism are realized.' (Simondon, 1980: 49)

2.12: Memory and Meaning

A good example of the inadequacy of analogy between human and machine is that concerning the operation of memory. Simondon argues that the operation of memory in humans and machines is of a very different kind. Where machine memory 'is able to retain very complex, detailed, precise monomorphic documents for a very long time' (Simondon, 2012: 75), human memory involves the retention of forms and meaning which are significant for that individual. What's more, human memory is plastic in that new content introduced to memory will change how it understands future content: 'in the living the *a posteriori* become *a priori*; memory is the function by which *a posteriori* matters become *a priori*' (Simondon, 2012: 77).

Simondon thus understands epistemology as a function of ontology insofar as the development of schemas of ontological operation (such as those developed from technology) enable developments of epistemology. Such a theory is in stark contrast to the rigid categories of Kantian transcendental idealism for it allows for the development of progressive schemas of

intelligibility whose understanding may well cut across the rigidly defined Kantian categories.

This difference between the operation of machine and human memory also leads to the impossibility for analogy between the operation of self-regulation in each.

> 'Machine memory is that of the document, of the result of measurement. Human memory is that which, after an interval of many years, recalls a situation because it involves the same meanings, the same sentiments, the same dangers as another, or simply because this similarity has a meaning according to the implicit vital coding that constitutes experience. In both cases memory allows self-regulation; but human memory makes self-regulation possible according to a set of meanings that are valid in the living and that can develop only in the living; machine memory establishes a self-regulation that has meaning in the world of non-living beings.' (Simondon, 2012: 78)

Such a distinction puts into question the account of teleology (negative feedback) described by Wiener as being a suitable account for the kind of self-organizing activity that Kant describes for natural purposes (organisms). This difference in the operation of memory and of self-regulation highlights another significant problem for cybernetics and that is regarding semantics. For in the paragraph above Simondon pinpoints that a key difference between the kinds of self-regulation found in machines and that found in humans is the role of meaning.

First, in the cybernetic account of teleology the origin of meaning remains unclear. For example, although the notion of the goal of a system is used to describe the meaning of an act, this can be seen to be a sleight of hand in that it is the observer or creator who is allocating a sense of meaning to the system (by analogy) rather than meaning emerging immanently from the

system itself. In short, meaning would either be epiphenomenal ghosting or requires a physical explanation just as any other phenomenon does.

Second, as already mentioned, the lack of an account of semantics at the heart of the Shannon-Weaver account of information as probability makes it problematic as an explanation of communication. Mirowski discusses this lack:

> 'In Shannon's version, there is no macro-micro distinction, only a given probability of a particular symbol showing up, and a measure of the likelihood of strings of symbols. This is often rephrased by suggesting that Shannon's entropy is about "choice" of symbols (Hayles, 1990a: 54), an interpretation first popularized by Weaver: "information, in communication theory, is about the amount of freedom of choice we have in constructing messages" (Shannon & Weaver, 1949: 13).' (Mirowski, 2002: 72)

Mirowski goes on to add that this idea of choice is 'sneaking intention and semantics back in through the back door' (Mirowski, 2002: 72). After all, who is doing the choosing?

Merleau-Ponty also points out the problem of semantics for cybernetics when contrasting the notion of language as code in cybernetics to that of orthography found in a spoken and written language:

> 'Now cyberneticists never study the relation of the signifier and signified. The problem for them is to translate. We code the message and this is the fundamental operation. We still have to arrive at the moment when the message has a relation with what it means. The enumeration of possible combinations does nothing to help us understand the very act by which language takes on a meaning.' (Merleau-Ponty, 2003: 163)

This leads him to the same conclusion found in Simondon: 'The code is no more a language than is the automaton a life' (Merleau-Ponty, 2003: 163). A

significant aspect of this inability for the cybernetic notion of information to develop meaning is that it fails to describe a system as being in a true relationship with what is external to it. It is the openness of a system onto a milieu that is required for Merleau-Ponty, Simondon and the second-order cyberneticists to enable a true theory of invention and emergence. It is also this openness that is required for the development of any system whether it be a language or a higher organism to develop meaning.

This lack of a coherent account of meaning in first-order cybernetics also became an issue for the projects of AI and the Philosophy of Mind that followed.

As Philippe Breton writes, 'Cybernetics has been one of the principal destabilizing instruments of the anthropomorphic conception of man . . . Cybernetics therefore assumes [the form of] a terrible paradox: it affirms humanity while at the same time depriving man of it' (Breton quoted in Dupuy, 2009: 109).

More specifically, the paradox cybernetics poses is that the more knowledge it claims to have of the physical and causal mechanisms from which the human is constructed the further the place of the human subject and its own universe of meaning is undermined as being a mere fiction, an illusion which hides those true mechanisms at work beneath.[6]

2.13: Conclusion

Although Simondon shared the universalizing ambition of cybernetics this chapter has demonstrated that his project diverged from that of cybernetics in some important instances, particularly in relation to meaning, information and

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[6] The Churchland's project of eliminativist materialism is a good example of an attempt at this reductionist approach.

ontology. One reason for this is Simondon's close connection to philosophy of science and particularly French epistemology. As such it is my contention that Simondon's work could be understood as the encounter between first-order cybernetics and phenomenology which Jean-Pierre Dupuy (2009: 102) argued had been missed.

In this chapter we have concentrated on some of the core tenets of first-order cybernetics and how these relate to Simondon's work. Although the connection between the two projects is clear what is striking is that in several areas Simondon's work had already developed into, and beyond, investigating some of the domains which were later to engage second-order cybernetics. Thus his project also investigates such problems as the development of autonomy, affect, cognition and ontogenesis some years prior to Von-Foerster, Maturana and Varela embarked on their projects and in some instances can be seen as already having gone beyond them, such as with his thinking about invention, emergence and openness of systems onto a milieu.

To more clearly explicate how Simondon achieved this we now will move on to his key notions of the pre-individual and transduction which are vital for understanding his notion of analogy and operation which we have already seen are at the heart of his criticism of cybernetics.

Chapter 3: Transduction and Self-Organisation

3.1: The Pre-individual

In the previous chapter we explored Simondon's criticism of hylemorphism and atomism, both of which Simondon opposes due to their underpinning of some form of substantialism.

In this chapter we will explore Simondon's concept of transduction and how it theorizes an alternative notion of being which is processual in nature. In particular it will relate this to some contemporary work in the study of self-organization, with the aim of evaluating transduction as an axiomatic distillation of the processes that are associated with this contemporary scientific development.

Before we begin this description of the operative nature of individuation we must first give an account of Simondon's conception of being as this is foundational for what follows.

As we saw in the previous chapter Simondon argues that being must not be equated with either a fundamental substance (or substances) or a receptive matter that can be given form through the action of forces or powers. Instead he argues that 'primary reality is pre-individual' (Simondon, 1964: 127). By stating this Simondon is not replacing the term substance with the synonym pre-individual.

The pre-individual does not name any primary entity or substance as such but rather a *condition of being*, that is 'a being that is more than unity and more than identity, and that has not yet dephased itself into multiple dimensions' (Simondon, 2010b: 23).

The inspiration for the 'hypothesis of a state of pre-individual being' (Simondon, 2005: 327) comes predominantly from Physics[7] and in particular the thermodynamic notion of metastability which describes a state which is neither completely stable or unstable but somewhere in between and which contains enough potentiality that it can 'produce a sudden alteration leading to a new equally metastable structure' (Simondon, 2005: 327).

An example Simondon provides of such metastabilty is that of the wave-particle duality of a photon which can be simultaneously described as 'in a certain sense' a physical individual and also as an amount of energy which is open to transformation. Being in a state of metastability an individual is never wholly stable, for it to be so would mean for it to be substantial (in the Aristotelian sense), but it contains within itself the potential for transformation and hence it is always 'more than unity and more than identity.' The photon is then always more than just a particle and more than just a wave.

This is why Simondon's concern is not then to ask what *being* is, such as to uncover physical entities that can be said to constitute primary reality (such as the hunt for quarks or the Higgs-Boson) but to inquire into *how* primary reality must be. And for being to be able to change or become it must necessarily have the potential to produce a difference or a disparity, which means that primordial being must be metastable.

For Simondon potential does not mean the same as possibility or the virtual but something wholly real which is indicative of the potential energy inherent in metastability: 'potential, conceived as potential energy, is the real, because it expresses the reality of a metastable state, and its energetic situation' (Simondon, 2005: 68).

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[7] Although in his doctoral thesis (2005: 327) and in the corresponding paragraph in *L'individu et sa genese physico-biologique* (1964: 286) Simondon claims that the hypothesis of the pre-individual 'is derived from a certain number of schemas of thought borrowed from domains of physics, biology, technology (2005: 327)' it is only science which is mentioned in the same passage in the later published *L'individuation psychique et collective*: 'it [pre-individual] is derived from a certain number of schemas of scientific thought, particularly the thought of physics' (1989: 232).

Just as a photon is simultaneously particle and wave so any individuation is simultaneously both structure and potential energy which together form a metastable organization.

We therefore don't find in Simondon a dualism between becoming and being; for him, being is pure becoming.

Although Simondon's inspiration for the notion of the pre-individual is predominantly scientific it is described in distinctly metaphysical terms, at times likened to the *apeiron* described by Anaximander.[8] Therefore although Simondon's metaphysics draws heavily on physical and biological science, the ground remains distinctly philosophical and metaphysical in character and not susceptible to scientific reduction. Hence he argues clearly that the pre-individual is not a scientific concept but a philosophical one: 'Physics does not show the existence of a pre-individual reality, but it does show that there are genesis of individualized realities had from state conditions' (Simondon, 2005: 327).

It is clear then that one of the roles such a notion enables is the thinking of an ontogenetic process which does not start from the assumption of an already constituted individual, which was one of the criticisms of the theory of hylemorphism, but that a primordial state has been identified from which all ontogentic operations begin and which is maintained within all individuated entities thus enabling further operations of individuation.

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[8] Simondon makes several references to the apeiron as described by Anaximander throughout his writing which he relates both to his notion of the transindividual and the pre-individual. In his text *Histoire de la notion d'individu* he describes the apeiron as 'the infinite and indefinite' and links it to the notion of homogeneity, especially regarding some natural patterns. E.g 'Natural patterns like cloud, air, water make tangible this link of unity and homogeneity' (Simondon, 2005: 340). In *L'individuation psychique et collective* Simondon connects the notion more definitively to that of the pre-individual: 'One could name nature that pre-individual reality that the individual carries with it, by seeking to find in the word nature the significance that the pre-socratic philosophers gave it: the Ionian physiologists found the origin of all species of being, anterior to individuation: nature is the reality of the possible, under this kind of apeiron Anaximander created all forms of individuation: Nature is not the opposite of Man, but the first phase of being, the second being the opposition of the individual and the milieu, complement to the individual in relation to the whole. According to the hypothesis presented here the apeiron would still remain in the individual, like a crystal which retains its water-mother, and that charge of apeiron would enable a going towards a second individuation' (Simondon, 1989: 196).

That the notion of the pre-individual is metaphysical is thus clear when it is claimed it can only be apprehended;

> 'through its manifestations, that is to say when it changes, we perceive only the extreme complementary aspects; but these are dimensions of the real rather than the reality that we perceive; we grasp its chronology and its topology of individuation without being able to seize the pre-individual real which subtends this transformation.' (Simondon, 1964: 130)

To understand this operation of the individuation of the real we must now turn to Simondon's theory of transduction.

3.2: Transduction

As well as an ontological process another aspect of Simondon's use of transduction is as a 'new method' that offers an alternative to philosophical thinking that relies on identity, that is that considers already-individuated terms and the relations that are thought to hold between them. He maintains that thought that relies for its method on the law of identity and the law of excluded middle 'is too restrictive' if being is fundamentally pre-individual in nature. It's on this claim regarding the fundamentally pre-individual and metastable nature of being that the concept of transduction is established.

As such transduction can be understood as an operation of ground creation that does not stipulate a prior *substantive* ground and asserts a priority of the transductive process to all grounds that emerge. As explained in Simondon's account of wave-particle duality, he is not concerned with any reductive move to stipulate either of the poles of this binary as primary but focuses instead on how the process of relation establishes new dimensions and structures which are themselves fresh grounds for further operations of individuation.

Thus structuration must be understood as a transductive ontogenetic process and being is the totality of transductive processes ever enacted.

It is worth quoting Simondon's definition of transduction at length in order to enable further development of this notion:

'By transduction we mean an operation — physical, biological, mental, social — by which an activity propagates step by step within a given domain, and founds this propagation on a structuration of the domain that is realised from place to place: each area of the constituted structure serves as the principle and the model for the next area, as a primer for its constitution, to the extent that the modification expands progressively at the same time as the structuring operation. A crystal that, from a very small seed, grows and expands in all directions in its supersaturated mother liquid provides the most simple image of the transductive operation: each already constituted molecular layer serves as an organizing basis for the layer currently being formed. The result is an amplifying reticular structure.' (Simondon, 1964:18)

First, it should be noted that the transductive operation is axiomatic for Simondon in that it is the universal method of ontogenetic structuration; that is it is the ontogenetic process by which all structure emerges. As such it is a response to the hylemorphic method which Simondon so fervently attacks. Instead of the idea that form is imposed on matter from without the notion of transduction asserts that form arises from the propagation of transductive processes and that this process is possible due to the *pre-individual tension* that inheres in being. It is this tension that leads to individuation in a process of becoming.

Although Simondon was writing prior to the development of the sciences of complexity, chaos and self-organisation in this chapter I will argue that his method prefigures some of what these disciplines describe and also provides us

with an ontology which enables a way of developing a metaphysical account that is aligned to their findings. This may not be too surprising given Simondon's interest in cybernetics and thermodynamics which were precursors to these scientific developments.

In his trilogy of books on pattern and self-organization Philip Ball (2009a, 2009b, 2009c) studies a wide range of phenomena (physical, biological and social) in order to understand the processes that lead to the creation of recurring patterns. Ball's work is both a comprehensive cataloguing of these processes and their scientific histories as well as an attempt to investigate if the phenomena of patterning seen in one instance are transferable to phenomena in vastly different situations, in a manner similar to the cybernetics' analogical method regarding organisms and machines. In that instance the drawing of such an analogy was problematic for Simondon as it was a structural analogy (resemblance) rather than an operational one.

Ball's main concern is not in developing an overarching law of Pattern that could account for the broad range of spontaneous pattern forming processes that he describes, nevertheless he does write, 'What Nature uses is not a law of Pattern but a palette of principles' (Ball, 2009c:180). At one point in his work he does come close to developing an overarching axiomatic principle:

'Competition lies at the heart of the beauty and complexity of natural pattern formation. If the competition is too one-sided, all form disappears, and one gets either unstructured, shifting randomness, or featureless homogeneity - bland in either event. Patterns live on the edge, in a fertile borderland between these extremes where small changes can have large effects. This is, I suppose, what we are to infer from the clichéd phrase "the edge of chaos". Pattern appears when competing forces banish uniformity but cannot quite induce chaos. It sounds like a dangerous place to be, but it is where we have always lived' (Ball, 2009c: 183).

The similarity here to Simondon is tantalising and significant. The key point of difference revolves around Ball's claim that it is *competition* between forces that is responsible for the emergence of pattern.

In the paragraph cited it is not clear whether Ball is arguing for an ontology based on pure force or if he should be interpreted as focusing on entities which relate to one another via forces. While this lack of clarity is perhaps not surprising given that Ball is not aiming to outline a philosophical ontology but just present varied examples of self-organisation it is a significant confusion insofar as it introduces a clear example of the groundedness of powers which will concern us in the next chapter.[9]

For the present, my claim is that Simondon's notion of transduction is a more consistent concept than competition to capture the impersonal, immanent processes which Ball describes. However, by stipulating that transduction arises from *pre-individual tension* Simondon captures this sense of *competition* immanent to the process without the danger of reducing it to being between already individuated entities. That is, Simondon remains ontologically consistent by insisting that this tension is a *condition* of being, rather than a condition existing *within* it.

Another important observation made by Ball in this concluding passage from his book series is that pattern/form occurs in a situation *between* 'featureless homogeneity' and 'unstructured, shifting randomness'. Although this statement will resonate with anyone familiar with chaos theory it also resonates with Simondonian transduction when he asserts: 'Information is thus midway between pure randomness and absolute regularity. We can say that form, conceived as absolute regularity, as spatial and temporal, is not information but a condition of information' (Simondon, 2001: 137).

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[9] In chapter 4 we will investigate the possibility of interpreting Simondon's ontology as a Powers based metaphysics. One of the key problems leveled at such dispositional accounts is that of *global groundedness,* that is 'that every dispositional property is grounded in some property other than itself (Mumford, 2006: 471).'

Thus not only does form not arise via hylemorphism but also, unlike in Gestalt theory, form is not something that is in a state of stable equilibrium against a passive background but something that arises in an active relation to a milieu.

How then does form arise? From the position of theories of self-organisation the key to understanding the production of form is via the notion of phase transitions. Ball describes these as the 'largely unseen bedrock of all physics today' (Ball, 2009c:182) and when considered in terms of form they enable the development of the idea of *symmetry breaking*. As Ball explains:

> 'The problem of creating patterns and forms that we tend to recognise as such is therefore not one of how to generate the symmetry that they often possess but of how to *reduce* the perfect symmetry that total randomness engenders (when considered on average), to give rise to the lower symmetry of the pattern.' (Ball, 2009a: 23)

The problem then is how does form develop from the total randomness (perfect symmetry) of true thermodynamic equilibrium; in what does this symmetry breaking process consist?

Ball goes to great lengths to demonstrate how symmetry can be 'spontaneously broken' and additionally that when it is, effects often differ from their causes.

For example, when a liquid is heated uniformly from below it will spontaneously develop hexagonal circulating convection currents. That is we witness the emergence of some form in the liquid that doesn't reflect the nature of the force that causes it (the heating). This is what Ball calls getting 'order for free' which means 'getting order out without putting order in … although it is

more correct to say that symmetry is being lost rather than order gained' (Ball, 2009a: 25).[10]

Such symmetry-breaking phenomena are evidence for a non-hylemorphic account of individuation given that form is not imposed on matter mold-like but emerges spontaneously.

As mentioned above a crucial notion for understanding such symmetry breaking, as well as for understanding Simondon, is the thermodynamic notion of the phase transition. A phase transition occurs when a system shifts from one *equilibrium state* to another, such as when water turns to ice or, as we saw in the example above, when a liquid is heated in such a way as to produce convection rolls. These transitions occur when certain systemic *thresholds* are crossed that leave the system in a metastable or *critical* state. With water this state is reached around 0°C although, as Ball notes, 'Water can be *supercooled* below freezing point without turning to ice, if it is free from small particles on which ice crystals might nucleate' (Ball, 2009c: 193). This aspect of freezing water marks it out as a *first order* phase transition because the transition requires a *seed* to initiate structural change and then propagate it through the system from that point.[11]

A *second order* phase transition (critical phase transition) differs from the *first order* variety in that there is no requirement for a seed to initiate the

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[10] A connection can be made here to von Foerster's important essay for neo-cybernetics, *On Self-Organsing Systems and Their Environments* (von Foerster, 2003: 1-19), in which he creates the thought experiment of a bag filled with magnetic blocks which upon shaking become more ordered. This is a cybernetic twist on the classic thermodynamic thought-experiment of Maxwell's daemon but in this case increased order in a system is created without order (only energy) being put into the system. Von Foerster calls this his 'order from noise' principle. As in Simondon Von Foerster's example also requires that the system is engaged with an environment from which it receives energy.

[11] Ball describes many other occurrences of this kind of structural propagation in naturally occurring phenomena which deeply resemble transduction. For example, the way that butterfly wings (Ball, 2009a: 193) are patterned by a chemical reaction-diffusion system which consists of *determination waves* emanating from morphogen generating points which are channelled and constrained by the veins in the butterfly wings.

Transduction could also be likened to reaction-diffusion phenomena which have been analysed at various levels from the chemical, such as Belousov's 'oscillating reaction' in glycolysis (Ball, 2009a: 111) to the ecological in Lotka's study of predator-prey relations which oscillate over time (Ball, 2009a: 117).

transition as it will always spontaneously occur when the system passes a certain threshold. Unlike a *first order* transition there can be no delay in the transition occurring (hysterisis) due to the lack of a seed and when the transition occurs it does so simultaneously throughout the whole system. For example, the convection rolls discussed above spontaneously occur throughout the whole body of the liquid when the threshold conditions are reached without the need for a seed or some form of propagation.

So how do these two types of phase transition relate to Simondon's notion of transduction and individuation? It is clear from his use of crystallization as the paradigmatic example of transduction that his notion is directly related to, if not based upon, the idea of *first order* phase transitions. Simondon's unique move comes with utilizing this concept as an axiomatic ontological method.

Why does Simondon focus so much on phase shifts, in particular the *first order* variety? A simple answer to the first question is that it enables him to develop an ontological method that underpins a coherent realism. As Ball makes abundantly clear in his work, phase transitions are the cornerstone of many different physical, vital and social processes. What this work on self-organization doesn't do however is situate these explanations of diverse phenomena ontologically. Simondon's project does just this.

As for why Simondon focuses particularly on the *first order* phase shift, one reason for this is that the requirement for a seed to generate a propagation across a domain is important for him so he can link this thermodynamic theory with the cybernetic notion of information in which he is also interested. The importance of this can only be ascertained if we fully explicate Simondon's theory of levels or orders of reality and how information enables communication between them.

3.3: Information

It is important to stress that for Simondon information is not the same as that theorised in information theory or cybernetics; it is not a mathematical measure of the uncertainty surrounding the communication of a message between two entities. Instead, for Simondon, we must understand information 'as the arrival of a singularity establishing a communication between levels of reality' (Simondon, 1964, 130). This difference between levels of reality which come into tension with one another is what Simondon calls *disparity* and which form a problem for being which needs to be resolved into a higher level. Information is not then something measurable but refers to the process of in-formation of one level onto another which resolves a disparity and, as we have seen, is a transductive operation.

The example of crystallisation is instructive, where the seed on which the crystallisation process depends to get started is the singularity which enables the communication between the microphysical and macrophysical levels, that is the molecular and structural crystalline levels. In this example the supersaturated solution is one order of reality, that is in a state of metastability which with the arrival of the singularity begins a process of dephasing to another physical level, that of the crystal.[12] It is this process which Simondon names information and the mode of individuation is transductive. The process of information initiated by the mediation of a singularity and resulting in a 'communication between orders of magnitude' can be found in many other examples in nature; Simondon gives the examples of 'the stone that initiates the dune, the gravel that is the seed of an island in a river carrying alluvium' (1964: 36n1) which Ball also describes as well as other examples such as the growth of cities (2009c: 65), avalanches (2009b: 104) and snowflakes (2009c: 20).

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[12] It is in precisely this way that Simondon's notion of information corresponds to Bateson's formula that information is 'the difference that makes a difference' (Bateson, 2000; 459).

Each level then is a phase of being and 'becoming is a dimension of being corresponding to a capacity of being to fall out of phase with itself, that is, to resolve itself by dephasing itself' (Simondon, 2010b: 6).

This structuration is simultaneously the creation of a corresponding chronology and topology that pertains to that system as a dimension of its individuation. For any system, space and time, are emergent from the process of the individuation of pre-individual being and subsequent individuations thereafter.

It is therefore a consequence of this theory of becoming that it requires a re-theorisation of what an individual is. It is now not possible to understand the individual as a self-contained entity existing within an absolute Newtonian temporality. Instead:

> 'The physical individual must be thought of as a chrono-topological ensemble whose complex becoming is due to successive crises of individuation; the becoming of being consists in this non-coincidence of the chronology and topology. The individuation of a physical ensemble would then be constituted by the concatenation of successive regimes of this ensemble.' (Simondon, 1964: 127)

The individual, then, is never one, it is instead a series of resonating phases bringing forth a toplogical-chronological structure and as such is always susceptible to further occurrences of information.

It is important that we do not understand Simondon here as equating being with a receptive matter or a substantial continuum on which forces/powers act. To think in terms of being in this way is to fall into a dualistic thinking of an opposition between matter and energy (such as Newton's dichotomy of bodies/forces or particle/energy, individual/field) but it is precisely these oppositions Simondon wishes to get beyond. Instead these oppositions

themselves should be understood as dimensions 'which surge forth in the real when it individuates itself' (Simondon, 1964: 127).

Resonance then is an important concept for Simondon regarding how we conceive of or come to describe an individual and how individuals are developed from groups of other individuals, whilst always remembering that any individual's coherence as such is always itself metastable. This is because individuation always results in an individual-milieu construction which is never wholly fixed and stable. A grouping of individuals can only themselves be described as an individual if their milieus are situated so that they can affect one another. For if this is not possible there cannot be said to be a true grouping and therefore the situation offers no possibility for a further individuation.

An example Simondon uses to demonstrate this is to say that a number of fissionable nuclei are not really a group/level if the fissioning of one nucleus cannot result in the fissioning of another. In that case each nucleus should be regarded as individual as 'each has its own chronology and fission occurs for each nucleus as if it was alone' (Simondon, 1964: 129). If however the fissioning nuclei are situated in such a way that the fissioning of one triggers the fissioning of the others then the entire collection of nuclei can be regarded as one individual with its own *chronology and topology*. This not only helps us understand what an individual means for Simondon (that is any grouping which has metastable limits that can receive information) but also how different levels might communicate. Therefore any individual is always, for Simondon, constructed from nested or imbricated levels which ultimately have arisen via individuation from the pre-individual - which must be conceived as a way of being or an activity of being.

As we have seen individuation for Simondon occurs via the process of the phase-shift and thus it is possible to see how the use of the thermodynamic

notion of the phase shift is axiomatic for Simondon's transductive theory of becoming.

> 'In fact, the general case [of becoming] is that of quantum thresholds of resonance: for a change occurring at one level to attain the other levels, it must be above a certain value; internal resonance is accomplished only in a discontinuous manner and with a certain delay from one level to another; the physically individuated being is not entirely simultaneous in relation to itself.' (Simondon, 1964: 126)

The specification that a threshold must be crossed before one level of reality affects another is recognizable from phase shifts in thermodynamics. Simondon's reworking of the notion of information enables him, however to move away from the kind of cybernetic systems thinking that was developed from an engineering perspective.[13]

Although Simondon still utilizes the vocabulary of cybernetics, with references to systems, his notion of information shifts his theorization away from the sender-receiver model which cyberneticians such as Wiener found so useful in developing analogies between animals and machines. Instead his notion of information as *ontogenetic*, that is, as the becoming which is being, still enables systems to condition themselves but via processes of structuration and resonance. That is (metastable) equilibrium structures are developed but are still able to fall out of phase with themselves, either from the prompting of an internal resonance (via a singularity) or by influence coming from outside and leading to a further need for resolution via individuation.[14]

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[13] As discussed in the previous chapter both Wiener and Ashby developed a notion of information that enabled animals and machines to be understood as systemically analogous. As we saw Simondon's account of primary-information as individuation counters this perspective.

[14] Another illustrative example is the creation of snowflakes (Ball,2009c: 14-26) which involve both the equilibrium breaking operation of a singularity as well as progressive de-phasing caused by environmental factors. Thus the singularity of the water molecule breaks the equilibrium of the surrounding atmosphere, the molecular shape of the molecule determining the six-branched structure of the snowflake via *anisotropy*, although the exact final shapes the branches will take is indeterminate

In the early cybernetic model the notion of information corresponded to the transfer of a message from a sender to a receiver within a system which presumed the pre-establishment of entities between which messages could flow and be received. It is important to understand that in Simondon's conceptualization of information terms do not exist prior to the operation of individuation therefore this cybernetic model of information exchange is not yet relevant. This is not to say that Simondon holds the quantitative theory of information to be erroneous, which is certainly not the case; only that whenever we see a context in which such information is being described it must be remembered that it depends on the priority of the operation of 'primary information' having already occurred. That is, any individuals that can send or receive information in the classical cybernetic sense must already have first been individuated from the pre-individual by a process of information in Simondon's sense. This is crucial, for to emphasize the primacy of information understood as message, as some cyberneticians arguably did,[15] could be to make a mistake regarding ontological priority. It is just such a mistake that enabled some cyberneticians to equate mechanisms with organisms.

This isn't to say that embracing a Simondonian prioritisation of primary information entails ruling out the possibility of highly determined mechanisms or the mathematical interpretation of some systems. However what we tend to find is that there are a broad range of systems with varying levels of determinacy 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.

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because it depends on the variations in the conditions which the snowflake encounters as it falls. There is a constant feedback between structure and environment that informs the individuation process that occurs after the initial symmetry-breaking.

[15] As discussed in the previous chapter there are times when Wiener and Ashby do this. Additionally some microbiology focusing on the importance of genes could also be understood to claim this, such as Dawkins *The Selfish Gene.*

Both total determinacy and total indeterminacy are rare in actuality. To understand why we need to understand what it would entail for a system to be either of these.

For a system to be entirely deterministic would require that its becoming be entirely predictable because it could not be the site of further individuation – that is, the structure of the system would not be changed by further exchanges of energy with itself, or between different imbricated levels of that system thus 'leaving it topologically identical to what it was in its previous states' (Simondon, 1964: 124).

A determined system, thus theorized, which contained no metastability, would then have the qualities of the philosophical conception of a substance which is identical with itself and not with another. Such a substantial kind of being would be unable to individuate as it 'would be a physical individual totally resonant in respect to itself, and consequently completely identical to itself, perfectly coherent with itself and one' (Simondon, 1964: 126).

A determined system therefore necessarily lacks internal resonance and 'we could know the becoming of this system by continuum theory, or according to the laws of large numbers, as thermodynamics does' (Simondon, 1964: 126).[16]

At the other extreme, for a system to be wholly indeterminate would require it to have 'an internal resonance so elevated that any change occurring at any particular level would immediately reverberate at all levels in the form of a change of structure' (Simondon, 1964: 126). That is to say that an indeterminate system would lack any form or structure that could be maintained over time. The becoming of such a system would result in an absence of a 'correlation between the topology and the chronology' of the system.

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[16] The law of large numbers is a thermodynamical law which utilises probability to make predictions regarding the likely states of systems. By saying that we could predict the becoming of a system in such a way Simondon is indicating that the system is effectively closed.

Complete determinism and indeterminism describe the theoretical limit cases regarding the development of individuals and it is at either end of this polarity that the conflicting traditional notions of the real have been forged - 'the continuous and the discontinuous, of matter and energy, of structure and operation' (Simondon, 1964: 129). What we find however is that systems are situated, and individuation always occurs, somewhere between these two polarities and involve both the continuous and discontinuous (e.g. Energy and particle) in such a way that an ongoing 'correlation between the chronology and topology of a system' results.

In other words, it is always, claims Simondon, along these axes that reality is conceived. However, by focusing on these disparate poles what is missed is the 'intermediary being' (Simondon, 1964: 130), which is the pre-individual being that connects and supports them:

> 'but the operation of individuation is the active center of this relation; it is this [operation] which splits that which is unitary into aspects that are complementary for us whereas in reality they are coupled by the continuous transductive unity of intermediary being, which we call here internal resonance; the complementary aspects of the real are extreme aspects defining the dimensionality of the real.' (Simondon, 1964: 130)

As Simondon writes, this correlation operates at a level that is:

> 'variable in function of the vicissitudes of its own becoming; a system which reacts on itself not only under the principle of entropy, by the general law of its internal energetic transformations, but also by modifying its own structure through time.' (Simondon, 1964: 125)

Simondon here notes that individuation must operate in accordance with the second law of thermodynamics which insists that any change in a system always results in an increase of entropy.

A good example of this is the formation of soap bubbles which take the form they do because that form minimises their total energy most efficiently which is why what is formed is known as an *equilibrium structure.*

However, many form-giving systems are non-equilibrium structures (due to their openness to the world) and thus have a different relation to entropy:

'The thermodynamics of non-equilibrium systems is concerned not with some end point in which entropy has increased in relation to the initial state; rather, it considers the process of becoming, of how change occurs.' (Ball, 2009c, 187)

It's precisely regarding how it is that change occurs that concerns both Simondon and those investigating self-organization. Both are concerned with how negentropic change can occur, that is how systems persist without contradicting the second law of thermodynamics, which maintains they should always be moving, due to probability, towards entropy. It must be remembered that even so-called equilibrium structures will eventually dissipate (e.g. a bubble won't last forever, iron turns to rust etc.).

This is a problem that has concerned those studying thermodynamics for some time. Ilya Prigogine's notion of *dissipative structures* is one important account of how negentropic structures are thermodynamically possible and also supports Simondon's overall thesis.

A *dissipative structure* is one that is prevented from reaching thermodynamic equilibrium due to boundary conditions and therefore 'the system settles down to the state of "least dissipation"' (Prigogine, 1978: 779), this state is one where entropy is still produced but at the most minimal level. One important conclusion Prigogine drew from this was that these processes are irreversible and therefore describe an arrow of time.

Another important discovery was of systems adopting structuration occurring far from equilibrium, a discovery which itself influenced the development of the scientific study of chaos. The example we have been using of convection rolls is a good example of this where, without means of prediction, the application of energy into the system taking it far from its equilibrium state results in the formation of a new macroscopic order.

One recent further development has been Edwin Thompson Jaynes's principle that, contra to Prigogine's theory of 'least dissipation', in non-equilibrium systems entropy tends to get maximised that is 'a system tends to adopt the state in which entropy is produced in the greatest rate' (Ball, 2009c: 207). If true, then because it develops via non-equilibrium systems which maximise entropy production, life in the universe could be argued to be inevitable. As Roderick Dewar describes it 'far from equilibrium, the coexistence of ordered and dissipative regions produces and exports more entropy to the environment than a purely dissipate soup' (quoted in Ball, 2009c: 207).

Returning to Simondon we can now see how his reference to entropy in relation to an individuals becoming makes sense in thermodynamic terms, as the development of structure does not contravene the second law.

Simondon's account of individuation can be seen as concurring with that of dissipative structures in that they require a constant input of energy (hence his persistent references to metastability and potential energy) and the mode of their becoming is via phase-shifts (transduction) usually occurring between disparate levels. That a system is dissipative requires it to be not just open to an environment but also intimately connected to it – aligning with Simondon's assertion that it is never just an individual that comes into being alone but an individual-milieu dyad.

Furthermore this makes clear why Simondon asserts that a 'physical being . . . must be considered as more than a unity and more than an identity, rich in potentials; the individual is in the process of individuation starting from a pre-individual reality that sub-tends it; the perfect individual, fully individuated, substantial, impoverished and empty of its potential, is an abstraction' (Simondon, 1964: 126).

The nature of individuation disqualifies the thinking of an individual apart from that which subtends its development (thus why it is more than a unity or identity) and this is why, for Simondon, a relation between two individuals is not something established after the individuation process but as part of this process. It is also why the individual is always considered as having only 'a relative coherence in relation to itself, a relative unity and a relative identity' (Simondon, 1964: 126).

To return to where we began the chapter, I hope that we are in a position to make some significant points regarding transduction. Each of these points provides areas for further investigation to be addressed in coming chapters.

1. Transduction as axiomatization of self-organisation

As discussed above, transduction bears a close similarity to first-order thermodynamic phase-shifts which progress by a process propagating through a system. This is a process widely found in accounts of physical self-organisation. Simondon translates this process of phase-shifting into a universal axiomatic for the creation of new levels, which are considered both as new grounds on which further becoming may occur and as new dimensions of being. The claim then is that at any level of being there is some level of equilibrium which can be broken and lead to further individuation, and that the mode by which this occurs is transductive. Therefore transduction is the barest description of the immanent operation of individuation which is being.

To outline Simondon's core argumentation for the priority of individuation; for any individual an account is required for how that individual came to be individuated. Such a demand is also required for any substantial account of what constitutes being and what's more individuation is not possible from any substance that is identical with itself (that is which contains no metastability); therefore if there are individuations this must be because being itself is nothing other than individuation from which further individuation proceeds. Therefore the pre-individual which precedes individuation isn't constituted by any being whatever until individuation occurs.

2. Transduction, causality and emergence

Transduction and the production of new levels also provokes questions regarding the nature of causality, especially in far-from-equilibrium situations. In particular it demands an account regarding both the role of indeterminism in such phenomenon as well as the fact that effects are different from causes; that is there is often nothing in the cause which indicates what its effect might be. This is, of course, one of the founding tenets of chaos theory when describing open-systems.

It is perhaps because of this that Simondon focuses on the *first-order* phase transition to furnish his transductive theory rather than the *second-order* variety. With the *first-order* variety of transition the jump between levels is more gradual and requires a singularity to cause the initial destabilisation of the level. This processual aspect allows Simondon to develop a relation between levels via the notions of resonance, singularity, information and the individual-milieu-environment.

One of the roles of the singularity in this process, is to enable recursive causality in systems as the singularity can be a point where a system can effect itself in a way similar to that found in cybernetic accounts of self-regulation.

There are different mechanisms at work here that need to be distinguished: the resonance that adheres between individuals which enable the attainment of individuality as well as the mechanism that enables the breaking of the equilibrium that inheres between and within such individuals.

3. The pre-individual as metaphysical, not scientific, ground

We have seen that transduction is a theory of becoming that is rigorously developed in line with thermodynamics, yet crucially, is also underpinned by the notion of the pre-individual. Whereas thermodynamics discusses the universe in terms of energy and systems, something that Simondon also does when discussing some transductive processes, when it comes to affirming a ground for the real he does not specify this as energetic. That is the pre-individual and energy are not equivalent: a fact that should be obvious when one considers that energy = mass x velocity^2 and therefore presumes prior individuation.

So although energy figures significantly in Simondon's ontology it is not prior to form. Indeed energy and matter are two complementary dimensions that arise from the individuation of the pre-individual; they are 'manifestations' of the pre-individual but we are unable 'to seize the pre-individual real which subtends this transformation.'

The pre-individual then is not a *substantial ground* that subtends all individuation but must be regarded as the principle of the process of becoming for all being. As such the pre-individual is not a scientific concept and not wedded to a particular scientific paradigm, although as I have attempted to demonstrate, Simondon's method of individuation is inspired by thermodynamics.

4. The identity of the individual as transductive unity

Once again we return to the problem of the individual but instead of asking how two already constituted individuals come into relation the question becomes how does a discernible individual emerge from the reticulation of relations that constitutes individuation?

In chapter 5, which looks at Simondon's notion of the *organism,* it will become clearer how an individual can be delineated through chrono-topological boundaries. As such Simondon's ontology becomes coherent alongside descriptions we find in neo-cybernetics and systems-theory.

This account of individuals also entails metaphysical questions regarding how dispositional powers are to be assigned to individuals and how can individuals be discerned from powers and relations themselves? As already discussed the individual has a relative reality which will have to be taken into account when discussing it in terms of such powers. Of interest here will be Simondon's theory of *allagmatics* which he describes as 'the science of genetic operations' (2005: 559).

5. How does transduction, as an axiomatics, relate to thought?

For Simondon transduction as an axiomatic also offers a new methodological tool. Transductive thinking requires us to understand individuals as neither fully determined or undetermined. An individual therefore, always occurs in a state that is never *wholly stable or unstable.*

Does this ontology require the development a new logical method which utilises the transductive axiomatic? That is, which does not rely on constituted terms (such as we find in the syllogism, for example) or negation and synthesis (such as we find in dialectics) as for Simondon all individuals, such as they are, are positive.

Chapter 4: Simondon & Powers

In the previous chapter we explained Simondon's transductive theory of ontogenesis. In this chapter we will attempt to develop our understanding of Simondon's position by contrasting it with some contemporary theories of dispositional metaphysics. By doing so our aim is to come to a more precise metaphysical understanding of allagmatics as well as see if Simondon's ontology might aid in resolving some issues in dispositionalism. A central goal of the chapter will be to demonstrate how Simondon's focus on operation and structure provides both a more fundamental as well as more productive schema for understanding causality than through powers.

This task will be achieved by looking at the work of three different theories of Powers or dispositions; these are the *new essentialism* of Brian Ellis, Stephen Mumford and Rani Lill Anjum's *dispositional monism* and Svein Anders Noer Lie's *relational realism*.

By analysing and contrasting these positions it should be possible to then demonstrate how Simondon's theory of Allagamatics can engage with some of the issues that divides them.

4.1: Powers

Disposition- or powers-based (for the purpose of this discussion these terms will be synonymous) metaphysics is realist and holds, following the Eleatic stranger's test of reality in Plato's *The Sophist*, that something is real if:

'it has any capacity at all, either by nature to do something to something else or to have even the smallest thing done to it by even the most trivial thing, even if it only happens once'(247e).

Powers based metaphysics thus holds that the definition of the reality of an entity is that it has the capacity *to do* something or have something *done* to it. An entity's ability to act is called its powers or dispositions, which are also often referred to as properties of the entity. It is impossible, according to this theory, that an entity has no power or disposition (actual or *in potentia*) for it is its dispositionality which defines its reality as an entity.

Although theorists may describe powers in slightly different ways they all agree that for an entity to be real it must have at least one property.

Thus Molnar holds that a property 'is a feature of reality that is, in typical cases, independent of language or of thought' (Molnar, 2006: 25) and Mumford and Anjum (2011: 3) claim that 'properties just are clusters of causal powers'.

On this theory then powers are fundamental for describing the reality of an entity and being causal in nature they are described as dispositional in that they are *disposed towards* certain outcomes or, for Molnar, they have a *directedness* 'in the sense that it must be a power for, or to, some outcome' (Molnar, 2006: 57). Similarly Lie (2009: 125) gives a working definition of a disposition as:

> '*a certain* **readiness** *that an entity has to perform specific kinds of behaviour under specific kinds of conditions.* (F is G means that F is ready to r, given Y.)'

In this chapter we will focus particularly on a debate amongst powers theorists regarding the question of what grounds dispositions or causal powers, that is must powers belong to some more real entity which will require further elaboration beyond just a description of its dispositions or are they self-grounding? The answer to this question will influence the account to be developed of what constitutes structures or entities.

It is our aim to demonstrate that it is regarding this issue of structure that Simondon's theory of allagmatics can make an intervention. Prior to making

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this argument we must first outline some of the key perspectives of the debate which we shall do by looking at three dispositionalist accounts beginning with that of Brian Ellis.

4.2: The New Essentialism of Brian Ellis

Brian Ellis positions his theory of New Essentialism against what he describes as passivist accounts of causation. The primary feature of a passivist account is that matter or entities themselves don't have causal powers but are passive in respect to laws or forces which are external to them and which cause events to occur.

Hume's is an example of passivist metaphysics because he doesn't accept that we can know that entities themselves cause events to occur because we can't have *a priori* knowledge of causal situations.

Ellis argues that Hume eliminates the idea of there even being forces at work from his account of causation and instead;

> '[T]hings do not move as they do because they are caused by anything to do so. They just do so move; and this is a brute fact about the world. Causes are illusions of causal powers in action, he [Hume] argued, but really there are no such things as causal powers.' (Ellis, 2002: 2)

Similarly, naturalist theories of mechanism are also seen as passivist because it is forces which form the causal links between passive entities which have no dispositions to act themselves. The apparent dispositionality or power of any entity actually 'must depend on what forces exist and how they act' (Ellis, 2002: 66).

The upshot of such passivism is that the way entities act in the world is dependent on forces and laws extrinsic to them and thus if these laws were to change then these *same* objects would necessarily act differently.

Against such passivism Ellis proposes his theory of New Essentialism in which the laws of nature depend on the essential dispositional properties of natural kinds. This marks a reversal in that where passivist theories portray matter as passive and inert Ellis' essentialism requires that matter is active (2002: 59). It is the way that matter is described as being active which colours his account of what constitutes dispositionality. To see why we must first describe what it is that Ellis sees as essential in his essentialism.

Ellis follows Aristotle in arguing that there are natural kinds of substances but claims that he does so in a more rigorous scientific manner. He achieves this by making a clear distinction between *kind* essences and *individual* essences and prioritising the importance of the former (Ellis, 2002: 12). The individual essence is that which concerns attempting to identify the same individual over time even though the individual may change in appearance (for example the use of Aristotle's final cause in identifying an acorn with an Oak tree) and is something Ellis sees as unscientific and therefore theoretically weak.

Of fundamental importance for Ellis, and what sits at the heart of his essentialism, are what he calls *kind* essences which identify 'the set of properties in virtue of which it is a thing of the *kind* it is' (2002:12).

For Ellis this focus on natural kinds as being restricted only to *kind* means that any reference to a teleological explanation of an individual is ruled out. Instead an explanation of how things interact must be derived 'from the intrinsic causal powers, capacities and propensities of their most fundamental constituents' (2002: 13).

Ellis' is a dispositional approach since he is taking as fundamental 'causal power, capacities and propensities' but it is essentialist in that the powers,

capacities and propensities which have real explanatory power are those which intrinsically belong to 'the most fundamental constituents' of any entity.

We then have two issues that need to be resolved before continuing, the first is what is meant by intrinsicality and the second is how do we identify the most fundamental constituents of an entity apart from their powers? Both of these questions generate problems for Ellis.

4.2.1: Ellis and Intrinsicality

Although Ellis's theory relies heavily on the notion that to be essential properties must be intrinsic his account of what constitutes intrinsicality is, on his own admission, somewhat vague (Ellis, 2002: 51). The definition he gives is:

> 'Roughly, it is a property that something has independently of any other thing.' (Ellis, 2002: 51)

The vagueness of this concept comes from the distinction between that which is *logically* intrinsic to an entity and that which is *causally* intrinsic to it.

Ellis gives the example of a stretched rubber band to explain this difference where he argues that the shape of a *stretched* rubber band is not intrinsic as it is 'distorted by the forces acting on it' (2002: 51). To see the intrinsic shape the rubber band would need to be excluded from any distorting forces thus revealing its 'natural shape'. However, the problem is how can we purify the rubber band from any distorting effects for any attempt to do so is itself a distorting effect. Thus any supposed intrinsicality is only achievable logically, which falls short of the causal independence required for an ontological theory.

Although Ellis claims that this kind of theoretical modeling is often used in science it is getting the explanation back to front to argue that the model is

anything but a purified reduction of the real rather than an explanatory description.

Ellis' second example to try and explain the difference using the shape of the earth seems even less successful. He claims that:

> 'To explain the shape of the earth, for example, we must contrast its actual shape with the shape that it would have theoretically if it were not distorted by tidal forces, not rotating on its axis, not vibrating and so on.' (Ellis, 2002: 53).

The question is then begged can an *intrinsic* shape of the earth really be said to exist when all of these supposedly non-earthly (what Ellis calls causally extrinsic) properties are subtracted? It may be the case that by stripping away certain phenomena a different shape can be discovered but that certainly does not make that shape intrinsic in any stronger sense.

Thus, we claim, that Ellis faces a problem with the rigour of his notion of intrinsicality.

4.2.2: Ellis and fundamentality

The second issue we noted above was that of Ellis' claim that the natural kinds are the powers that belong to the 'most fundamental constituents' of any entity. Here Ellis takes a reductionist approach where he seems to identify some specific types of entities as having more fundamental causal power than others.

We agree with Lie (2009) here that this reductionism is a problem for Ellis. First, if causal explanation is to rest with the most fundamental constituents of any entity then clearly the question of how we identify a fundamental constituent must be answered. Ellis has a tendency to use examples from chemistry where his explanation does seem the most plausible when addressing

this issue. Given our extensive knowledge of the atomic constitution of chemicals to assert that individual chemicals are natural kinds does seem something of an easy win. However, even at this level we could ask if the level of explanation could go even deeper. Might more fundamental explanation be sought in subatomic particles for instance?

Of greater concern is the implication this approach has for emergent properties. Although Ellis's example of the essence of water, its natural kind being H2O, seems relatively straight forward, I agree with Lie (2009: 89) that he runs into greater difficulty when discussing emergent properties at higher levels.

Lie is concerned with seeking a dispositional account of naturalness which also seeks to be able answer normative questions concerning natural purposes (his enquiry then is not too dissimilar to that of Kant's in the third critique in this respect).

For Lie, Ellis' account of causal description fails because it can't give a suitable account of an entity that exists at a higher level than a natural kind:

‘A hen is not a hen in Ellis' account, it is a (fuzzy) combination, and it does not help that the constituents are intrinsically active, because even if they are, they can say nothing about what a hen is in any case.’ (Lie, 2009: 89)

The problem being that Ellis' essentialism doesn't have much to say regarding causation at levels higher than fundamental constituents. It says little about what the causal world of the hen qua hen is like as it always seeks a *real* explanation at a more fundamental level.

It's true that Ellis does allow that genetics offers a description of some such fundamental layer, which we concur offers more explanatory power than that at the atomic level, although his description of why genes are intrinsically fundamental (despite not being natural kinds) seems assumed. Indeed Ellis'

commitment to a straightforward account of development via natural selection seems one dimensional given there are other theories of evolution with greater explanatory capacity, for example, epigenetics. That he prioritizes genes as intrinsic and epigenetic factors as extrinsic and thus non-essential seems simplistic in the face of more balanced accounts which attempt to take into account the ontogenetic relationship between organism and milieu, for example.

Additionally his argument regarding reinstating 'the concept of human nature' (Ellis, 2002: 156) in social theory so as to 'put natural constraints on the kinds of social engineering practices that are sustainable, without excessive use of force or propaganda' also seem naively reductionist given the wealth of sociological theory that resists such interpretations such as, for example, the role of *originary technicity* in the co-constitution of the human.[17]

Although Ellis' criticism of an emphasis on social construction in some social theory may be warranted this does not mean that essentialism is required to counter it. As we will argue in this thesis realism can do just as well at restricting constructionist excess without recourse to an over-determination via essences or reductionism.

Ellis' ontology does give us a base from which to engage with a number of issues that trouble powers based theories.

First, his ontology indicates that there needs to be an account of the role and constitution of structures and that this in fact will be of critical importance for how an ontology is developed. In particular Ellis points to both the relation between dispositions and structures and also the fundamental importance of certain structures as being of particular importance.

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[17] The theory of originary technicity holds that the human is always already bound up with the technical in a temporal relationship of co-constitution. It is not that the technical is a prosthesis that is added to the human but rather that it is ineluctably presupposed in its composition. Such a theory thus rules out any attempt to seek some kind of essential human nature such as Ellis does for this would be to ignore epigenetic factors in human development such as described in Bernard Stiegler's theory of epiphylogenesis. Drawing as it does on Simondon's theories we will discuss Stiegler's work in a later chapter.

As we have seen Ellis holds that he sees certain structures as essential in that they are for him natural kinds:

> 'Properties and structures are natural kinds of facts about the intrinsic nature of things; substantive and dynamic natural kinds refer to kinds of objects and substances, or to kinds of events and processes.' (Ellis, 2002: 101)

He therefore gives these special kinds of structures increased explanatory power (e.g. H2O, genes) above and beyond other properties that may exist on a higher level to them.

This attitude raises two issues which Ellis does not sufficiently confront but which will be important for our task here; first, is an account of the ontogenetic development of structures important? (this also includes the important question of ground for both structures and dispositions); second, what is the ontological status of dispositions that reside at higher levels than those of natural kinds?

These two questions are intimately related. If we are to avoid the reductionist move that Ellis makes, which given Simondon's explicit allegiance to a levels based ontology we must (without this move Simondon's commitment to strong emergence is lost as higher level structures would be seen as ontologically reducible), then it seems further work is required to theorize the relationship between structures and powers and also allow the existence of teleological forms of causation and a more complex mereology.

In the next section I want to develop these issues by looking at the dispositional monism of Stephen Mumford and Rani Lill Anjum.

4.3: Dispositional Monism

As the name suggests dispositional monism is a theory that causal explanation is given solely in terms of dispositions. It is thereby a true powers-

based theory of causation where dispositions are the sole components of causal explanation. By making this claim the dispositional monist is denying the explanatory power of any categorical base as they hold that any such thing must actually be dispositional in nature. Thus where we saw Ellis claim that, for example, the dispositional properties of water are based on the intrinsic categorical base of its chemical constitution as H_2O, the dispositional monist argues that as this constitution causes any dispositionality it itself must be dispositional. To argue otherwise would require the base to be outside of causal explanation which would leave it impotent in explaining anything.[18]

As such the monist argues that dispositionality is necessarily a *sui generis* modality which Mumford and Anjum admit is a *theory* of causation but can't be a *reductive analysis* of causation as powers are already causal notions themselves (Mumford & Anjum, 2011: 7-8).

In this section I want to outline the core aspects of this *sui generis* modality which, as I will explain in a later section, shares some striking similarities to Simondon's ontology.

An important aspect of this primitive modality is that it does not attempt to prove that causal connection is necessary. Mumford and Anjum believe it is due to a mistaken response to the Humean theory of constant conjunction that opponents try to prove the necessity of causal connection (Mumford & Anjum, 2011: 49).

Instead they develop a dispositional account of causality that has possibility and necessity as its extreme cases:

'Dispositionality is not necessity and it is not pure possibility but something in between.' (Mumford & Anjum, 2011: 183)

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[18] It might be argued that categorical bases just have the disposition to act as bases for other dispositions. But this would also then make them dispositional in nature.

The core reason they argue against a need to counter the Humean standpoint by arguing for a purely necessary theory of causation is that 'a natural process can be interfered with and thus that a cause never necessitates its effect' (Mumford & Anjum, 2011: 12). The main argument they present to argue this is that of antecedent strengthening which holds that:

> 'It is thus empirically plausible that for any type of causal process, in which *C1-C4* are typically causes of the type effect *E*, there is some possible *Ci* that when added to *C1-C4* typically results in *E* not being caused.' (Mumford & Anjum, 2011: 56)

Given this, attempting to develop a theory of causation based on the requirement for necessary connection in order to just counter the contingent nature of Hume's theory would be misguided.

Instead Mumford and Anjum develop a theory of causation utilising vector addition theory that allows for the possibility of a particular cause being thwarted from achieving that toward which it is disposed. That is, although a cause may dispose toward a particular effect it is always possible that it can be prevented from reaching the necessary threshold to actualise that effect due to the addition of another cause. Therefore even though a disposition is always directed towards a specific effect it doesn't necessitate it, that is, dispositions are defeasible.

The vector addition theory is proposed as a replacement to plotting causes and effects in neuron diagrams which visualise the cause and effect as discrete entities connected by a relation. Instead a vector diagram enables multiple dispositions to be mapped simultaneously so they can be either added to or subtracted from one another in relation to an effect that will occur when a certain threshold is reached. Another advantage of this method of mapping dispositions as vectors is that by doing so one can diagram how opposing dispositional vectors may work against one another to effect the maintenance of

a state of equilibrium. An example the authors give is how the power of magnetism counters the force of gravity to prevent a fridge-magnet from falling. Although in this example, empirically nothing appears to be happening there are actually powers constantly at work.

Another characteristic of Mumford and Anjum's dispositional monism is that cause and effect are simultaneous. This description of causation explicitly rejects the two-event model of causation where one event, a cause, is followed by another discrete event, an effect, at a later time. Instead they argue that causation should be understood as 'involving a single temporally extended change in which cause and effect occur together, almost as though the one turns into the other' (Mumford & Anjum, 2011: 120).

This is a more processual conception of causation than the Humean one involving discrete events. For them causation is not seen to be something that occurs *between* two discrete events but is an unfolding temporal process between mutual manifestation partners by which a cause becomes effect.

Thus sugar dissolving in water should not be understood as 'a relation reaching across' the two events of the sugar being placed in the water and its dissolution, with the cause being the initial placing of the sugar in the water. Instead the causation involved should be understood as the operation of the appropriate mutual powers of water and sugar with one another during the time that the dissolving occurs. The cause is not how the sugar got into the water but the actual working together of two mutual powers once the sugar is in the water.

'For the effect of it dissolving, all that matters from a causal point of view - as an accurate and informative causal explanation of its dissolving - is that it is in the liquid and appropriately empowered.' (Mumford & Anjum, 2011: 122)

Causation then, in this view, must be seen as a process. Even when explaining Hume's ideal example of causation, the collision of two billiard balls, one should not think of the explanation being between two events but rather the transmission of a power from one ball to another during a collision which although momentary does occur over time:

> 'The cause was ball *a*, with its momentum. The effect was the acquisition of momentum by ball *b*. This passing on of powers takes time. It is passed on gradually but quickly. And when it is passed on, or enough of it for *b* to go separately along its own path, then causation is over and done with.' (Mumford & Anjum, 2011: 109)

Therefore whatever the causal situation, for causation to be simultaneous doesn't mean it is instantaneous. It may appear to occur quickly from our point of view but that doesn't mean it isn't a temporal process.

Included in the example above is the idea that causation is best described as the passing around of powers. This idea holds that if causation is an irreducible and primitive modality involving powers then what happens during the causal process is that powers are passed around. Thus as we saw in the billiard ball example the power of momentum is passed from one ball to another. This idea perhaps makes less intuitive sense with the sugar and water example where one might presume the sugar passes on its power of being dissolvable to the water in which it dissolves. However the authors hold that the powers that are passed on can be different to those doing the passing. Descriptive issues aside this theory of passing powers around is one that we'll return to shortly when we return to the problem regarding the place of structures in powers ontology. The core way the dispositional monist accounts for structure is via the theory of mutual manifestations resulting in the emergence of structures with their own properties. It is to the theory of emergence we now turn.

4.4: Emergence & Potential

Mumford and Anjum (2011: 86) point out the inadequacy of their additional, vector model of causation in accounting for the non-linear nature of some instances of causality. For giving an account of this type of causation they suggest a different account called *compositional pluralism* which holds that there is 'a plurality of ways in which powers compose to produce an effect' (Mumford & Anjum, 2011: 86). The underlying idea here is that often dispositions do not work together in a linear and additive manner towards an expected outcome but can combine in non-linear and non-additive ways and produce outcomes which are described as *emergent*.

Emergent causal phenomena can be grouped into two categories. Weak emergence describes what happens when a phenomenon emerges from a lower level in an unexpected and surprising manner. It is regarded as epistemic emergence due to the impossibility of predicting its emergence given knowledge of the lower levels from which it emerged. Strong emergence however describes those phenomenon which aren't merely unexpected epistemologically but which are instances of the production of ontologically novel phenomenon which are 'not deducible even in principle from truths of lower level domain' (Mumford & Anjum, 2011: 92). This adds the further claim that the emergent phenomenon is real in the stronger sense that its causal powers cannot be reduced to activity at lower levels.

Mumford and Anjum's answer to the question of emergence is quite straight forward in that they argue:

> 'When we described causation as passing around of powers, we allowed that it was sometimes a different set of powers that is passed on. New powers come from old ones, therefore, and this is how we have a changing dynamic world. The regular nature of such changes is often called nomological, though we think the powers alone can do all the work.' (104)

In short, from the perspective of dispositional monism and compositional pluralism it is simply the case that when multiple dispositions work together the resulting effects can be strongly emergent, that is one can get new powers from old.

However it must be added that the authors also hold to a theory of the supervenience of higher level powers on those below. Thus a composition of the same powers at a lower level will always result in the same emergence of higher level powers.

Dispositional monism therefore does not attempt an analysis of how emergence operates as a process but positions itself as just being able to accommodate it via compositional pluralism. Similarly, in regard to reductionism, although the authors are not convinced by it as a theory, they also maintain their theory can accommodate it thus enabling them to hold a noncommittal position: 'It seems to be an asset of the dispositional theory, therefore, that it leaves the question of emergentism versus reductionism open' (Mumford & Anjum, 2011: 103).

The openness to the possibility of the emergence of novel phenomenon at higher levels also gives this theory an account of potentiality in that:

'As causation typically involves changes, it thereby makes new powers available for composition and thus instigation of new causal processes.' (Mumford & Anjum, 2011: 126)

That is a causal process can be seen to produce new dispositions which don't necessarily *cause* fresh causal processes but have the potential to *enable* them.

Such a view highlights another characteristic of dispositional monism which is that it must be possible for a disposition to be real even when it's not actualised. That is it has to be the case, for this account, that dispositions are 'unactualized possibilia' (Lie, 2009: 128). This requires that a clear distinction

is made between a disposition and its manifestation, with the former being in the seemingly curious position of being real without being actual.

> 'What is the nature and extent of their existence, actuality, or their being when they are unmanifested? This can be called the question of Being, making use of an ancient term.' (Mumford, 2006: 481)

If one were to hold the contrasting Megarian position which holds 'that only manifested properties are real' (Lie, 2009: 121) and thus there is no such thing as 'unactualised possibilia' then one runs into problems in explaining how one can account for certain dispositions when they're not manifest. It is a problem then for the dispositional monist to explain what grounds a disposition, particularly an unactualised one.

4.5: The Problem of Ground

As we have already seen Ellis holds that dispositions are grounded by their belonging to a categorical base such as natural kinds. There is a similarity with Locke's distinction between primary and secondary properties in this account where the latter are dependent on the former, which are seen as fundamentally more real as they are intrinsic. Primary properties or categorical bases offer one understanding of ground as that which is fundamentally real and as such does not itself require grounding or is self-grounding.

Dispositional monists like Mumford and Anjum dispute the necessity for such categorical bases and the resulting thesis of 'universal or global groundedness' it implies: 'that every dispositional property is grounded in some property other than itself' (Mumford, 2006: 471). Thus ground arises for Mumford and Anjum not separately from the dispositional process, but in consequence of it and within it.

In this section I want to explore the problem of the grounding of powers in light of its relevance to the distinction between structure and operation found in Simondon.

Although it is possible the requirement that every disposition be grounded just originates from some 'Lockean ontological instinct' that demands every property must belong to a categorical property this raises the question of what makes a categorical property self-grounding. Furthermore, as Lie enquires; 'how can something be self-grounding at all, and why should something like "self-grounding" mean categorical?' (Lie, 2009: 146)

Or to turn the question around we could ask what is it about dispositions which could prevent them from being self-grounding? Additional to this is the further question, what are categorical properties if they are not dispositional?

Lie's response to these questions rewards reflection as it will take us to the heart of one of the issues we will face in relation to Simondon. Lie first considers three potential solutions to the problem which are:

1. That categoricality demands independence from external conditioning.

2. That dispositions are grounded in other dispositions or ground themselves.

3. That there is no ground.

1. If for a property to be categorical requires that it be independent, which the notion of intrinsicality demands, then is this achievable? As already discussed with regard to Ellis' rubber band it isn't possible to purify the rubber band's situation of all extrinsic influence as any attempt to do so is *de facto* just to change the extrinsic conditions. The shape of the rubber band always relies

on some extrinsic condition. Lie argues that this relationality holds for any properties, even the smallest one that can be found.

> 'Therefore, it would not help much to call something pointlike properties if those properties are totally dependent upon their relations. So, if nothing can be singled out as independent, discrete and monadic we cannot have a description of the "entity" grounding something as "un-conditional" anyway, (which will rule out categorical properties that are "independent discrete properties" by definition).' (Lie, 2009: 146)

If this is the case, and we will follow Simondon here who also holds a relational approach, then the notion of intrinsicality will need to be framed in some other way.

2. The second response to the issue that Lie considers is that of the dispositional monist who dispenses with categorical properties because dispositions are either grounded in other dispositions or ungrounded. The beauty of this approach is that not only does it produce a more parsimonious ontology but also dispenses with the problem of trying to give an account of a non-dispositional base, which is argued to be required to support unmanifest dispositions in particular.

The core of Mumford's argument for ungrounded dispositions concerns the claim that although subatomic particles are ontologically simple (that is they have no lower-level components) they still have dispositional properties. If it is the case that: 'The grounds of a dispositional property can be found only among the lower-level components or properties of that of which it is a property' (Mumford, 2006 :477) then clearly the dispositions of simple subatomic particles have no ground as their bearer has no such lower-level components or properties.

Or to put it the other way around, as a subatomic particle, by definition, has no lower-level components or properties its dispositions have no ground. It is

important to realize here that Mumford's argument only wishes to demonstrate that if a subatomic particle is simple then its dispositions are groundless and thus the argument 'is against there always being a lower level of entities or properties in relation to every disposition' (Mumford, 2006 :473). Mumford is therefore demonstrating the 'coherence' of the notion of ungrounded powers.

The fundamental point is that being is dispositional, and this is something we also find in Simondon's notion of metastability although he doesn't make the move to attempt to argue that pointlike particles have dispositions. For Simondon ground is pre-individual and metastable, and thus prior to the individuation of any particle. As described in the previous chapter pre-individuality describes not *what* being is but *how* it is, specifically 'more than unity and more than identity', which is to say it is disposed to fall out of phase with itself. Simondon thus has no need to argue for simple subatomic particles as proof for ungrounded dispositions, for the very metastability of being entails that it is dispositional.

This is not to say Mumford's argument is weak, it still supports the same conclusion that primary reality is fundamentally dispositional. The way the Ungrounded Argument is organized is specifically aimed at undermining Humean metaphysics, hence the focus on pointlike subatomic particles.

> 'For Humeans, however, only grounding in non-dispositions would be acceptable ultimately. Humeans want everything to be built on a solid bedrock of occurrences or occurrent, categorical properties.' (Mumford, 2006 : 478)

What Mumford's argument demonstrates is that this solid bedrock that the Humean demands doesn't ultimately make sense because it doesn't explain how the dynamic dispositional world can arise from or supervene upon it. By doing away with this categorical ground and allowing for ungrounded dispositions this problem of accounting for the causal dynamism of the world, it is claimed,

is solved. Yet such a world contains, as we have seen, unmanifest powers, since if all powers were manifest there would be no possibilities other than the actual, and defeasibility would be lost.

So what is Mumford's answer to the problem of how unmanifest powers are maintained? Simply that they ground themselves.

To illustrate this Mumford uses an the example of squareness as a non-grounded property:

> 'Squareness depends on nothing other than itself. Why can we not say the same about dispositions? It might be argued, that all we know of a disposition is through its manifestations so any actuality other than those manifestations requires some further element. But the same would be true of squareness. We know of it only when we are testing for it.' (Mumford, 2006: 484)

Lie counters this with the criticism that it is difficult to see squareness as dispositional for it is hard to understand how it 'can do anything at all, (and thereby meet the Eleatic reality test), if it is not instantiated, if it is not squareness of something' (Lie, 2009: 149).

Although Mumford's rejection of categorical properties is attractive for Lie he questions Mumford's claim that dispositions are, or can be, self-grounding, at least in the way Mumford describes.

The problem he gives for this is that in this account properties seem to be something that just 'exist[s] as such' even though 'Mumford and dispositionalists in general would say that a disposition always belongs to a bearer' (Lie, 2009: 149).[19]

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[19] For example: 'Properties do not, however, float around freely in the world. They are properties of things. Weight has to be the weight of something' (Mumford & Anjum, 2011: 1).

This problem stems from the way Mumford has set up his argument to focus on countering Humeanism by describing dispositions monadically, that is as 'discrete and distinct beings'.

Lie holds that a disposition cannot be self-grounding in this monadic way, that is it must have some grounding, even if that grounding is not of a categorical kind. To support this claim he points to the problem with claiming that categorical properties could be independent or intrinsic (see 1 above) and that the same must also apply to dispositions.

Mumford's ungrounded argument then does a good job in arguing against the need for categorical properties but seems weak in establishing the necessity of ungrounded dispositions. His argument only establishes a preference for ungrounded powers given the weaknesses of the position of categorical properties. The example of squareness as an example of an ungrounded disposition is problematic as its actual dispositionality is questionable.

Lie holds that there is another possible position which is a revised version of neutral monism which he calls relational realism. This position will argue that the debate between the need for either a categorical base or ungrounded dispositions is in fact not the core issue but a false problem created by a misguided need for some form of fundamentality or reductionism. Lie's relational solution then most closely allies itself to the third of his suggested solutions, which is that there is no ground as such, although not in the sense that powers can be ungrounded as Mumford claims, but that it is relationally constituted.

4.6: Relational Realism

Lie's relational realism is an adaptation of neutral monism, which is a position that holds that being is comprised of levels and that all dispositions are

grounded in a categorical aspect on the level below their manifestations. The position is described as neutral because both the disposition and categorical aspect are considered as equally important. The distinguishing point, and how this account escapes being a dualism, is that the manifestations of actualised dispositions, whilst not being categorical properties, do provide a locus (a categorical aspect) which dispositions are intrinsic to. An entity, in this account, is the result of the combination of two or more dispositions combining on the level below that which it emerges. The entity is not categorical in a strong sense but is real and offers an enduring manifestation which is able to have new dispositions.

What Lie takes from this position is that it is still a dispositional monist position but that it also highlights the importance of the manifestations of dispositions. The role that manifestations play is important in addressing the issue Lie has with Mumford's ungrounded argument, which is that it does not, he claims, offer a convincing account of how dispositions can be ungrounded (recall the weakness of Mumford's example of squareness). For Lie manifestations address this problem of intrinsicality by 'filling in space' and thus explaining how unactualized dispositions can endure.

The other striking feature of Lie's ontology is its thoroughgoing relationalism. Although manifestations provide a way in which intrinsicality can be obtained this version of intrinsicality is always relational in nature, that is 'that nothing is able to have a disposition or do what it does independently of anything else' (Lie, 2009: 180).

This position moves Lie's relational realism away from a monadic account of dispositions because dispositions can only manifest when the bearers of two dispositional partners come into relation and this relation is constituted by the partnering of their dispositions. Lie can therefore give the following definition:

'The being of some being is defined by its doing. Having a specific disposition to do something is only possible and specified by the dispositions of other beings. The disposition P has its specific identity P in virtue of its relations to dispositions Q, R, S. An object with only one property, completely alone in the universe, would accordingly not have any properties.' (Lie, 2009: 170)

On this account manifestations (which are also bearers of novel dispositions) are themselves constituted by dispositions and thus are not categorical properties. As such they should be identified in line with the Eleatic reality test through what they are able to do. This account then is still a dispositional monist one but unlike Mumford and Anjum's the relational manifestations of dispositional partners plays an important level-specific role. The relationality and level specificity of dispositions also makes this ontology deeply resistant to any reductionism.

It is also the level specificity of manifestations which Lie argues counters one of the main challenges to a relational ontology, namely the problem of 'relata disappearing in the relation'.

This problem is clearly described by Bird as '[T]he identity of a property is determined by its relationships with other properties whose identities are determined by their relationships with yet other properties, in a set of relationships which at some point returns to involve the very property we started with. The identity of this property is what the set of relationships was supposed to settle. Yet the nature of this set of relationships is dependent on the identities of its relata, which ex hypothesi have not yet been settled' (Bird, 2007: 12).

It is partly in response to this issue that some sort of intrinsicality is required, for without it, it wouldn't be possible to distinguish any kind of bearer that can endure over time within the relational melange. But as we have

already seen an intrinsicality that requires categorical properties has its own problem. The solution, then, seems to lie somewhere between categoricality and ungrounded dispositions. It is in this space that Lie asserts that the bearer of dispositions should be found. The question that requires answering though is: 'Despite the relational nature of everything; is it nevertheless possible to pick out the relata and characterize them in terms of their being?' (Lie, 2009: 195).

The solution, according to Lie, is that an object is that which is manifested by the dispositions on the level below *as well as* the dispositions this manifestation itself has. It is this manifested object which enables its dispositions to be unactualized when the appropriate dispositional partners are not present.

Thus in the case of sugar and water, it is the sugar that has the disposition to be dissolved and the water to do the dissolving but they both work together to create a new manifestation with novel dispositions (sugar-water). These novel dispositions do belong to this new manifestation which endures at its specific level and whose manifestations are intrinsic to it in the sense they belong to it although not non-relationally. Thus any manifestation is dispositional when seen from the level below which it manifests. Although a manifestation is that which enables dispositions to endure this does not mean that manifestations which endure for a very short time or which manifest as processes (e.g. thunder storms) are therefore not manifestations. Thus this account also allows for emergent phenomena which are not just objects in the conventional sense.

This position also has implications for reductionism and holism in that the manifestation, due to its emergence on a new level, has different dispositional relations than its component dispositions/parts. As such the manifestation is 'between the disposition of the parts and the properties of the whole' (Lie, 2009: 184).

Lie's position then can still be understood as a dispositional monist one but where some element of intrinsicality is introduced to guard against free-floating and unmanifested dispositions.

What is the ultimate ground of this ontology however? Are there some ungrounded dispositions which ground all other dispositions and manifestations or is it disposition-manifestation partners all the way down? Lie's reply to this is that it is Turtles all the way down in that the web of relations supports itself as there is no primary level. This is a flat ontology where no level of being is prioritised over any other.

Having outlined some dispositional positions and related issues with each of them I now want to turn to contrasting powers ontology with Simondon's allagmatics. Having done this we will also analyse whether the account Lie gives of a kind of intrinsicality developed from the relations between powers really does enough to give a more grounded account of powers.

4.7: Simondon & Powers

Both Simondon's and powers metaphysics are theories that are concerned with the modalities of being. However due to its development from concepts such as metastability and phase-shifting Simondon's understanding of being engenders a different approach to the modality of causation to that of powers theory.

Although Simondon doesn't claim to be a dispositionalist there is no doubt that his concern is with the power being has *to do*. As we explained in the last chapter the heart of his philosophy concerns the *operation* of being - a project he calls allagmatics. One of the key difference between powers metaphysics and allagmatics is the emphasis they put on the notion of form.

Simondon's is primarily a theory of the development and transformation of form. This concentration on the genesis of form is closely linked with

Simondon's opposition to the hylemorphic schema of explanation. It is through his reformulation of how form arises that his understanding of causation and relation are acquired. That is to say that Simondon's understanding of cause and relation follow from the transductive account of the ontogenetic development of form.

Although Powers theory as described by Mumford and Anjum is concerned with how things change it is actually noncommittal regarding the mode of operation of ontogenetic development. Their main concern is with countering the Humean twin-event theory of causation rather than giving an account of ontogenesis. The closest Mumford and Anjum come to discussing the development of form is through the theory of the passing around of powers which has little to say about ontogenesis as operation.

Simondon however makes a firm commitment regarding the operative nature of being in ontogenesis and such a commitment has consequences.

This commitment arguably puts him at similar risk to that which we witnessed with Kant's commitment to mechanism, that is on committing to the truth of a specific scientific theory. In this case Simondon founds his notion of pre-individuality on the theory of metastability adapted from thermodynamics and quantum mechanics. As we aimed to show in the previous chapter Simondon's theory of becoming is certainly consistent with much contemporary scientific thinking regarding complexity and the individuation of physical phenomena. But that is not to say that such scientific theories won't develop and change over time.

However the core Simondonian insight of the presence of some kind of difference inherent in being which acts as a motor of ontogenesis is a crucial one and although inspired by scientific theories is not dependent on them. That is to say that the claim made for the operationality of being is resistant to

the development of such theories for it points to the metaphysical reality of operation irrespective to how it is described by the sciences.

What Simondon's commitment gives him is a richer operational account of ontogenesis than that given in the powers theories we have looked at. What it offers is not inconsistent with powers theory though, but where powers theory remains merely formal and in some cases noncommittal, Simondon's allagmatics commits itself to being 'in the order of the sciences' (Simondon, 2005: 559) and able to have real explanatory power due to its axiomatic nature.

4.8: Pre-individuality as Ground and Motor of Causation

As discussed in the previous chapter the notion of the pre-individual is central to the development of Simondon's account of ontogenesis. It also provides key differences to other accounts of causation including powers theories. Two areas where this difference has significant consequences is regarding the problem of ground and also explaining why causation occurs at all, that is, what drives it?

Most of the theories of causation that have been considered so far in this thesis tend to address the question of the modality of causation but not the question of why there is causation in the world in the first place.

In Hume's account we wouldn't expect an explanation of why there is causation in the world given that for him causation is nothing more than constant conjunction. With Kant what we understand as causality is in fact a necessary structure for nature legislated by reason.

As explained above this form of explanation is what Brian Ellis calls passivism in that entities don't have causal powers themselves but are passive in respect to external laws or forces. Naturalistic accounts of causation can also be understood as passivist because causation occurs due to laws and forces extrinsic

to the entities concerned. However such accounts still do not give us an account of why causation occurs, that is how such laws and forces arise.

Powers theory is in part a response to such passivist causal accounts. Instead of Humean scepticism or passive naturalism powers theory holds that it is powers that do the causal work. As we have seen Mumford and Anjum assert that such an account of causation is *sui generis* and as such irreducible. Hence when the question of ground arises an impasse is reached between the choice of ungrounded powers or a requirement for some kind of categorical property that is not dispositional but is a ground from which powers can act. Unhappy with both solutions Lie introduced the solution of manifestations which are both dispositional and intrinsic (in a specific relational sense). Although Lie's solution to accounting for structure is fully worked out it doesn't add anything to the question of accounting for a primal ground; for there to be any initial manifestations in the world there would first need to be at least one ungrounded power. Lie instead holds that the relational nature of dispositions means the emphasis on needing to specify a primary and fundamental ground – the 'Lockean ontological instinct' – is unwarranted and he therefore sidesteps the issue.

Simondon's notion of the pre-individual offers a different solution to this problem which does not name any primary entity or substance but rather describes *how* being must be in order to be productive; that is it must be 'a being that is more than unity and more than identity, and that has not yet dephased itself into multiple dimensions' (Simondon, 2010b: 23).

Furthermore, the metastability of the pre-individual also offers a solution to the question of why causation is in the world as by falling out of phase with itself being is also a motor of individuation.

That there need be a motor of causation is something that is integral to powers theory given that a disposition by definition is the disposition *toward* some particular outcome. Thus Mumford and Anjum claim that:

'Dispositionality . . . can be understood as a sort of selection function — a natural one in this case — that picks out a limited number of outcomes from all those that are merely possible. These "preferred" outcomes are the ones that the disposition is for.' (Mumford & Anjum, 2011: 189)

Similarly Molnar defines powers as 'properties *for* some behaviour, usually of their bearers. These properties have an object towards which they are orientated or directed' (Molnar, 2006: 60). Molnar also argues that dispositions are actually a kind of *physical intentionality* in that they are directed towards something beyond themselves in the same way that Brentano argues psychological intentionality is (Molnar, 2006: ch3). Mumford and Anjum dispute this claim and argue instead that dispositionality is a 'primitive, unanalysable modality' of which intentionality of whatever nature would be a subset.

Despite their differences both of these theories hold that there is a causal modality in the world whether it be called physical intentionality, dispositionality or powers. What these accounts do not describe however is how it is that this modality operates. That is, to claim that physical intentionality exists is not to explain how it works. Simondon's theory of metastability offers just such an explanation of why there is directionality in causal occurrences.

Given this fundamental difference between the two ontologies I now want to list some of the similarities between powers theories (particularly Mumford and Anjums and Lie's) and Simondon's ontogenetic theory. My argument will be that the account of individuation Simondon gives is modally fundamentally consistent with these theories but due to its basis in metastability Simondon's

theory is less universal in kind but more productive as regards explanatory power.

4.9: Between Necessity and Contingency

Mumford and Anjum argue that dispositionality is something weaker than necessity yet stronger than pure contingency. This argument is based on the claim that causes can always be prevented by the addition of other dispositions (antecedent strengthening). From this they develop the further claim that the modality of dispositionality is *sui generis* and due to its irreducibility to necessitation or contingency it lies somewhere in between.

As discussed in the previous chapter Simondon also places the operation of the individuation of being as between determinism and indeterminism. For example, Simondon states that:

'Information is thus midway between pure randomness and absolute regularity.' (Simondon, 2001: 137)[20]

Mumford and Anjum differ from Simondon in that his claim is made as a necessary consequence of the ontological claim that the pre-individual is metastable. As such Simondon's argument for this claim relies on the truth of his claim regarding the metastable nature of being.

Mumford and Anjums's argument is sustained *a posteriori* by the lack of empirical proof of any form of causation that is not preventable. Like Simondon they assert that pure determinism and pure indeterminism are limit cases on a causal spectrum.

As such we can see that both theories come to the same conclusion from different premises; Simondon reaches it as a necessary outcome of his

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[20] For a fuller discussion of Simondon's situating individuation between determinism and indeterminism see chapter 3 (86-87) of this thesis.

ontological claim regarding primary reality; Mumford and Anjum from empirical observation regarding the preventability of causes.

The different way they reach the conclusion is significant in that Mumford and Anjum's theory, as a general theory, concurs with Simondon's on this issue without making the same ontological commitment.

4.10: Equilibrium

Mumford and Anjum argue that equilibrium is really a state that is maintained by an equality of competing dispositions. This is due to their account of causation being based upon the idea of powers competing against one another to attain the outcomes for which they are disposed.

This idea of competing powers is similar to Philip Ball's understanding of competing forces which lie 'at the heart of the beauty and complexity of natural pattern formation' (Ball, 2009c: 183).

As discussed in relation to Ball's claim[21] a Simondonian understanding of such competition would be clear that it is not between already individuated entities but that such competition arises from the metastable tension that is a condition of being.

So although the notion of equilibrium is also important for Simondon equilibrium for him is always metastable in nature. A metastable equilibrium always holds within it the potential for the production of further individuation whereas a dispositional equilibrium doesn't necessarily have this potential and returns us once more to the problem of accounting for the fundamental motor of ontogenesis as discussed above.

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[21] For a discussion of this see chapter 3 (76) of this thesis.

4.11: Simultaneity

Mumford and Anjum's causal theory resonates with Simondon's ontogenetic approach in that both understand causation as a process where cause is simultaneous to effect.

> '[W]e see the causation as an unfolding process whereby *a* turns into *b*. The combined powers of the cause, such as the solute and the solvent, become the effect - a substance held in liquid suspension - as part of what it is to be those powers.' (Mumford & Anjum, 2011: 119)

Unlike the Humean understanding of causation as an unexplained relation between two distinct events (cause/effect) this theory understands causation as a single temporal process where the cause merges into its effect. As Mumford and Anjum (2011: 119) explain 'If we accept that causation ought to be some kind of relation holding between temporally distinct events then the game already may be lost'. For as soon as the notion is in place that cause and effect are distinct events the problem becomes of how to connect these two events in a relation and explain the nature of that relation.

The simultaneity of cause and effect is also central to Simondon's transductive theory of individuation where causation is described as a temporal process involving the resolution of disparities in a manner which also creates a corresponding chronological and topological dimension relative to that causal occurrence. As such Simondon would concur with the powers theorist that;

> '. . . causation as a coming together of many powers, having an effect as a joint combined manifestation according to some function of composition. . . The cause will be depicted as merging into and becoming the effect through a natural process.'

The key difference, once again, is in how Simondon describes how powers come together in his ontology in terms of disparity and information.

4.12: Emergence

That Simondon's ontology supports emergence was also discussed in the previous chapter. By specifying the metastable nature of the pre-individual as ground he sharpens his explanation of the operation of emergence through phase-shifts in comparison to the powers theorists.

Mumford and Anjum explain emergence as a consequence of compositional pluralism but do also hold to a doctrine of supervenience (the same composition of powers always lead to the same emergent effect). They also subscribe to a theory of levels which we also witness in Lie's theory where levels are also described as manifestations.

Once again Simondon's account fits with the Powers approach however once more the specificities of his ontology means that he cannot remain as noncommittal as Mumford and Anjum regarding certain consequences. For example Mumford and Anjum claim that 'It seems to be an asset of the dispositional theory, therefore, that it leaves the question of emergentism versus reductionism open' (Mumford & Anjum, 2011: 103). Simondon certainly does not hold that the question of reductionism is left open by his ontology as his clear commitment to strong emergence via phase shifts makes this impossible.

Simondon also holds a species of a theory of levels in the form of his notion of orders of magnitude. Orders of magnitude refer to the disparities within any pre-individual scenario prior to communication and the forming of relation. In the case of the formation of a crystal the pre-individual state would be the disparity of the seed and the solution in that both inhabit a different order of magnitude in the sense of being different in both structure and energetic milieu. Individuation names that operation by which these orders come into relation and the disparity is resolved to some degree.

Should we then see Simondon's description of individuation (which is also an account of causation) as a compositional pluralism? Although we can certainly interpret his description of the resolution of disparities as such we should not lose sight that his account concerns an axiomatic of how being operates which is compatible with powers theorizing such as Mumford and Anjum's but is also attempting to do more work in explaining how actual compositional operations work.

4.13: Potential

This pattern continues when we consider the comparison of the account that both theories give of potential. Mumford and Anjum's account is that the changes brought about via causal processes create new potentials for further causal processes.

> 'A key point to note in this model is that one causal process is not seen as the cause of another but only as an enabler; thus we do not need to invoke causation between temporally distinct events.' (Mumford & Anjum, 2011: 126)

In essence this tallies with Simondon's account of potentiality or the 'actually possible', but as with the other aspects of this comparison the axiomatic nature of Simondon's account enables a more precise explanation. For Simondon possibility resides both in the pre-individual singularities that enable fresh transductive process as well as in the energetic continuum's he calls *milieus*.

As explained in the previous chapter in Simondon's ontology an individual is never fully individuated. All being has the capability to individuate further as all individuations carry with them potential energy which can be the ground for further individuations. The reason for this is that the operation of individuation does not exhaust all the potentials of the pre-individual reality from which it

develops. There is a remainder of non-actualised potentiality which also emerges alongside the individual in this process which Simondon calls its milieu. Simondon describes the milieu as a 'system, a synthetic grouping of two or more levels of reality' (Simondon, 2005: 30, n6) but the resolution of the disparity between these levels is never a complete resolution without remainder. If that were the case then all the potentials of the system would be made actual.

What Mumford and Anjum don't offer is this kind of operational account of how being both changes and harbours potential. We don't offer this as a criticism as both Mumford and Anjum admit that they are not attempting an analysis of causation:

> 'Causal dispositionalism is a theory, therefore, but not an analysis of causation. We can say more. Powers, we maintain, are productive of their manifestations, and production is clearly itself a causal notion. We cannot, therefore, analyse causation in terms of an already causal notion of production. This we accept.' (Mumford & Anjum, 2011: 8)

As a theory it has many attractive features which help explain the parameters within which a theory of causation must work. However the lack of focus on the operational aspect of the causal process means that this theory lacks the necessary scope to offer a productive schema for understanding certain phenomena, such as, for example, the mode of being of technical objects.

Although Mumford and Anjum hold that powers are irreducible we hold that Simondon points to something more fundamental, which is how powers operate.

From this perspective it is not that powers theory is incorrect or inconsistent, it is a very well argued and logically consistent theory, just that it doesn't offer a very rigourous schema for explaining phenomena. To explain causation as the passing around of powers is, as we have seen, a useful way to counter Humeanism regarding causation as well as develop a clear account of

the modality of causation but does not go far enough to establish an ontogenetic account of powers, without which genetic element, powers metaphysics remains merely formal. However we believe that Simondon enables a more fine-grained account of causation via operation.

4.14: Structure and Operation

It should be clear by now that Simondon's theory of individuation is consistent to quite a high degree with the modality described in Mumford and Anjum's powers based theory of causation. As has just been explained Simondon's theory agrees with their theory regarding the key issues of equilibrium, simultaneity, emergence and potential although it does so in a manner specific to Simondon's focus on operation rather than powers.

The question of structure is one that has divided the powers theorists that have been investigated in this chapter. From Ellis' reductive focus on structures that are natural kinds through to Lie's argument for the requirement of manifestations to act as the ground for dispositions absent in Mumford's theory. It is predominantly a concern with the role of structure that divides them.

It will be my contention that although I concur (as I've hopefully demonstrated above) that the modal description of Mumford and Anjum's theory of causation is sound I also think that Lie's focus on manifestations is warranted and that Mumford and Anjum's lack of address to this problem is to their theory's cost.

There is no doubt that powers theory does a good job at providing an alternative coherent realist theory of causation to that of Hume. And it is perhaps the concentration with countering Humean theory which is also its weakness in that by doing so it neglects to address the problem of form and

structure due to a concentration on disproving the necessary connection of events.

4.15: Simondon & Structure

Simondon maintains that an 'act contains both operation and structure' and that an operation is not a structure although it might describe the convertibility of one structure into another, or the dynamic transformation between structures, which is described as a modulation.

For Simondon a structure is that which emerges via individuating operations by which potentials are *actualised*. A structure for Simondon is understood as the ongoing development of the operation of the resolution of a disparity. Although structures and operations are complementary for Simondon it should never be forgotten that the operation of metastability is primordial, so that Simondon can claim: 'we can say that the operation is what makes appear a structure or that modifies a structure' (Simondon, 2005: 559).

The role of allagmatics is to describe how structure emerges through transductive operations which are ontologically prior to those structures' appearance and then how operations and structures engage further.

There is a close affinity to Lie's relational realism here because for Simondon the structures that emerge are the ground for further operations (they can act either as singularity or energetic continuum in a new operation) and are required for these operations as these structures delimit the kinds of operation that can emerge both around and between them.

However it is not possible to transplant Lie's relationalism directly on to Simondon's. Although Lie is also a thoroughgoing relationist his account of relation differs from Simondon's. Lie's relationism is founded on the dispositional partners account of powers where to be actualized a power must

work with a dispositional partner. That is a relation is that which is formed between entities (manifestations) through their dispositions.

For Simondon a relation is not formed between entities but emerges through the act of the resolution of a disparity of orders of magnitude in an individuation itself.

This distinction is subtle and once again results from Simondon's metastable account of being. Whereas Lie's account sees relations through the purely empirical account of the actualization of powers Simondon concentrates on the actual operation of how those powers work. Thus the dissolving of sugar into water for Lie would be the forming of a relation between the mutual manifestation partners of the two but for Simondon this relation would be forged by the energetic transformation brought about by the operation that occurs because of the disparity between two structures at two different orders of magnitude. That is, Simondon would be interested in, for example, the disparity of the structures of both sugar and water and how these are modulated when they individuate together. It is the operations of modulation, internal resonance and conversion which interests Simondon.

The powers theorist could argue that this isn't problematic to their claim that powers are *sui generis* and irreducible. They could counter that the more fine-grained account of operation that Simondon offers could still be described using dispositions. That is, the structure of the grain of sugar has certain energetic powers etc. I'm unconvinced that such an argument would work. For me, as for Simondon, all powers involve operation and it is operation that is fundamental. For any description at any level of being one could assert that an entity has a certain power but would it not always be then possible to ask *how* does that power operate when enacted? In any description an operational description must be possible to describe the actualization of a power. That is to

make the strong claim that without operation, powers are not powers, but schemata of possible powers.

What I believe this comparison between powers theory and allagmatics shows is that it is possible that powers are not the irreducible mode of causality Mumford and Anjum claim if one is prepared to follow Simondon in his axiomatic account of operation. If one does this then one can see that operation (in Simondon's sense) gives a finer grained account of the working of powers. To do this does require an ontological commitment but also enables powers to be reduced further. This commitment and reduction we argue gives Simondon's ontology real analytic rather than just descriptive powers.

4.16: Real Idealism

Simondon makes a clear distinction between structure and operation and as we saw in our discussion of analogical knowledge (chapter 2) he also describes a clear difference regarding the kind of knowledge that we can derive from studying either.

It is, for Simondon, a problem for analytical epistemology that it overlooks the constantly individuating, i.e., processual or genetic nature of entities and instead discusses structures as fully-formed and static.

> 'The duty of the allagmatic epistemology is to determine the true relationship between the structure and operation in being, and thus to organize the rigorous and valuable relationship between structural knowledge and the knowledge of the operation of being, between analytical science and analogical science.' (Simondon, 2005: 565)

As we have seen it is the operation of individuation which Simondon argues is prior to any structuration and thus any focus on structure without reference to this operation is unbalanced, hence the need for an analogical science to

complement analytical science. By analytical science Simondon means the reductionist method which 'assumes that everything is reducible to the sum of its parts or the combination of its elements'. Contrary to this, analogical science supposes that 'the whole is primordial and is expressed by its operation, which is a holistic function' (Simondon, 2005: 565).

There is evidently a similarity with powers theory here in that the definition Simondon gives asserts that allagmatics allows for emergence, understands a being in terms of what it does (its operation) and not just what it is and is primordial (in the sense Mumford claims that powers are irreducible and *sui generis*).

It is also worth noting that with the reference to holistic functioning Simondon also makes an explicit commitment to the existence of teleological causation, which is something Mumford and Anjum do not rule out but also don't explore. This is symptomatic of their quietism with regard to the ontological commitments of their account.

Simondon's goal is to develop a science of operations, initially by categorising them so as to 'define the major categories of operations, the different types of dynamic transformations that objective study reveals' (Simondon, 2005: 559), with the ultimate goal of defining 'a single fundamental type of operation . . . of which every particular operation is derived like simpler cases' (Simondon, 2005: 559). The latter goal is of course what he achieves with his distillation of the transductive operation as axiomatic with the exemplary case being that of crystallisation.

There are two important projects here, one is to uncover this fundamental axiomatic operation which we have already investigated as transduction (see chapter 3). The second is the proposed project of investigating and categorizing the different types of operations that emerge and inhere within and between various structures and systems.

In this latter project structures at all levels and of all types (physical, biological, psycho-social, technical) can be understood as singularities or signals around which new operations or individuations can occur. This then is a goal to map the types of operation that these singularities enter into. This concern with operation is something that Simondon develops from his encounter with cybernetics and is a required complement to the structural focus of analytic science:

> 'Allagmatic theory is the study of individual being. It organizes and defines the relation of the theory of operations (applied cybernetics) and of the theory of structures (deterministic analytical science).' (Simondon, 2005: 565)

It should perhaps be noted here that Simondon is not attempting a refutation of an account of analytical science (e.g. by portraying it as reductionist) but seeking to point out an operative aspect of reality that science overlooks.

It is arguably the case that since Simondon wrote these words (he wrote his thesis in the mid 1960s) that this suggested project of mapping types of operation has indeed become part of scientific investigation. The science of complexity has certainly made progress with describing processes in physical phenomena as Ball describes in his trilogy of books on the matter mentioned in the previous chapter.

To say this is only to point to Simondon's prescience regarding this aspect of reality and causality as well as point out that such scientific developments also sustain Simondon's project through providing a demonstrable evidentiary base. And of course Simondon's project goes further than just phenomena falling under the physicists purview and also aims to describe causality as it operates within and across the different regimes of individuation that constitute nature. So although Simondon describes allagmatics as being 'in the order of the sciences' he certainly does not mean that this restricts it to what are seen as

the classical sciences (physics, chemistry, biology). As will be investigated in the coming chapters allagmatics is just as relevant to investigations of the social, technical or aesthetic. It is as such that Simondon considers his project as encyclopedic.

With the mapping of types of operation Simondon's can also be seen as a precursor to the kind of project that Manuel DeLanda describes when he sees the task of the modern philosopher as detailing the ontological reality of possibility spaces which are real even if not actualized:

> '[W]hat is needed is a way of specifying the *structure of the space of possibilities* that is defined by an entity's tendencies and capacities. A philosopher's ontological commitment should be to the objective existence of this structure and not to the possibilities themselves since the latter exist only when entertained by a mind.' (DeLanda, 2011: 5)[22]

This mapping of types of operation also applies to the operation of thought. In chapter 2 we discussed the role that technology has played in manifesting 'successive waves a power of analogical interpretation' that are *sui generis*. By this Simondon means the various technical schemas, that is ways of thinking about the world, that technology has helped develop such as hylemorphism, Cartesian mechanism and Cybernetics. He described such theories of knowledge as a form of realist idealism. The proposed mapping of types of operation is another aspect of this project of realist idealism which is rooted in Simondon's reformed notion of information being completed by the axiomatic operation of transduction.

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[22] DeLanda's project uses concepts from the science of complexity (attractor, singularity, gradient etc) to map the various patterns by which various pre-individual conditions can develop. These patterns are described as spaces-of-possibility and are real (otherwise how could they be mapped?) although not actual. As such they have a similarity to Simondon's description of technical schemas as constituting a *realist idealism.*

This commitment to a metaphysics which seeks to map the reality of that which is unactualized returns us to our discussion of powers and the contested role regarding the role that structures do or don't have.

What Simondon develops (or at the very least proposes) with this realist idealism, this categorizing of the unactualized and the development of schemas, also marks a clear difference to how the powers theorists we have discussed thus far discuss unactualized potentials and emergence.

4.17: Conclusion

In this chapter we have discussed how Simondon's account of individuation compares to some powers based accounts of causality.

Although there are some core similarities between the modality of both we argue that Simondon's allagmatic project gives a more comprehensive description of the operation of causality.

We hold that Lie is correct in his criticism of ungrounded powers that manifestations have a key role to play. Manifestations do provide some kind of categorical base from which higher-level manifestations can be grounded. But what manifestations also are are structures, not just in the sense of being things or objects which have properties but the actualization of operations. As such Lie's account is also closer to describing Simondon's account as a powers based metaphysic than Mumford and Anjum's (DeLanda might say they are actualized structures generated from within the space of possibility of an operation).

To answer the question we set ourselves earlier, the difference between operation and power is that operation takes the role of structure far more seriously, so much so that they are seen as having a crucial role in the processual understanding of being. Lie seems to have a better grasp of this than

Mumford and Anjum but even his ontology finds it hard to find the middle ground (the filling of space) between disposition and entity that Simondon's notion of structure supplies.

As well as offering a solution to the problem of ground Simondon's notion of the pre-individual also offers a reason for why there is causality in the world through metastability.

Finally Simondon's description of the interrelation of operation and structure enables him to develop his categorization of the structures of operation, which we have seen relates to this conceptualization of a *real idealism*.

We shall see that such categorization will be useful when we come to investigate biological self-organization and systems in the next chapter which will also bring us a step closer to giving an answer to Kant's concerns regarding natural purposes.

Chapter 5: Vital Individuation

In chapter 3 I gave an exposition of Simondon's theory of the individuation of the physical by way of a comparison with some recent work in complexity. My aim in that chapter was not only to describe Simondon's project but also to demonstrate its continuing relevance to thinking scientific work philosophically.

In this chapter I will undertake a similar exposition of Simondon's description of vital individuation, this time in relation to Stuart Kauffman's work in Biology and complexity.

In the previous chapter I considered Simondon's work in relation to Powers metaphysics and argued that for Simondon operation, as ontogenesis, is that which is causally primary. I hope to demonstrate in this chapter that although Kauffman's biological account of the emergence of life is consistent with Simondon's account, that some of the philosophical implications he draws are problematic.

What Simondon proposes is a thoroughgoing transformation of the understanding of individuals not as constituted by different types of substance but as the recursive interweaving of three different regimes of individuation. Although the operation of individuation is primary for Simondon he is clear that there are different 'forms, modes and degrees of individuation' (Simondon, 1964: 16). The three regimes of individuation that Simondon describes are those of the physical, vital and psycho-social. As we have already seen this prioritization of the transductive operation of individuation enables Simondon to move beyond hylemorphism and establish an ontogenetic approach:

'The separation, the layering, the relationship of these domains are seen as aspects of individuation according to its different modalities; the notions of substance, form, matter, are substituted with more fundamental notions of

primary information, internal resonance, potential energy, orders of magnitude.' (Simondon, 1964: 17)

An initial task for a chapter focusing on the regime of vital individuation is to ask how this regime is distinguished from that of physical individuation. It must be made clear that the difference between these two regimes is not a case of their being constituted by different substance. All individuation for Simondon emerges from the pre-individual and as such his account of how the living is individuated must also be tracked in the same genetic manner with which we described physical individuation. I will attempt to address the discernment of vital individuation from that of the physical by working through the four key interrelated concepts Simondon uses to describe this regime: level, modality, topology and chronology.

5.1: Level

The notion of orders of magnitude, which was introduced in the previous chapter, complements Simondon's theory that individuals are constituted though imbricated levels. To briefly recap, an individual emerges from the bringing into relation of different orders of magnitude such that the individual is understood as relation. One example Simondon gives is of a plant which, when described in terms of orders of magnitudes, is the bringing into relation of the cosmic order (particularly sunlight) and that of the soil. The plant individuates on a new order of magnitude as relation between these two initial orders.

Simondon holds that vital individuation is found at the level of the *macromolecular*. This level of the real is that which is situated between the microphysical and the macrophysical. He describes that which is of an 'inferior order of magnitude' to the macromolecular, the microphysical, as that being 'in

fact neither physical nor vital, but pre-physical and pre-vital' (Simondon, 1964: 131).

Thus for Simondon we can only talk about physical and vital individuals as occurring above this level and on the macromolecular level where individuation can produce 'a crystal or a mass of protoplasmic matter' (Simondon, 1964: 131).

Any distinction between living and non-living is to be found at this macromolecular level of organic chemistry and not at the pre-physical level nor at the level of more complex individuals. As such Simondon is arguing that for an entity to be understood as vital does not require it to have a sophisticated organization, as we shall see, even a unicellular organism is considered as vital. Rather the vital is established as a certain mode of individuation occurring at the macromolecular level of reality.

5.2: Modality

Simondon's ontology resists any kind of substantialism. He does hold however that there are regimes of individuation which are described by differences in the modality of individuation. These modalities must not be mistaken for different substances however.

In Simondon's paradigmatic example of physical individuation, which is crystallization the individuation occurs in 'a manner of *instantaneous* settlement, quantum, sudden and definitive, leaving after it a duality of the milieu and the individual' (Simondon, 2005: 27). This physical individuation does not perpetuate itself beyond the initial resolution of the original disparity which results in the formation of a stable and unified crystal and what it leaves of the mother-water from which it transductively emerged.

Although vital individuation also develops from the pre-individual it does so in a manner that 'keeps it in a permanent activity of individuation, it is not

just the result of individuation, as crystal or molecule, but a theatre of individuation' (Simondon, 2005: 27). Unlike the individuation of a crystal where once individuation occurs it exhausts the pre-individuality of its milieu, vital individuation continues through the establishment of a sustained metastability 'which is a condition of life' (Simondon, 2005: 27).

The establishment of a continuous mode of individuation, which Simondon maintains characterizes the vital, requires that the individuating system doesn't exhaust itself in just one moment of information but that it's able to receive and self-limit repeated informational singularities thereby extending the activity of individuation indefinitely. As such Simondon recognizes that physical and vital individuation both emerge at the same macromolecular level yet one does not build on the other:

'we would assume that vital individuation does not come after physicochemical individuation, but during this individuation, prior to its completion, by suspending it at the moment when it has not attained its stable equilibrium, and rendering it capable of extending and propagating itself prior to the iteration of a perfect structure capable only of repeating what would conserve in the living individual something of the pre-individual tension, of the active communication, in the form of internal resonance, between the extremes orders of magnitude.' (Simondon, 1964: 132)

It is thus an extension and prolongation of the individuation process at the level of the pre-individual which enables the establishment of a mode of individuation that is vital. Both physical and vital individuations emerge from the macromolecular level of the physico-chemical (as such they are both physical) but the vital describes a modality of individuation which remains 'in abeyance long enough at its origin' (Simondon, 2005: 233).

Simondon also describes this abeyance of individuation which denotes the vital mode of individuation as neotenic: by this he means that there is with vital individuation a slowing down or variation in the speed and rhythm of the individuation process which means it 'retains and dilates the earliest phase of physical individuation – such that the vital would be the physical in suspense, slowed in its processes and indefinitely dilated' (Simondon, 1964: 133).

This slowing down of the individuation process and a variation of its rhythm, provides further opportunities for the reception of information to be made available which can enable the system to both stabilize and organize.

At this point having established that vital individuation involves a certain prolongation and modal variation of physico-chemical individuation at the macromolecular level it is important to recognise that the informational opportunities that this enables are also topological in nature. As Simondon states:

> 'The bodies of organic chemistry do not provide with them a different topology to that of physical relations and habitual energy. However, the topological condition is perhaps primordial in the living qua living.' (Simondon, 1964: 258)

5.3: Topology

Simondon makes a number of claims regarding the central importance of topology for the 'essence of the living being' (Simondon, 1964: 259).

One such is the claim that it is the maintenance of 'certain topological conditions' rather than just purely energetic or structural ones that characterize the living. Additionally such topological conditions are ontogenetically emergent with the vital and so cannot be 'known on the basis of physics and chemistry' (Simondon, 1964: 259).

The topological characteristic which Simondon views as foundational for all vital function is that of the permeable cell membrane because its establishment is simultaneously also the creation of regions of interiority and exteriority. This topological development is important as it enables the instantiation of the 'polarized, asymmetric character of cellular permeability' (Simondon, 1964: 259). This polarity enables the membrane to act as a barrier which allows certain entities (via centripetal or centrifugal motion) into the interior of the cell from the exterior whilst also blocking the passage between the two. It is this *selectivity* which Simondon argues 'makes the living alive at every moment' and by which it maintains a 'milieu of interiority' (Simondon, 1964: 260).

At the level of the unicellular organism such selectivity may be relatively simple but it still gives the organism 'a direction inwards and a direction outwards' (Simondon, 1964: 260), which Simondon argues provides a foundation for agency.

Returning once more to the example of crystallization we can see how the topological characteristics of individuation help establish the difference between physical and vital beings. The individuation of the crystal only occurs on the outer molecular layer of the crystalline formation; its interior remains as an inert historical record of previous individuating activity. However, in the case of even the most rudimentary cell although the boundary plays the important role of selection and partitioning it also enables the maintenance of an interiority which is both a 'condensation' of past activity but also the maintenance of an internal resonance throughout the topology of the whole cell. This resonance is both the source and receptor of constant communicative activity between both interior and exterior as well as structures and operations solely on the interior thus enabling further organizational and informational activity.

'There exists within the being a more complete regime of internal resonance requiring permanent communication and maintaining a metastability that is the precondition of life.' (Simondon, 1992: 305)

The topology of the cell enables the on-going production of disparities (thermodynamic, informational and topological) in need of transductive resolution which maintain the cell in a condition of metastability.[23] Thus when Simondon states that 'the living lives at the limit of itself, on its limit' (Simondon, 1964: 260) we can interpret this as meaning that the cell is living at both its topological limit but also its energetic and informational limit in the sense of at the edge of chaos (the critical limit between complete determinism and complete indeterminism).

This account of the vital is therefore not describable by vitalism or mechanism as it neither requires a vital principle to sustain it and nor is it deterministic.

So although crystallization may be given as the paradigmatic example of the transductive operation in that it tracks this operation from initial disparity to resolution, in the case of vital individuation the operation does not resolve for doing so would be the death of the organism. Vital individuation requires an on-going metastable tension and the need for further problems requiring solution. As we have seen the maintenance of such a situation also requires a topological organization that supports its operation. Necessarily this topological operation requires the establishment of interior and exterior milieus which sustain informational activity at various levels. As organisms become more topologically sophisticated then so the level of complexity increases between the varied interior and exterior milieus that develop.

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[23] This metastable condition is what Kauffman calls *criticality* and denotes the same type of energetic condition that were described in chapter 3 (71) when discussing systems that were close to falling out of phase with themselves.

Given the emphasis on the primordial importance of topology for the emergence of the vital Simondon proposes that all organisms, however complex, can be classified not just by the level of differentiation they demonstrate but also by the levels of interiority and exteriority by which they are organized and how these are mediated. Such classification points to the different levels of topological complexity that exist in the structural organization of various organisms, with the more complex involving more opportunities for informational mediation between structures and hence the development of higher order functional structures such as central nervous systems.

Thus the various differentiated systems that constitute an organism should primarily be understood topologically; that is the organism is an organized enfolding sustaining various interiorities and exteriorities which maintain relations and that have developed specific functions to aid the maintenance of the metastable resonance across the organism. Simondon calls those interiorities which contain intermediary interiorities (digestive, nervous, endocrine etc.) that are in communication, medial interiorities. One example Simondon gives is of the intestines:

> 'Depending on the topology of the living organism, the interior of the intestine is in fact exterior to the organism, although it accomplishes in this space a certain number of transformations conditioned and controlled by organic functions; this space is an annexed exteriority.' (Simondon, 1964: 260)

The understanding of the organism as a topological organization in the service of the self-maintenance of a metastability has important philosophical implications. First, such an understanding disqualifies the explanatory power of a reductionist approach such as atomism or mechanical materialism when

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describing organisms. The fundamental unit here is the topological structure of the cell the operations of which are strongly emergent[24] from the atomic level.

For reasons given above, neither is recourse to explanations using physics or chemistry sufficient. Although the development and operation of organisms do not contravene physical or chemical laws their topological and chronological characteristics cannot be reduced to either.

However this does not mean that we should attempt to understand organisms holistically. By doing so we risk 'privileging the organization of integration and differentiation'. Evidently such organization is extremely important for any organism but Simondon's point is that it is dependent on the primary topological structure which is a metastable asymmetry between interiority and exteriority. Without this structure such integration and differentiation would be impossible. Simondon maintains that however complex and organized the organism is it is this topological structure which remains primary and that 'living individuation must be thought according to topological schemes' (Simondon, 1964: 262).

Such an understanding also rules out any equivalence of organisms with machines. Although we covered the inadequacy of such equivalence in the chapter on cybernetics it is worth noting that Simondon's topological account of vital individuation provides another way in which organisms differ from technical objects. As we'll see in the forthcoming account of technology Simondon will give an account of these involving the central role of the integration of differentiated structures (concretization) however this process does not occur in the service of maintaining a topological metastablity and differentiates machines from being organisms.

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[24] In this thesis Strong Emergence is defined as 'those phenomenon which aren't merely unexpected epistemologically but which are instances of the production of ontologically novel phenomenon which are 'not deducible even in principle from truths of lower level domain' (Mumford & Anjum, 2011: 92).' See Chapter 4 (107).

5.4: Environment

An important aspect of Simondon's theorization of the vital concerns the relation of the bounded topological structure of the organism to its environment. What is at stake here is the extent to which the topologically defined organism is closed to its environment and the implications this has for both its autonomy and the possibility for further differentiation.

It was these concerns that engaged a number of second-order cyberneticians in the development of systems theory and for which the work of Maturana and Varela is particularly pertinent.

It is with their distinction of allopoietic systems with autopoietic systems that the poles of the problem are initially defined. An allopoietic system is an organization which produces something different to the organization itself. Contrasted with these are autopoietic systems which are organizations whose operation is recursive and self-maintaining in that they self-reproduce the same processes which produced them. Additionally, through doing this the system also constitutes itself spatially as a unity.

Thus a cell is understood to be autopoietic in that its operation recursively reproduces the same set of processes which produced it and in doing so constitutes itself as a unity with a certain amount of autonomy. As a unity the autopoietic system is understood to be thermodynamically open to its environment but its operation is closed to informational exchange. The system must be thermodynamically open to be able to energetically sustain its operation however its boundary is required to insulate it from informational disturbance from its environment that would be disruptive of its operation. This condition is also known as 'operational closure'. This closure also enables the reduction of the influence of the environment on the system to one of signification such that the system itself constructs a meaningful order out of the

noise of the environment. It is via this signification that a system is understood to be structurally coupled to its environment.

Although such a theorization gives the system a high level of autonomy the problem remains regarding how it comes to develop structurally without disruption to this required closure. As such this conception trivializes the operation of the environment in relation to the system.

It is this regard that Simondon's theorization of individuation offers a novel way to think about the openness of systems. Where in the case of autopoiesis the coupling of the system occurs at a single level of magnitude, under Simondon's account of individuation the system maintains an ongoing relation to the broader environment (pre-individual) as a whole. That is to say that the individual 'is sustained by a double relationship' (Simondon, 1980: 54), first with its milieu which exists on the same level of magnitude as it, and second with the wider metastability of the pre-individual. As Mark Hansen explains in his use of Simondon to develop his notion of the System-Environment Hybrid:

> 'For Simondon, in short, it is not simply the global perspective *of the organism* – a perspective tied to the organism's specification of a world – that informs the bootstrapping of identity from level to level; rather, the upward spiral of individuation is driven by two important conditions: the nonidentification of individuation with any form of individual (physical, biological, psychic or, collective) and the coupling of individuation with the entire environment as a source of "preindividual", "metastable" potential.' (Hansen, 2009:134)

As such the pre-individual overflows and remains independent of the reduction that the system understands as its environment. Simondon shifts focus from the epistemological, which was the domain of interest for many of the second-order cyberneticans, to an ontological understanding of systems as including system, milieu and pre-individual.

5.5: Chronology

The topological character of the vital ensures that there is a resonance that holds throughout the interiority of the organism. Through this resonance the entirety of the organism's content is in contact with that which is exterior. As such any disturbance on the boundary of the organism can affect the interiority of the organism by disturbing this resonance. This means that the whole of the interiority of the organism is in effect in contact with the exterior 'without delay' and ergo this enables a sense in which the organism exists in a temporal *present*.

The mode of this chronological present is not constituted in 'the form of time in Physics', that is as a linear series of punctual moments, but is specific to the topology of the particular organism:

> 'it would be necessary define, in addition to a topology of the living, a chronology of the living associated with that topology.' (Simondon, 1964: 264)

The chronology of a vital individuation (organism) depends then on its topology and in particular how this topology organizes the past of the interior milieu in opposition to the futurity it receives from its exterior milieu.

The interiority of the living individual is a condensation of its past in that it is also a physical memory of the selections that have taken place on the interior of the outer boundary. For Simondon the present of the living organism is the metastable transductive relation that is maintained between the past as constituted by the organism's interiority with the future, which is that which confronts the organism as its exterior milieu.

The fundamental chronology of an organism is thus conditioned by its topology and co-emergent with it. This entails that there must be as many

kinds of chronology possible for the living as there are possible topological structures:

> 'continuity is one of chronological schemes possible, but it is not the only one; the schemes of discontinuity, of contiguity, of envelopment, can be defined in chronology as in topology.' (Simondon, 1964: 264)

With this realization of the chronological with the topological Simondon identifies a primary dimensionality of the organism. Ontogenetically this dimensionality is necessarily prior to any possible distinguishing of the spatial or temporal. This dimension must also come before any sensori-motor structures.

This combination of a fundamental dimensionality from which higher order sensibility may emerge places Simondon in the position of getting beyond subject-object dualism. Although obviously not denying that the subject-object schema may emerge, Simondon's ontogenetic approach ensures that it is not misconstrued as a starting place for thinking the organism.

5.6: Stuart Kauffman

In this section, and in the interest of *thinking with* contemporary science I want to look briefly at the work of the biologist Stuart Kauffman through the lens of a Simondonian analysis. This will also continue the connection we have been making since chapter 3 between Simondon and contemporary engagements with complexity.

As for Simondon one of Kauffman's primary concerns is to understand the emergence of the vital. Kauffman also proposes that it is at the macromolecular level where the development of life must first occur. His reasoning for this is similar to Simondon's in that we must think the organism from its initial

organisation, for Kauffman this occurs at the macromolecular level via the construction of autocatalytic dissipative structures.

Such structures must be bounded and thus he also stipulates closure as a necessary requirement for the kind of 'propagating organisation of process' that constitutes life. He writes; 'This closure is a new state of matter — the living state' (Kauffman, 2010: 93). As such Kauffman shares Simondon's view that the topology of the cellular structure is required for life.

The evolution of such structures requires a kind of bootstrapping process whereby cell membranes act to constrain the release of energy from thermodynamic work-cycles whilst also being the result of just such processes themselves. That is to say that the cell membrane develops as a result of chemical reactions and once constructed provides an environment that is both far from equilibrium (Kauffman, 2010: 47) and bounded in a manner that it constrains the work that continues to be done (Kauffman, 2010: 93).

The concept of work is central to Kauffman's account. He uses the Carnot thermodynamic heat engine to demonstrate the notion of a work-cycle. The operation of the engine combines spontaneous and non-spontaneous processes. A non-spontaneous process is one that requires an intervention from outside the system. This required mix of spontaneous and non-spontaneous processes for the completion of a cycle means that the cycle is a non-equilibrium concept as at some point in the cycle the system must be *forced* away from equilibrium in order to begin again.

Additionally what can be taken from the example of the Carnot engine is that work is not just 'force acting through a distance' but also 'the constrained release of energy into a few degrees of freedom' (Kauffman, 2010: 90). To create work it is thus necessary to constrain the release of energy and the constraints required to do so (e.g. Piston/cylinder) require work for their

production: 'No constraints, no work. No work, no constraints' (Kauffman, 2010: 90).

At the level of the most basic cell one of the roles of the cell membrane is to act as a constraint in which to maintain the disequilibrium between its interiority and exteriority as well as to constrain the chemical based work cycles that occur within. Such constraint enables cells to organize in such a way as to produce further constraints with which to organize work further. This reciprocal activity of work and organization is an example of what Kauffman calls a 'self-propagating organization of processes' (Kauffman, 2010: 91).

Such *self-propagating organization of processes* emerge at the molecular level via a process involving what Kauffman calls collectively autocatalytic sets. This process involves the spontaneous formation of sets of chemicals which mutually catalyse each other's reproduction and which can also form chemical-reaction networks with the ability to self-reproduce.

The chemistry involved in this process need not concern us here albeit it to state that this process enables a way to theorize the emergence and self-reproduction of more complex macromolecules.

Already there are a number of ways in which Kauffman's account is consistent with Simondon's theory of vital individuation. Like Simondon he recognizes as fundamentally important the topological closure of the cell for the organizing process of resolving problems related to structuration. Additionally he offers, by way of his theory of autocatalytic sets, a chemical description of the kind of ontogenetic self-propagating process described by Simondon as the modality of 'perpetual individuation, which is life itself' (Simondon, 1989: 16).

Just as we saw in the example of the Carnot engine the topology of the system acts as a constraint which can organize the *'kinetic behaviour of the chemicals of which it is made'* (Kauffman, 2010: 51). Such topological constraints therefore play a causal role in the self-organizing process of the living system:

'Thus, the emergence in the universe of collectively autocatalytic, evolved cells and their "topology" of organisation of kinetic-controlled process is ontologically emergent, and the same topology of kinetic control of the "whole" is partially causal in constraining the kinetic behaviour of the parts.' (Kauffman, 2010: 58)

With this Kauffman returns us to Kant's problem regarding the relationship of the parts to the whole of the organism with the claim that the whole effects a downward causation on the parts just as much as the parts are responsible for affecting the whole. Thus despite the similarities to Simondon noted above at this point Kauffman's account is perhaps closer to that of autopoietic systems given its focus on bounded recursion.

One of Kauffman's aims in his books is to question the limitations of reductionism and establish a realism of entities existing at higher levels than the molecular. One example he uses is that of the heart. If we were to give a reductionist account of the heart, that is an explanation of it only using physics and chemistry, then there are some key properties of it that would be missed. That is although we may be able to account for its molecular constitution and even its mechanics, Kauffman maintains that we wouldn't be able to describe how the heart came into existence, explain that its function is to pump blood or that it is a causal entity in its own right.

In short his argument comes down to the point that neither physicists or chemists are able to predict the evolution of the heart because the evolution of organisms involves processes which, although they don't contravene physical or chemical laws, are not reducible to them because they involve processes of emergence which are 'partially lawless and ceaselessly creative'.

To make his argument Kaufmann employs the notion of Darwinian preadaptation. This holds that an entity such as an organ 'could have causal features that were not the *function* of the organ and had no selective

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significance in its normal environment' (Kauffman, 2010: 131). However when in another environment these entities may indeed have significance and introduce a 'novel functionality' into the environment. The noise hearts makes, for example, is not part of their function but it is nonetheless a real causal property.

Another illustration of the unpredictability of preadaptation is the evolution of the swim bladder from the lungs of early fish. Kauffman claims that such an evolution could not have been predicted.

Given the unpredictability of such preadaptation Kauffman goes on to make the stronger claim that the evolution of the biosphere is radically non-predictable because it cannot be possible 'ahead of time, or finitely [to] prestate, all possible Darwinian preadaptations of all species alive today.' (Kauffman, 2010: 132)

This argument returns us to the discussion of powers and causality in the last chapter and the differences between weak (epistemological) and strong (ontological) emergence. Kauffman's claim is that the preadaptations found in the biosphere are both epistemologically and ontologically emergent. This is not just to make the claim that one cannot deduce or infer the emergent phenomenon from that of lower-levels (epistemological emergence) but the stronger claim that such higher-level phenomena are real entities in their own right and are operations that can't be reduced to entities or activity at a lower-level.

Such a claim has obviously damaging consequences for the ubiquity of reductionist science but does not mean that all higher-level phenomenon should be understood as indeterminate. Kauffman's view is similar to that developed in the previous chapter in that causality for him occurs somewhere between determinism and indeterminism, that is that ontological emergence in the biosphere is 'ontologically partially lawless and ceaselessly creative'

(Kauffman, 2010: 36). So to return to the example of the heart: 'it is epistemologically emergent because we cannot deduce it from physics alone' (Kauffman, 2010: 86) and it is ontologically emergent because the laws by which it did come to be (heritable variation and natural selection) are not just irreducible but apply to that entity at the ontological level at which it exists. That is, just as we saw in the last chapter, there are causal powers which are owned by higher level entities which are not reducible to the lower-level parts from which they are constructed.

Although in arguing for strong emergence Kauffman is close to Simondon we must note a distinction in how such emergence is theorized by these thinkers as it highlights some insufficiencies in the philosophical entailments Kauffman claims.

In stipulating preadaptation as the principle by which such emergence supposedly occurs he is foreclosing the strength of this emergence as by doing so he is restricting it to the actualization of unrealized possibilities which are in some way already present in the actual. Thus in the cases discussed above of the heart and of the swim bladder we can question if these aren't really cases of epistemological emergence as the developments involve the recognition of new *functionality* that these already have but aren't demonstrating due to their environmental context. The changes thus only involve operations at the same level of magnitude. This is different from the stronger claim that Simondon makes for transductive operations occurring across different levels which can lead to truly novel structures. That is to say that Kauffman's account surely entails that as preadaptations these developments point just to functional changes due to their placing in a different environment rather than the stronger thesis that the environment is causally implicated in an operation of radical creation – that is the invention of something completely new and not just adapted.

Kauffman argues that a key reason that the evolution of organisms and open-systems is so unpredictable is that they are partially lawless in that no natural law governs their emergence. The reason for this is that we cannot know the space of possibilities (state space) for such an emergence prior to its occurrence. The range of possible causal influences in any situation is simply too massive to be able to predict an outcome. However both of these points are questionable: by arguing for the principle of pre-adaptation isn't he specifying a 'natural' law for governing this emergence? And in specifying that there is a space of possibilities, however vast, isn't he admitting this is an epistemological issue regarding knowledge of that space?

These points can be applied to another example of Darwinian preadaptation he gives. It is a scientifically accepted fact that the three bones of the human middle ear evolved from the jawbones of early fish. Kauffman argues that predicting such an evolution occurring is impossible because it's just not possible to state beforehand which of the many functional aspects of the entities involved will be relevant. The combinatorial possibilities of all possible environmental situations is impossibly vast. Because seemingly non-functional properties of entities (such as the sound of the heart, the distance apart of fishes' jaw bones) all have real causal properties this makes any situation's state of possibility too large to pre-state. For Kauffman this ontological emergence leads to the claim that the universe is radically creative. However this conclusion does not follow as he is attempting to make the leap from weak epistemological emergence to stronger ontological emergence.

These problems can also be detected in another important concept that Kauffman develops to augment his argument, which is that of the adjacent possible. He initially develops this concept in relation to organic molecules. First he asks the reader to:

'Consider a reaction graph with N molecular species, polymer sequences of A, and B monomers of diverse lengths. Call this initial N the actual […] The adjacent possible in relation to the actual so defined is "the set of new molecular species reachable in a single-reaction step from the actual." (Kauffman, 2010: 64)

The actual and the adjacent possible are constantly changing. As the actual expands into its adjacent possible then so too does the adjacent possible itself change as new chemical reactions are made possible.

Kauffman is clear that the concept of the adjacent possible does not refer just to organic chemistry but applies to other real entities as well such as economics, the organic evolution of the biosphere, the evolution of autocatalytic sets, technological development and human history: 'The adjacent possible is real. We are invading it much of the time . . . *History enters* when the space of the possible is vastly larger than the space of the actual. At these levels of complexity, the evolution of the universe is vastly nonrepeating, hence, vastly nonergodic' (Kauffman, 2010: 123).

However, this argument also suffers from the same criticism as that made to the examples above: the creativity Kauffman is describing involves the actualization of adjacent possibles that in some sense already exist, in the sense that they are already possible. As such all that differentiates these possibilities from actualization is their becoming actual. But surely strong emergence means more than just actualizing non-actualized possibilities?

Additionally this account of creativity entails that for any creation to occur there must already be actual some entity such that it may have adjacent possibles which can themselves become actual. Without such an actual entity there can be no possibles to actualize, however the only way an actual entity can become actual in the first place is through first being possible. This therefore

requires the contradictory need for a possibility which is not adjacent to an actuality.

Such a theory describes just such an account which Simondon's genetic theory of individuation set out to overcome. That is to say that it lacks an account of the individuation of the entities under discussion in the first place but assumes they already individuated. As such Kauffman's arguments rest on an implicit Aristotelianism as it presupposes some kind of enduring actuality to which possibility can be adjacent.

With Simondon these confusions are avoided as his notion of individuation doesn't rely on already existing actuals which provide adjacent possibilities by which creation can occur. As we have already described in the chapter on transduction his notion of invention is radically creative because it recognises the individual not as having possibilities (in the way an Aristotelian substance has accidents) that might become actual but as involved in on-going transductive relations with both a milieu on the same level of magnitude but also with a metastable pre-individual.

5.7: Information

Given the concern of molecular biology with studying genetics over the past half century it is perhaps surprising that Kauffman has relatively little to say about the subject. This is because he is predominantly interested in developing an account of life that precedes the mechanisms of genetic inheritance. Thus he investigates the possibility of life developing via the emergence of autocatalytic sets at a molecular level.

By following this line of investigation Kauffman shares a methodology similar to Simondon in looking at how individuation emerges from a pre-individual level. It is perhaps also unsurprising that when discussing the

concept of information, like Simondon, he concludes that there are two different operations being described which shouldn't be collapsed into the same term.

In chapter 2 (50-51) we saw that Simondon made the distinction between primary and secondary information. Secondary information describes the classical cybernetic account of information (as developed by Shannon) relating to the transmission of a message between sender and receiver. However primary information describes the actual transductive operation of individuation by which individuals (such as senders and receivers) actually come into being.

Like Simondon, Kauffman accepts that secondary information exists and plays various important roles but that it is not primary enough to play a role in connecting matter and energy in the foundational process of morphogenesis.

Thus, for Kauffman, Shannon misses that the receiver of information in the cybernetic sense must also be an agent. Thus he agrees with Simondon who regards Shannon's notion of information as secondary and which can only come after the primary information that is individuation. Kauffman echoes this sentiment when he writes: 'The problem with applying Shannon's information theory itself to biology and the evolution of the biosphere is that we cannot make sense of the source, channel, or receiver' (Kauffman, 2010: 95).

Kauffman goes on to develop an account of a more primitive type of information that would be influential in ontogenesis. Developing an idea of microcode initially proposed by Schrödinger he proposes a type of information that is coherent with the notion of morphogenesis already discussed and recognises the importance of the topological for it. Thus he understands Schrödinger's microcode as a more fundamental kind of information, which is a;

'highly heterogeneous set of *microconstraints* that are *partially causal* in the myriad organized events that are unleashed in the cell and organism in its propagating organization of processes. In this sense, information is nothing but the constraints themselves. This interpretation has the merit that it unifies information, matter and energy into one framework, for constraints are also boundary conditions.' (Kauffman, 2010: 97)

What Kauffman develops here then is an account of information that recognizes the importance of topological conditions for directing work and thereby influencing the development of diversification in systems. As such Kauffman's account of a primordial information resonates with Simondon's in that it also focuses on the resolution of disparities between energy and topology in his allagmatics as the science of the relations between operation and structure. The key being that for Simondon information refers to the process in which the constraints are involved and not just the constraints themselves.

5.8: Agency

Like Simondon, Kauffman is also aware of the paucity of an account of semantics in Shannon's account of information. Although Shannon's theory is useful for describing the transmission of a message it fails to give an account of how the receiver obtains meaning from the message.

This is the same criticism that we saw both Merleau-Ponty and Simondon level at this account of information in chapter 2 (60). For those two thinkers the problem is that this form of information fails to describe a true relation to that which is external to the receiver, that is to its milieu. I shall develop Simondon's account of this in the next section with his theory of psychic individuation and of the image.

It is worth noting here that Kauffman also develops just such an account of secondary information although by way of Pierce as, 'the discrimination of a sign, say, of a local glucose gradient, and interpreting that sign by an action, say swimming up the glucose gradient.' (Kauffman, 2010: 96).

For Kauffman such a reaction by a bacterium would be an example of agency and would also constitute an example of teleological causation. Meaning enters the picture because it is derived from agency. Kauffman gives the minimal definition of a molecular agent as:

'a nonequilibrium self-reproducing system doing work cycles, to receive the information, discriminate it, and interpret and act on it.' (96)

For Kauffman then, it is via this operation of the discrimination of that which is external to the organism that meaning emerges, that an *ought* can be derived from an *is*. As we will see in the next chapter Simondon develops a somewhat more sophisticated account of meaning but nonetheless one which emerges at the same molecular level as Kauffman's.

Chapter 6: Psychic and Collective Individuation

In the physical and vital regimes individuation occurs by way of the resolution of problems through a process of differentiation and integration resulting in the development of structures at higher levels.

Simondon continues with this genetic axiomatic in his description of the third regime of individuation, that of the psychic and the collective. In this chapter we will explore Simondon's theory of the psychic dimension by focusing on two of his texts: *L'Individuation psychique et collective* (1989) and *Imagination et invention* (2008). Both texts describe a different aspect of psychic individuation which relates to our overall project of thinking about technology. *L'individuation psychique et collective* is of particular interest because of the concept of the transindividual which is developed therein. *Imagination et invention* is important because of the theory of the image which Simondon develops there along with the related notion of invention.

Each of the theories developed in these texts demonstrates an exemplary application of the ontogenetic, transductive method and once we have completed our investigation of this final regime of individuation we will be well placed to explore the place of technology in Simondon's thinking.

Before describing Simondon's account of psychic and collective individuation we will first discuss some work of the ethologist Jacob von Uexküll as well as some aspects of the later work of Simondon's doctoral supervisor Merleau-Ponty. The reason for covering this material is that von Uexküll's theory of the *Umwelt*, although not directly cited by Simondon, has evidently been influential via Merleau-Ponty or his other supervisor Canguilhem. Additionally, Merleau-Ponty engaged with some of the same scientific work (particularly biologists such as Coghill and Gessel) as Simondon.

Merleau-Ponty's engagement with this work is valuable as it enables an understanding of the heritage of the phenomenological aspect of Simondon's engagement with cybernetics. In this chapter, I will argue that Simondon's project can be seen as the progression of an engagement between phenomenology and biological science which Merleau-Ponty himself was working on in his later work. If we are to give a balanced account of Simondon then this engagement must be made explicit.

6.1: Merleau-Ponty and von Uexküll

In the notes from his course on *Nature* can be discerned the groundwork for Merleau-Ponty's later philosophy, as laid out in the unfinished work, *The Visible and the Invisible*, and which traverses some of the same key issues as Simondon's work.

As several commentators have already elucidated (Hansen, 2005; Mazis, 2000) Merleau-Ponty's second turn to Biology was in response to what he saw as the failure of his first engagement (utilizing Gestalt theory) in that it didn't manage to overcome its foundation on the dualism of consciousness and object. In a working note in *The Visible and the Invisible* he writes:

> 'The problems posed in Ph.P. [Phenomenology of Perception] are insoluble because I start there from the "consciousness"-"object" distinction.' (Merleau-Ponty, 1968: 200)

Because of this distinction and the gap it indicates, no account is possible from this basis of how 'a given fact of the objective order' (Merleau-Ponty uses the example of a cerebral lesion) can disturb the 'given relation with the world', that is consciousness (Merleau-Ponty, 1968: 200).

With the attempt to bridge this gap, that is to answer the question, 'what is the alleged objective conditioning?' (Merleau-Ponty, 1968: 200), Merleau-

Ponty moves away from phenomenology towards ontology. The concept of Nature is used here to signify that which is ontologically primordial to the object-consciousness dualism.

At the heart of Merleau-Ponty's exploration is the theorization of embodiment as an organization from which consciousness emerges as a behaviour. That is, consciousness is immanent to the activity of Nature (the biological body) and through understanding its emergence we can understand what Nature is. As Hansen argues:

> 'the fundamental correlation of behaviour and morphogenesis Merleau-Ponty discovers in his exploration of the biological sciences grounds the correlation of phenomenology and ontology in his late work, and that it does so precisely because it overcomes the dichotomy between mind and body on one side and world and environment on the other . . .' (Hansen, 2005: 233)

As Merleau-Ponty points out, he doesn't turn to science expecting a 'ready-made conception of Nature' (Merleau-Ponty, 2003: 86) as the scientist 'looks for a way to grasp the phenomenon, but he doesn't seek to understand it' (Merleau-Ponty, 2003: 86).

In his earlier work, such as the *Phenomenology of Perception*, Merleau-Ponty predominantly focuses on the perception of the world undertaken by the subject. In his later work he shifts to attempting to describe an ontology that could underpin these earlier phenomenological investigations but that also demonstrates how the gap between consciousness and object is not foundational. Furthermore, one of the tasks he undertakes is to show how this gap is constructed and is a necessary aspect of the morphogenetic development and ongoing existence of the organism.

As described in the last chapter Simondon also has the erasure of this gap in mind with his assertion of the priority of the topological-chronological

dimension for the organism. Simondon's concern is for the overcoming of the dualism such a gap implies which is unacceptable for his genetic informational ontology based on individuation beginning from the pre-individual. As such he must demonstrate the establishment of the psychic from the regimes of individuation already described in previous chapters.

A key part of the second course on Nature in relation to the development of Merleau-Ponty's later 'ontological turn' is regarding the work of the ethologist Jacob von Uexküll. One concept of von Uexküll's that Merleau-Ponty returns to frequently throughout his later work is that of the *Umwelt*. Merleau-Ponty describes the *Umwelt* as that which:

> 'marks the difference between the world such as it exists in itself, and the world as the world of a living being. It is an intermediary reality between the world such as it exists for an absolute observer and a purely subjective domain.' (Merleau-Ponty, 2003: 167)

As a concept that deals directly with how the 'consciousness-object distinction' is established it is clear why this concept engages Merleau-Ponty.

In von Uexküll's work the *Umwelt* is comprised of the *Merkwelt* (perceptual world) and the *Wirkwelt* (the active world) of the organism. The *Umwelt* can be understood as the organism's subjective experience of the objective environment in which it lives. As such it is perhaps unsurprising that von Uexküll was influenced by Kant. That the *Umwelt* of an organism is not direct experience of the things-in-themselves but a subjective world constructed by the organism in relation to the world has echoes of transcendental idealism:

> 'Forever unknowable behind all of the worlds it produces, the subject – Nature – conceals itself.' (von Uexküll, 2010: 153.)

Von Uexküll considered himself as a Kantian because he maintained that there could be no such thing as a meaningful objective reality because meaning is

something that is constructed *between* an organism and its environment; it is a function of its *Umwelt* (as we will see Simondon will say something similar when he describes meaning as a relation).

It is the idea of the emergence of consciousness through such a relationship which Merleau-Ponty investigates through the concept of behaviour. The understanding of behaviour is key for understanding how von Uexküll's theory of the *Umwelt* helps Merleau-Ponty ontologically found the separation of the objective and subjective.

Significantly, behaviour is not to be understood as something that occurs only at the level of consciousness but neither is it to be understood as mechanistic. In fact:

> 'Consciousness is only one of the varied forms of behaviour; it must not be defined from within, from its own point of view, but such as we grasp it across the bodies of others; not as a centrifugal form, but as a closed world where external stimulations appear to it as outside of it.' (Merleau-Ponty, 2003: 167)

To demonstrate how consciousness and the *Umwelt* are related and how the former can be seen as emerging in relation to the latter Merleau-Ponty uses some examples of lower and higher animals.

Merleau-Ponty accepts that a lower animal, such as the Medusa, is little more than a machine. By this he means that the animal 'obeys its anatomical plan' (Merleau-Ponty, 2003: 168). All machines, for von Uexküll, operate according to their 'plan of construction' (*Bauplan*) and these lower animals do little more than move mechanically in search for food with very little or no regulation or interaction with the external world. As such the lower animals can be understood as operating in accordance with a Bauplan, although we should not misunderstand this analogy to mean that these animals actually have an external designer.

With what Merleau-Ponty calls the lower organized animals, such as amoeba and paramecium, although they have an *Umwelt*, importantly it is closed. That is, the *Umwelt* of such animals protects the organism from stimuli that are not relevant to their immediate existence, hence why von Uexküll states that 'the paramecium rests in its *Umwelt* more surely than the infant in its cradle' (Merleau-Ponty, 2003: 170). As such the lower organized organism doesn't offer a true response to its environment. It is in this way that Merleau-Ponty also theorizes cybernetic machines; although they may give an impression of responding creatively to their environments in fact their responses are 'a foreseen assembly for a finite number of cases' (Merleau-Ponty, 2003: 162) and therefore these machines also form a tight-fit with their environment.

The *Umwelt* of higher animals, however, do not form such a tight-fit with their environment and entail a level of openness towards it. This openness is made possible by their possessing a different type of *Umwelt* called a *Gegenwelt*. A *Gegenwelt* is the product of a central nervous system, and is a copy of the world [*Welt*], to which the organism stands in opposition:

> 'The sensorial inputs about the world are coordinated and elaborated, brought in to a kind of relation like language in which there is an address which is interpreted against a background of meaning.' (Mazis, 2000: 238)

Unlike the lower animals where the stimuli of the environment is either ignored (as they operate deterministically like the Medusa) or where their responses to stimuli are predetermined (such as the amoeba), the higher animal constructs an 'image of the exterior agent', an image which it 'orders, coordinates, and interprets'. This *Gegenwelt* is a symbolic mirror of the world that the organism stands opposed to. Its symbolic structure is like that of a linguistic system in that it is truly open (unlike a code) and thus truly creative responses and interpretations are made possible - the 'possibility of the object'

is deduced. The *Gegenwelt* is also very similar to the third phase of Simondon's image-cycle described below.

It is important here to recognize that the relation that the animal has to its *Umwelt* is not just a matter of perception, but concerns a broader account of the relation the animal has with the world; that the *Umwelt* influences the animals development as well as being developed by the animal. This is why it is important to remember that the *Umwelt* is constructed from the two intertwined systems of the *Merkwelt* (the animals conscious experience of the Welt) and the *Wirkwelt* (the behaviour of the animal in the Welt). Therefore, care has to be taken not to slip back into a consciousness-object dualism when describing the relation of the organism and its *Umwelt*. The *Umwelt* is of the organism but also of the world, it is 'the appearing in the physical world of a field radically different from the physical world with its specific temporality and spatiality' (Merleau-Ponty, 2003: 173). The appearance of the *Umwelt* comes about through a combination of the animal's behavioural and perceptual activity which together define how the animal experiences itself, the world and itself in the world.

Some differences with Kant are worth noting here. Whereas Kant argues that our experience of time and space are transcendentally structured and the nature of this structuring is both necessary and deducible a priori; Merleau-Ponty argues that spatio-temporal experience is constructed by the organism's developing relation to its *Umwelt*, that is, it is constructed and contingent upon the organisms perceptual capabilities and behaviour. As such Merleau-Ponty, like von Uexküll, would have no problem asserting that different animals may have radically different experiences of the world. So although von Uexküll would agree with Kant that we couldn't have direct experience of things-in-themselves a certain ontological necessity requires that there actually is a brute world against which each organism constructs its *Umwelt*. The existence of the

Umwelt therefore indicates the existence of this brute world and forecloses the possibility of absolute idealism.

Likewise, the positing of an *Umwelt* must not be confused with a form of naive realism in that there is no direct perception of a world. The *Umwelt* is developed by the relation of the activity of the organism with the world and as such the *Umwelt* is meaningful to that organism. The *Umwelt* therefore relies on the structure of the organism and also plays a role in guiding the future behaviour of the organism as far as it acts as an individual.

It is the presence of the regulatory and semantic aspects of the *Umwelt* which allow von Uexküll to assert that it is the presence of the *Umwelt* which allows for the development of culture. Culture and meaning are then theorized as emerging from the ongoing relation between organism and *Umwelt* (especially if the *Umwelt*'s construction can also be thought of as social).

Merleau-Ponty thus develops a philosophy of immanence from the ethological work of von Uexküll.

Unsurprisingly given the influence of the ethologist a key notion is that of behaviour. How is it that an organism comes to behave in a certain way? Alongside his use of von Uexküll, Merleau-Ponty also looks at both Gesell's Dynamic Morphology and Coghill's account of behaviour (both of which Simondon also references).

Coghill's work on the maturation of the axolotl lizard is important as it provides a scientific account of how 'the maturation of the organism and the emergence of behavior are one and the same thing' (Merleau-Ponty, 2003: 144).

His work also introduces a problem of mereology: although a physiochemical explanation suffices at the level of the parts of an organism it is not adequate to account for the organism as a totality. Philosophically this problem raises a challenge for understanding organisms as causally mechanistic.

However, if an immanentist explanation for behaviour is to be maintained, and there is to be no lapse into a crude vitalism or Aristotelian essentialism, then it must also not be allowable to look for an explanation external to the organism. Gesell's response to this is that the 'animal must be considered as a field' (150), for;

> 'Only a field has properties such that it is always distinguished from things partes extra partes, because it always includes a relation between the parts and the whole. It is a regulative principle.' (Merleau-Ponty, 2003: 150)

This field, behaviour as form, is theorized then as something that emerges from the 'lower level' system of criss-crossing motor powers of the body in an epigenetic movement. Merleau-Ponty is careful here not to fall into hylemorphism. The behaviour of an organism must not be thought of as in some way the fulfillment of what is already contained in some kind of essence (entelechy) or vital force that has always been present in the organism as this would be to 'double observed reality with a second reality' (Merleau-Ponty, 2003: 152) which would also require explanation. Instead the organism's future must not be seen as being 'contained in the present' but coming 'from the present itself'.

But how does the future emerge from the present? What is the driver of development? Merleau-Ponty's answer to this is that there is a principle of negativity or absence operating within the organism which enables development through the creation of an imbalance or disequilibrium ('The negative principle is less identity-with-self than non-difference with self' (Merleau-Ponty, 2003: 156)). This disequilibrium cannot be stabilized by a return to a previous state, due to the presence of structures within the organism which disallow it, therefore the disequilibrium must be resolved by development along another path. This form of development is to be understood not as just operating via physiochemical processes but partakes of

the notion of the totality of the organism, as theorized above as a field, and elsewhere as a 'dimension':

> 'It is less a unity of the multiple in the living than of an adhesion between the elements of the multiple. In a sense there is only the multiple, and this totality that surges from it is not a totality in potential, but the establishment of a certain dimension. From the moment when the animal swims, there will be life, a theater, on the condition that nothing interrupts this adhesion of the multiple. It is a dimension that will give meaning to its surroundings.' (Merleau-Ponty, 2003: 156)

It is through the establishment of this totality, the adhesion of the 'elements of the multiple' as well as the negativity inherent within the organism that Merleau-Ponty utilizes the work of these biologists to theorize an emergence that springs immanently from the organism.

The development of an organism progresses as a cascade where, as each structure is developed, fresh possibilities for differentiation emerge. This development is on-going and established not in advance but from within the operation of the process itself. The actual organism is only one possible realization of the potentials that were carried in each part of the organism at prior stages of its development. For scientific evidence of such a process Merleau-Ponty turns to the work of the biologist Driesch who demonstrated that the same cells could develop in different ways under different conditions therefore denying the existence of entelechy governing the development of an organism.[25]

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[25] Driesch worked on dividing the blastulas of Sea Urchin eggs and observing how the pieces grew to form complete blastulas. Merleau-Ponty quotes from Driesch's *Philosophie de l'organisme (1929):* 'There are more morphogenetic possibilities in each part of an embryo than is possibly realized in a given morphogenetic case' (Merleau-Ponty, 2003: 232).

We can also not fail to notice in the quote above that the emergent dimension which is mentioned as giving 'meaning to its surroundings' also fits the description of an *Umwelt*.

One of Merleau-Ponty's philosophical aims was to undercut the subject-object dualism that plagued his phenomenology. To do this he considered scientific developments in an attempt to form an ontology from which this dualism could be developed, whilst simultaneously ensuring it was no longer seen as philosophically foundational.

This ontological move has deeper implications than just undercutting the subject-object dualism however. With the focus on the emergence of the organism there is also a shift away from just considering already fully-individuated individuals. This in turn means a shift of emphasis from considering the subjectivity of the organism as a given and enquiring into its emergence. The philosophical import of the consideration of the organism as emergent is that the development of sensibility must also be immanent to its emergence.

It is regarding the development of consciousness as a behaviour of the organism in relation to an *Umwelt* which has emerged during the organisms maturation that Merleau-Ponty tries to capture with his notion of the flesh in his final unfinished work *The Visible and the Invisible*.

This account of sensibility (the invisible) emerging from the physical (the visible) has philosophical implications which Merleau-Ponty also links to developments in physics. A move away from the theorization of time as Newtonian, that is a series of discrete moments, and space as Euclidean, that is, having a fixed and limited dimensional range, is also required. These perspectives, Merleau-Ponty argues, are limited as they are based on the phenomenology of the fully individuated organism and do not take into account the organisms emergence. That is, just as the Cartesian view fails to account for the emergence of the organism, these perspectives fail to take into

account the process and 'pre-individual, pre-phenomenal horizon' (de Beistegui, 2005: 116)[26] from which they emerged.

With his focus on individuation Simondon is concerned with the development of the individual from the outset. Where Merleau-Ponty moves towards ontology as a means to get beyond the subject-object dualism Simondon takes this as his starting point. For Simondon this dualism, as such, is not the main issue to be resolved. For him all dualisms need to be interrogated in order to provide an ontogenetic account of how they developed from that which is pre-individual.

Thus although there are many similarities between his and Merleau-Ponty's later project, such as the central importance that the idea of the *milieu* has, their crucial point of difference is the importance of the axiomatic nature of ontogenesis via problems for Simondon. Where Merleau-Ponty describes an organism's ontogenesis as the production of a disequilibrium generated via negativity, Simondon founds his entire philosophy on the notion of metastability and the transductive mode of individuation which this enables. As such Simondon's work on psychic and collective individuation and of the cycle of the image can be understood as a reinterpretation of much of that which interested Merleau-Ponty in light of this axiomatic of the problem. With this in mind we now turn to Simondon's theories.

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[26] De Bestigui uses this description to indicate Merleau-Ponty's starting place for a 'philosophical ontogenesis' which aims to describe the genesis of spatiality and temporality for the organism; in short, to track the emergence of phenomenological consciousness. The use of 'pre-individual' indicates the kinship of this project to Simondon's own.

6.2: Simondon and Psychic Individuation

6.2.1: Affect

In the last chapter we investigated how the topology of an organism creates a resonance that is sustained throughout the interiority of that organism and also establishes a metastable relationship between its interior and exterior. Simondon recognizes the emergence of a rudimentary agency from the disparity between interior and exterior, and the ability of the organism to police the permeability of its polarized membrane.

Such agency at this level is what Simondon names 'affect'. More precisely, for Simondon, affect is that awareness an organism has of the disparity between itself (as a resonating structure) and its environment over time:

> 'The affections are an orientation of a portion of the living being in relation to itself; they realize a polarization of a determined moment of life in relation to other moments; they coincide to being with itself across time, but not with the totality of itself and its states; an affective state is that which possesses a unity of integration to life, it is a temporal unity which is part of a whole, according to what one might call a gradient of becoming.' (Simondon, 1989: 119)

Such affect needn't be conscious, in the sense of involving conscious mental activity, but nonetheless can be the cause for action. Kaufmann's example of a bacterium moving up a glucose gradient is a good example in that the affective sense of the sugar in the environment creates a transductive relation between the sensation of the presence of sugar and the action of movement in response. Affect then is the fundamental way that an organism orients itself within its environment. It operates between two different orders of magnitude and is signified in each of them differently: from the perspective of the organism it is signified as a change in its internal resonance and from an environmental perspective it is signified by a change in the organism's behaviour. This change

in internal resonance is described by Simondon as a transmission of information by which he means not information in Shannon's sense (which Simondon calls secondary) but as a form of individuation:

> 'The living being can be considered to be a node of information that is being transmitted inside itself – it is a system within a system, containing within itself a mediation between two different orders of magnitude.' (Simondon, 1992: 306)

The internal resonance of the organism came about as the result of the organization of the parts of the organism into a whole and enables the signification of the difference between this whole and what is external to and greater than it. Temporally this resonance between internal and external can also lead, via recursion, to further internal developments, external action, as well as transductive opportunities between these. In our discussion of Simondon's theory of the image in *Imagination et invention* we will investigate the recursive nature of the development of ideation in more detail.

In *L'individuation psychique et collective* Simondon sets out the genetic development from affect to psychism to transindividuality as a schematic progression through a series of transductive relations which he describes as a 'gradient of becoming'. What is key to this becoming, which is inaugurated through affect, is that at the same time as being a process of progressive individuation of the organism, due to it always being a process in which that which is exterior is brought into the interior, the individuation is never able to be completed and resolve the metastability inherent in its resonance. The process of individuation of the psychic is thus one that is asymptotic in regards to a resolution between interior and exterior, for this can never be achieved for it necessarily only ever creates further problems; for any individual is always in relation to a pre-individual that signifies its incompleteness.

From the most primary kinds of sensation and affect, perception and emotion develop via a gradient of becoming. Together with action Simondon describes these as the three dimensions of the living animal.

It should be apparent that even at the level of affect Simondon is proposing that the relation between the resonance of the organism and its milieu is described in terms similar to von Uexküll's and Merleau-Ponty's notion of the *Umwelt* (e.g. The relation of a field to world constitutive of its own temporality and spatiality).

6.2.2: Perception

The question of perception is important for Simondon for it is via perception that the psychic arises. For Simondon the question that requires answering is how a subject 'seizes separate objects rather than a continuum of confused sensations, how it perceives objects with their individuality already given and consistent' (Simondon, 1989: 73).

In developing his answer to this question Simondon addresses other theories with which, in a similar way to that in which he considered atomism and hylemorphism in relation to physical individuation, he wishes to disagree whilst also integrating aspects from them.

The three theories he considers are associationism, Gestalt theory (which he calls the theory of the good form) and Shannon's information theory.

 The theory of associationism holds that the ability to perceive objects rather than an undifferentiated continuum of sensations comes about through the habitual use of analogy and association of one experience with another in a learning process. As such it has some similarity with Hume's recourse to habit as a foundation for prediction. And just as Hume's use of the *synthetic a posteriori* is open to scepticism so also is associationism. One can question how

the initial perception upon which others are associated comes to be. If to perceive is always to engage in an analogical or comparative act then it is hard to see how perception can get off the ground. And indeed these are just the kinds of concerns that troubled Kant regarding Hume.

For Simondon associationism is also inadequate as it fails to give an account for how objects appear to have internal coherence rather than just remaining as 'an accumulation of elements'. This is a repetition of his criticism of atomism reapplied to the perceptual domain.

It is between Gestalt theory and information theory as described by cybernetics that Simondon finds a tension in need of resolution. This tension is that between the different accounts of form that each theory provides. Where Gestalt theory gives an account Simondon describes as concerned with the 'quality of information', information theory's concern is with the 'quantity of information'. Simondon situates his own account of perception as mediating the tension between these two theories via his theorization of information as *intensity*.

For Simondon Gestalt theory is concerned with the quality of form due to it seizing form as a whole 'by virtue of a certain number of laws (e.g. the law of pregnancy, of good form)'. Simondon finds this approach questionable in that the wholes that Gestalt theory is concerned with are 'merely structural' that is they do not necessarily refer to metastable and energetic wholes that are required by Simondon to form a system. Furthermore, and echoing his critique of hylemorphism, this focus neglects the genesis of form only to concentrate on the quality of the form as already perceived. This is not only a problem in accounting for past genesis but future ones as well:

'If the form was truly given and pre-determined, there would be no genesis, no plasticity, no uncertainty relative to the future of the physical system of

an organism, or a perceptual field; but this is precisely not the case. There is a genesis of forms as there is a genesis of life.' (Simondon, 1989: 74)

In contrast to the focus on the *quality* of information that interests the Gestaltist, Simondon describes the cybernetic approach to perception as focused on the *quantity* of information. As we saw in chapter 2 Shannon's cybernetic account of information is concerned with the technical problem of transferring signals.

An initial problem this raises is that this definition of information lacks semantic content. This criticism may not apply to Gestalt theory so much given one of the laws for judging form is that of pregnancy as in whether a form is pregnant with meaning, but it fails to account for the genesis of this meaning or of the forms themselves. A second issue, following on from the first, is that there doesn't hold a necessary connection between the quantities of information (however one wishes to quantify this) transmitted by a perception and how expressive or meaningful that perception is. Without this connection between form and quantity no solution is forthcoming regarding the problem initially posed as to why we see coherent objects rather than a continuum of sensations:

> 'the transmission of the image of a pile of sand or an irregular surface of granite rock demands the same quantity of signals as the transmission of the image of a well-aligned regiment or the columns of the Parthenon.' (Simondon, 1989: 87)

Simondon's solution to this problem is to introduce another conceptualization of information which is applicable only to 'subjects directed by a vital dynamism' and that is information as intensity. To understand this it is necessary to take into account the 'whole subject' in a concrete situation in which the perceiving subject is equipped 'with tendencies, instincts, passions, and not the subject in the laboratory' (Simondon, 1989: 88). For Simondon

those other theories of perception neglect the role of the polarized nature of the organism (its field), its metastability, as well as that perception is a constitutive relation between the organism and its world.

In situating perception as holding between an organism and its milieu, and more specifically that this relation has meaning, Simondon shares much with both von Uexküll and Merleau-Ponty, as we have seen. However Simondon develops this schema by describing perception as a system of individuation developed between a subject and world the entirety of which 'constitutes the unity of perception'. This system involves the continuing and recurrent activity attempting to resolve the tension between an individual that which is more-than-itself (due to its internal resonance) and the metastable pre-individual which is its world.

The subject for Simondon involves two processes of recursion which occur concurrently and which are in a problematic relation of which the subject is an on-going resolution. These two processes are the recurrence of affect and of sensation which each develops along a series of gradients into emotion and perception. This means that perception; far from concerning the distinguishing of stable pure forms or quantities of information involves a state of tension involving heterogeneous factors.

Simondon's notion of the intensity of information aims to describe this tension and the process of its resolution. Thus although good form or the amount of information involved in a perception may be relevant they don't necessarily make that perception meaningful for a subject:

'It is not necessarily the simplest and most geometric image which is the most expressive; it is also not necessarily the more detailed image, the more meticulously analysed in its details that makes the most sense for the perceiving subject.' (Simondon, 1989: 88)

On the contrary it is quite possible that an image with a reduction in both the quality and quantity of information can have more intensity for a perceiver. Thus 'a slightly blurred photograph may have more value and intensity than the same photograph with perfect gradation respecting the value of every detail, or the geometrically centred photograph without deformation' (Simondon, 1989: 88).

This is because the intensity of information relates to the perception of the organism *qua* organism; that is as vital, affective, emotional and world-orientated. Perception can't be distilled into a technical operation but requires theorizing for the role it plays regarding the organism and its relation to the world.

Such an observation may seem mundane given how one's mood or even the influence of mood altering drugs can change the 'perceptual polarity' of how one perceives certain things but nonetheless it is not something taken into account by cybernetic information theory.

The question still remains however regarding how it is that the subject comes to perceive the world as more than a confused continuum of sensations. In answer to this Simondon argues that as a transductive relation between subject and milieu it is also one of invention, in this case of form. Thus Simondon states:

> 'Before perception, before the genesis of form which is precisely perception, the relation of incompatibility between the subject and the milieu exists just as potential . . . Perception is not the seizure of a form, but the solution of a conflict, the discovery of compatibility, the *invention* of a form.' (Simondon, 1989: 76)

The invention involved in perception is the organization of intensive thresholds and differences to establish the coherency of the object. Such intensity, as we have seen, involves the subject's orientation to the world as well as the retention

of its perceptual history. In a way similar to that in which recurrent sensations can develop into perceptual activity then also past perceptions can have a conditioning effect on present perception. This brings Simondon close to a transcendental aesthetic such as found in Kant although one which is sharply distinguished from Kant in that Simondon both demands a genetic account, which Kant would condemn as a mere "physiological derivation", answering the question *quid facti* (CPR A87/B119), of any such development and in doing so also intimately connects the subject, body, emotion, action and world in a manner similar to that we've already described by Merleau-Ponty. We will more closely consider this development later when we look at Simondon's theory of the image which concerns itself with the genesis of the systemization of ideation.

However, with the theorization of intensive information it is clear that Simondon understands perceptual activity as a kind of vital individuation that is not reducible to the cybernetic notion of information.

6.2.3: The Psychic

Affectivity enables the living to resolve problems it encounters through a transductive relationship between perception and action. According to Simondon it is on the occasion that affectivity is unable to resolve a problematic situation, or in fact causes it, that the psychic emerges.

Psychical activity should not be seen as the emergence of a new substance, such as described by dualism, but as the development of new types of vital functionality which emerges in response to problematic situations organisms finds themselves in. As such the structuration of a psychic domain should be understood as a new kind of vital relation to a milieu developing out of somatic functionality.

This structuration isn't the realization of a potential that is limited to only certain vital beings, such as being restricted just to humans. Simondon is clear that psychism is not an essential characteristic of certain species but rather that many animals might 'find themselves in psychical situations, only those situations which lead to acts of thinking are less frequent in animals' (Simondon, 1989: 152 fn).

The psychical emerges then where an organism faces a problem that disrupts its seamless somatic relation with its milieu.[27] This disruption is also described by Simondon as the result of a neotenic 'deceleration of the living'[28] such that the psychic literally emerges as a response to an intervention in the operation of this relation.

For Simondon the psychic necessarily must emerge from a vital process of individuation which as we have seen is of a different modality to that of the purely physical. This emergence should be properly understood then as a structuration of the vital individual that results in both the somatic and psychic domains. This entails that Simondon must rule out panpsychism as a theory.

Additionally, this non-essentialist perspective regarding psychism also means that it cannot be utilized to 'found an anthropology' because it is only the human that demonstrates psychical ability. Some animals are capable of psychical activity and the extent of psychical activity varies not just from animal to animal but also person to person.

6.2.4: The Transindividual

Simondon claims that the psychic should also be understood as the 'nascent' transindividual. Does this mean that the coming into existence of the psychic is

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[27] The emergence of the psychic from the somatic is thus similar to the distinction von Uexküll makes within the *Umwelt* between the *Merkwelt* (the animals conscious experience of the World) and the *Wirkwelt* (the behaviour of the animal in the World).

[28] See chapter 5 (142) for a discussion of neoteny.

also the emergence of the transindividual? One way to understand this is to recall that for Simondon an individual must always be understood by its genesis, as a phase in a process of individuation and not therefore as the culmination of such a process. Such a process is transductive and as such is comprised of the relation between both individual and milieu. In the case of affectivity this relation is also one that involves meaning for the individual concerned as it orients itself within its environment:

> 'affectivity indicates and comprises the relation between the individualized being and preindividual reality: it is therefore to a certain extent heterogeneous in relation to the individualized reality, and appears to bring it something from the exterior, indicating that it is not a complete whole and closed reality.' (Simondon, 1989: 108)

The transindividual is a certain mode of relation that can be established between psychic individuals in that in doing so there occurs a *co-individuation* of those in relation to a shared pre-individual milieu. As such the transindividual marks the achievement of a double movement of individuation: in the first movement there is the physical individuation of the vital individual and in the second there is the establishment of the psychic and collective individuation, which is the transindividual.

Simondon distinguishes between two modes of relation that occur *between* psychic individuals: the inter-individual and the transindividual, thus making it clear that the transindividual relation indicates a specific accomplishment. This accomplishment is required as the resolution to a new problem that a psychic individual encounters which is precisely the disparity it finds between itself and that which exceeds it, both in respect to its environment and to other psychic individuals.

Simondon calls this situation of the incompatibly of the individual with itself the 'problematic of embodied immanence [*problématique d'immanence*

incorporée]' (Simondon, 2005: 302). In attempting to resolve this affective problem purely within itself the individual undergoes a state of *anxiety*. That is, Simondon claims, as a solitary subject it attempts to subsume within it all that is necessarily exterior to it. Such an attempt is necessarily doomed to failure.

From the impossibility of the subject finding a resolution of this problematic within itself it becomes clear that is through individuation with the collective that this problem is to be resolved for the subject:

> 'The collective taken as axiomatic in resolving the psychic problem corresponds to the notion of the transindividual.' (Simondon, 1989: 22)

The difference between the inter-individual and the transindividual relationship is that the former is unable to resolve this problem because it is a relation that 'goes from one individual to another' (Simondon, 1989: 191) but 'it does not penetrate individuals'. Instead the inter-individual relationship is understood as simple in that in it individuals relate to one another via the representations they have of one another as if they are fully-constituted individuals. The inter-individual relationship is one that is normative and based on functional relationships. Unlike in the transindividual relation, the individuals do not form a system with one another where there is an on-going resonance between them:

> '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: 191)

It is the forming of a system which involves the reciprocal action of individuals between one another as well as with the collective that distinguishes the transindividual. This becoming social of the psychic is thus clearly demarcated as the *psycho-social* insofar as what is being thought is a relation that constitutes

two poles in the sense that each (psychological/social) is just a description of the same relation (the social relation) from a differing perspective. For this reason Simondon, continuing his habit of attempting to get beyond dualisms, questions the undertaking of Psychology and Sociology as separate disciplines.

For him each disciplines area of study is situated at the extreme pole of the same social relation and as such, each limits itself from understanding the actual nature of what they claim to study. Thus psychology approaches its subject purely from the perspective of the interiority of the subject thereby neglecting the reality of exterior relation, that is that it is both a *mediation* of interiority and exteriority. Sociology, on the other hand, substantializes the determining nature of the social on the psychic reality of individuals. Both subjects overdetermine the importance of the pole on which they concentrate to the detriment of gaining an understanding of the relation that is constitutive of the phenomenon they study, which is the social relation of transindividuality. Instead of understanding the psychological and social in transindividual situation as co-constitutive and in constant negotiation the relationship is viewed as atomistic or hylemorphic, depending on the theory.

Although Simondon's critique of sociology and psychology may seem rather general given more recent developments in these fields including the development of the psychosocial as a field of study in its own right it does indicate that with his goal of encyclopedism he presaged today's growing awareness of complexity. The interconnectedness of all things has today become something of a cliché and in its holistic form as unhelpful for thought as reductionism. Simondon's attempt to think through how things interconnect, that is what the nature of relation is, without resorting to reductionism or holism is one of his great achievements.

Another way of understanding the relation of individual to society as well as that of subject to collective is through their relationship with time. That is, an

individual's relation to both past and future can be understood through the structuring relation it has with its social group.

To describe this Simondon develops a schema that describes the reality of an individual's social relation. Initially this schema consists of two groups which he calls the *group-of-interiority* and the *group-of-exteriority.*

To participate in the *group-of-interiority* requires that an individual's past and future correspond with those of others in the collective. In order to do this the individual must have a shared heritage with the group as well as share in the direction for future collective action. The delineation of what constitutes a suitable past or heritage for a group is diverse in that it might be comprised of a shared set of traditions, laws or politics or even around objects of shared interest such as religious or academic texts. The point is that via this heritage the collective has a shared past as well as a shared horizon for action in the future.

To think this as a transindividual relation we must be careful to understand this relation in its modality. It is not to say that an individual stands alongside another but rather that all individuals in the group are in a state of resonance brought about by their being penetrated by social relations which constitutes them as a subjects in that group. This can also be experienced by the subject through belief:

> 'Belief, as a mode of group membership, defines the expansion of the personality to the limits of the in-group, such a group in effect can be characterized by the community of implicit and explicit beliefs among all members of the group.' (Simondon, 1989: 177)

We can now return to the problem of anxiety that we saw was the problem for 'embodied immanence' in that it had no way to resolve the emotion of going beyond itself through action. A transindividual relation which is maintained through a *group-of-interiority* enables a resolution to this anxiety in that there

becomes available to the individual a course of action as part of a group which enables the individual to extend itself. The transindividual relation can thus be understood as different aspects of the same individuation such that an 'action is collective individuation seized on the side of the collective, in its relational aspect, whereas the emotion is the same collective individuation seized in the individual being as it participates in this individuation' (Simondon, 1989: 107).

We can now understand a little more how although emotion has its roots in the affectivity of the individual, it is also constituted via the social and 'neither the pure individual nor the pure social can account for emotion which is the individuation of pre-individual realities at the level of the collective instituted by this individuation' (2005a: 314, 315).

Additionally it is now clearer how emotion and action are also intimately linked through psycho-social individuation.

In contrast to the *group-of-interiority* there is the *group-of-exteriority*. Unlike the social relation a subject has with a *group-of-interiority* there is not an isomorphism between the past and future of the individual with the past and future of the collective in the social relation of the *group-of-exteriority*. Instead the individual does not experience a collective but rather the social. Although sometimes inconsistent in use it is worth drawing out Simondon's use of terminology here. A subject, for Simondon, is an individual that has been able to make use of its pre-individual charge through an operation of transindividual individuation. Thus he writes:

'The entry into the collective must be conceived as a supplementary individuation, utilizing a charge of pre-individual nature which is borne by living beings.' (Simondon, 1989: 215)

The subject is then an individual that has individuated with a collective thus resolving the problem of anxiety.

However an individual who has not made use of the pre-individual charge to resolve the affectivo-emotional problem through a transindividual relation is not seen to be a subject but instead finds itself unable to co-individuate. As such Simondon describes such an individual as relating to a *group-of-exteriority*.

Such an individual cannot share in the heritage or past which the collective does, the past appears to it as 'a set of isolated points' which can't be formed into a system. Similarly, relationship to the future instead of being open to a transductive collective relation of invention is one where the future is so set out as to condition the present. Due to an inability to pool its potential with others its ability to change the future or expand itself is restricted.

What Simondon is describing with these two groups is not actual social relations but the mode by which social relations develop and are experienced. Thus the *group-of-interiority* describes the transindividual relation of those who are firmly embedded in the collective. Conversely the *group-of-exteriority* describes the quality of those who are less integrated into the collective. As such these two groups mark the extreme poles of the transindividual relation with the subject/collective at one end and the individual/social at the other. The social must not be seen in a substantial sense standing in opposition to the individual but rather as the outer limits of a 'zone of participation' (Simondon, 1989: 179) in which the individual participates, which has the group-of-interiority at its core. The group-of-interiority marks the 'social body of the subject' from which it orientates itself and in which it invests itself.

As well as it being possible for an individual to shift its relation on this gradient between the two groups over time it is also likely that the nature of these groups will also change. For example the group of interiority could narrow under the influence of a fascistic influence or indeed it could broaden and become more inclusive.

One of the powerful features of Simondon's schema is that not only does it enable a direct connection between the psychological and the social but it is also applicable to the theorisation of collectives of all size. There is also no reason why it can't be applied to the simultaneous co-individuation of multiple collectives.

Thus far we hope to have demonstrated that Simondon, in extending his transductive axiomatic to the psycho-social domain, has enabled an approach to the psycho-social which falls neither into the trap of reductionism or holism whilst also developing a framework in which to situate that which we find in both sociology and psychology.

However what we have yet to really interrogate is what constitutes the pre-individual in this schema and how it could be useful in our broader enquiry into Simondon's socio-cybernetics. That is, Simondon's account depends on the pre-individual charge of nature by which the individual is able to go beyond itself, by which it transcends its own unity.

As we have seen in relation to both physical and vital individuation the pre-individual has been described in terms of energetics and disparity. It is less clear in relation to psychic and collective individuation what the pre-individual references. A passage from near the end of *L'individuation psychique & collective* does little to illuminate:

'This charge of individuated reality conceals a power of individuation which, in the subject alone, cannot succeed, through poverty of being, through isolation, due to a lack of an overall system. Together with others, the subject can be correlatively theatre and agent of a second individuation which is the birth of the collective transindividual and relates the subject to other subjects. The collective is not nature, but it presupposes the prior existence of nature attached to the subjects between which the collective establishes itself by recovering them. It is not really as individuals that

beings are attached to one another in the collective, but as subjects, that is to say, as beings which contain pre-individuality. This doctrine seeks to consider individuation as a phase of being. This phase, also, might not exhaust the possibilities of pre-individual being, so that a first individuation gives rise to beings which still carry with them virtualities, and potentials; too low in each being, these potentials, joined together, may operate a second individuation which is of the collective, attaching individuals to each other by the pre-individual they retain and carry.' (Simondon, 1989: 204)

In this passage Simondon is clear that the individual does not have enough of this pre-individuality within itself to undertake a further individuation by itself but it is not clear yet what constitutes the pre-individual in relation to subjects.

Before we can attempt to address this question of pre-individuality any further it will be necessary to also understand Simondon's understanding of invention.

6.3: Imagination and Invention

In his course on general psychology from 1965-1966, which was later published as *Imagination et invention* (2008), Simondon develops a theory of the image as the genetic development of psychic activity from the vital.

As we have already discussed Simondon was critical of psychology as a discipline due to its focus on interiority. This criticality is maintained in this course in that his theory is directly opposed to those which maintain the centrality of the subject and representing consciousness.

One target for criticism is Sartre's theory of the transparent consciousness in *L'imaginaire* (1940) in which images are the products; that is that consciousness produces representations in a form-giving hylemorphic manner.

For Simondon, this understanding of imagination as a faculty of the subject gets the description back-to-front and is in error because it excludes 'the hypothesis of a primitive exteriority of images with respect to the subject' (Simondon, 2008: 7).

Although Simondon is sometimes described as a phenomenologist this attribution is not entirely accurate as he is less interested in describing the relation of phenomenal consciousness to the world as describing the genetic process by which vital organization gives rise to, and is continued in a different mode, by the psychic activity upon which phenomenological consciousness is constructed.

What Simondon proposes, regarding organisms with central nervous systems, is the reality of a pre-conscious (or at least subconscious) 'fund of images' which underpin and make possible the forming of representations. That is to say that for Simondon images arise prior to and independent of consciousness as such and are also prior to and necessary for perception and any intentionality of consciousness.

To understand this we need to describe the genetic theory of the cycle of images which Simondon proposes. The cycle has three phases: the first involves the development of an image which is an 'embryo of activity and perception'; the second involves the development of a perceptual world along with various 'schemas' of response to it; the third involves a systemization which results in the development of a mental model of the world. Each phase of this image-cycle can be 'related to a dominant activity or function'; these are anticipation, experience (perception) and memory.

Earlier we noted that Simondon, like Merleau-Ponty, made use of Gesell's work regarding the ontogeny of behaviour[29] and in particular how it developed alongside the growth of the organism. In this as well as in the work of other biologists and ethologists (such as Coghill and Jennings) Simondon discerns the emergence of what he calls a 'motor-image of anticipation':

> 'But in fact, Gesell's studies have shown that the ontogeny of behaviour is similar to growth: not only is it made according to the principles of polarity, orientation, according to gradients, and not evenly like a balloon that is inflated, but it also occurs according to successive cycles separated by de-differentiations preparing new structuration. Each step results at the end of the cycle to a defined behaviour, which might stand on its own unless it was only a moment of a larger genesis; temporarily abandoned, it will be reincorporated in its essential lines to the definitive more complex synthetic "pattern". It is this existence of the essential lines of behaviour that can be considered as furnishing the content of the motor images of anticipation of the conducted.' (Simondon, 2008: 38)

In the first phase of the cycle these anticipatory motor-images develop endogenously in the organism independently from one another in a 'free state' in a manner analogous to the growth of organs. As such, Simondon clearly indicates that this phase is biological or vital.

Thus although these images may be independent from one another at this stage of the cycle they all develop in relation to an associated milieu. Simondon conceives of images at this anticipatory stage (that is prior to experience) as activity that has been put in reserve, that is as the developed behaviour of the organism it has acquired as it has grown; he describes such reserved behaviours as virtual. What Simondon has in mind here is the spontaneous development

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[29] The phrase 'ontogeny of behavior' indicates the idea that 'behaviour could be treated like a body' (Merleau-Ponty, 2003: 148). That is to say that behavior of a body can be ontogenetically accounted for in the same way as its form.

of patterns of behaviours (which are often described as instinctual) such as those related to typical situations like feeding, evading predators and mating.

An important consequence of this theory is that of the primacy of motoricity. That is to say that an organism's motor abilities are developed prior to (or at the very least contemporaneous with) the development of perception. This priority holds from simple organisms to the more complex; from the unicellular organism's development of a polarity as an index of orientation to the human whose motoricity begins developing during its time as an embryo.

> 'To say that the motor precedes the senses, is to assert that the stimulus-response pattern is not absolutely the first, and that it refers to a situation of actual relation between organism and environment which has already been prepared by an activity of the body during its growth. Research by Jennings on the simplest organisms show that reactions (performed in the presence of an object) are preceded by motor spontaneities existing before receipt of signals characteristic of an object.' (Simondon, 2008: 29)

The priority Simondon gives to motoricity not only places him outside the remit of phenomenology (at least as that characterized by Husserl) but places him in a radically non-Kantian position regarding the questions of the possible conditions for both perception and knowledge. As Mark Hansen observes:

> 'By defending the autonomy of the sensory, Simondon is able to correlate the image with motoricity *prior* to the advent of perception and to maintain its independence from object perception.' (Hansen, 2011: 110)

This independence of the image is another radical difference in Simondon's theory. Unlike in representational theories of the subject where the image is created by the subject Simondon argues that the image actually has a relatively independent existence from the subject; to such an extent in fact that he describes the image as like a parasite; that is to say that although it is reliant for its existence on the organism the image develops within it independently.

Simondon describes the second phase of the cycle of the image as that of experience. In this stage the previously independent anticipatory images organize into groups according to the reception of information from the milieu. It is at this stage that the images are described as forming a 'world' for the organism and attain a functionality of both stabilizing the relation between the organism and milieu as well as developing schemata of response to the world.

It is clear that such an understanding of world for Simondon is close to how Merleau-Ponty utilizes von Uexküll's notion of *Umwelt* in developing a philosophy of immanence: that is the *Umwelt* as the relation of an organisms activity with a milieu.

In this second phase the organism moves beyond merely anticipatory, 'instinctive' reactions and obtains 'the perception of its present state, with appreciation of variations and differences . . . The image is used here as an instrument of adaptation to the object, it assumes that there is an object, and not merely a situation' (Simondon, 2008: 22).

Perception can then be understood as a function which emerges from this secondary phase of the image and also as the development of a psychology in the form of a mental analogue of a primary relationship with the milieu which enables the organism to move beyond just instinctive responses and organize responses to objects (planning/motivation).

Perception then is never direct but relies on this fund of images which are organized relative to experience of the object in a recursive fashion, in what Simondon calls an apprenticeship. Such an apprenticeship involves the development of schemata to help organize responses to the milieu via experience.

The third phase of the cycle is that of a systemization of images, built on this apprenticeship, utilizing an affective-emotional resonance which:

'achieves the organization of images in a systematic mode of links, evocations and communications; it creates a real mental world where regions, domains, qualitative key points by which the subject possesses an analogue of the external milieu, having also its constraints, its topology, its complex modes of access.' (Simondon, 2008: 19)

This resonance is the development of the function of memory for Simondon and enables the 'ability to relive situations from the evocation of the image'. Additionally this phase also involves a systemization of the images and the achievement of a 'real mental world'.

It is here that Simondon comes closest to a Platonism in that he discusses the formal role that such a systematized image can have.[30]

'Like anticipation the a priori image appears as a form of motor intuition, a scheme of projection from an active center of spontaneity and radiating towards the plurality of situations or objects.' (Simondon, 2008: 22)

In chapter 2 we discussed Simondon's concept of technical mentality; that is how schemata of thought have been based through analogy on technical operation. Simondon cites Cartesian rationalism and cybernetics as examples. Such schemata can be understood as the systematic organization of images which, so organized, can facilitate a formal relation to the world.

It is at this point that Simondon introduces the notion of invention as a fourth and final phase of the image cycle. As we have already described, for Simondon, the image is to be understood as a process involving a process of formalization through a cycle of phase-shifts. Additionally each phase of this cycle is related to a function (anticipation, perception, memory). The third stage consists in the systemization of symbolic images. However any

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[30] Again we can correlate a stage of the image-cycle to von Uexküll's theory. The achievement of a 'real mental world' is similar to von Uexküll's *Gegenwelt*, the more advanced form of *Umwelt*, which acts as a symbolic mirror of the world that the organism stands opposed to.

systemization can become problematic if it becomes saturated in such a way that it is unable to integrate new information. Such a situation can result in the dephasing of the current systemization resulting in:

> 'a new state of free images allowing the recommencement of a genesis: the invention would be a renaissance of the cycle of the images, allowing an approach to the milieu with new anticipations from which emerge adaptations that were not possible with primitive anticipations and a new internal and symbolic systematization. In other words, the invention makes a change of level, and marks the end of one cycle and the beginning of a new cycle, each cycle consisting of three phases: anticipation, experience, systematization.' (Simondon, 2008: 19)

Thus invention can be understood as a transductive operation where the symbolic organization is dephased due to a disparity within the organization of a system of activity. Furthermore a true invention is one which involves the invention of an object, just as production would not have occurred were there no product, a process which Simondon understands as the making exterior of the process of the image (material images). That is not that the invented object was first a representation to a consciousness that has then been realized externally but that the exteriorization is a part of the process of the development of the image itself and in turn helps in the ongoing systemization of the image through its involvement in structuring the relation of organism with milieu. The image then is always the on-going support of the process of the organism-milieu. As such we must also consider it to be a support for the transindividual:

> '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. Every image is susceptible to incorporation in a process of materialising or idealising recurrence; deposited in fashion, art, monuments, technical objects, the image becomes a source of complex perceptions awakening movement, cognitive representation, affections and emotions. 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: 13)

In this remarkable passage Simondon connects within a recurrent causal relationship the gradations of psychical activity from sensation to ideation and transindividuality with the world of artefacts described as object-images. The reciprocal flow of causality that connects the 'mental to the objective real' takes on a similar relationship as that of the oil and water in the Guimbal turbine which implies a truly novel way of thinking the psychic, the social and technology as systemically modulating one another.

What Simondon's *Imagination et invention* suggests is that to make sense of the pre-individual for psychic and collective individuation requires it to be thought, at least, at all levels of the development of the image given as these are conditioning of one another as well as invention. Such a trajectory necessarily also complicates any attempt to theorize technology.

For example, such an approach rules out the understanding of technology as substantive given it's interwoven in this causal loop. Instead technology, as one

form of object-image will need to be understood in its causal relation at all levels of the gradation of the psychic. There is already some work being undertaken to implement this Simondonian insight especially for understanding contemporary digital technologies in relation aspects of the psycho-social just outlined. We will attempt to address some of these in the final chapter.

For example the anticipatory and motor dimension indicates that our engagement with a milieu must involve aspects which are pre-phenomenal. This is an area investigated in the recent work of Mark Hansen who in attempting to theorize contemporary digital technologies considers the 'mental image as microtemporal pattern of cognitive activity' (Hansen, 2011: 87), that is at a level prior to that of discursive determinacy and phenomenology, for example.

Memory is also another important aspect of this relation and this is something Bernard Stiegler theorizes in his work which views technology primarily as mnemo-technics. There is certainly much to commend this perspective although we will perhaps not draw the same conclusions as Stiegler regarding contemporary technology use if we try it understand it as involving a broader relation to the social than just at the level of memory, as the cycle of images suggests we should.

Similarly there has been plenty of work already on the relation of technology to perception/cognition by authors such as Hubert Dreyfus (post-phenomenology).

It must be remembered that symbolization also involves an affective and emotional dimension and thus these must also play a part in constituting any understanding of technology. This also reminds us that the image involves an organism's relation to its milieu and that this is not fundamentally linguistic

but auto-kinetic. Hence we can more clearly understand why Virno's understanding of the pre-individual as general intellect is too narrow.

Finally, we can also enquire about the transindividual existence of the schematic forms of understanding which imply a type of Platonism regarding ideas or at least a similar way of understanding the development of ideas as described by Thomas Kuhn.

It is perhaps now clear that the scope for such an investigation of technology is going to be extremely broad and complicated.

But before we can attempt this we must first address Simondon's own perspective on technology containing as it does another key idea that must be incorporated into our analysis which is the reality of technical evolution as a causal factor.

To conclude, it should now be clear that with his description of the problematic development of psychic activity and the cycle of the image that Simondon has moved beyond the kind of phenomenological approach undertaken by Merleau-Ponty. Despite sharing a similar project for developing an ontological account of psychic activity Merleau-Ponty doesn't manage to extricate himself clearly enough from a phenomenological perspective. Simondon manages to make a more decisive break from phenomenology and develop a more thoroughgoing ontogenetic approach. This shift is perhaps most clearly expressed in the way that Simondon extends the importance of thinking individuation by way of the relation with a milieu from just that as occurring at the psychic level like Von Uexküll to also occurring for individuation at all levels of reality.

Chapter 7: Gilbert Simondon's Philosophy of Technology

7.1: Philosophy of Technology

Before looking at Simondon's philosophy of technology I first want to outline some of the key work in this field with which I will contrast Simondon's position.

A good place to begin is to ask why such a philosophy is required? What is it about technology that it requires independent consideration alongside other traditional philosophical areas such as ethics, metaphysics, aesthetics or politics?

Indeed there are some who deny it has any such claim and who therefore subsume technology's relevance to other more fundamental areas, the most simplistic of which would be those who understand technology as being nothing more than a means to an end.

An example of such a perspective is Frederick Ferré's definition of technology as the 'practical implementations of intelligence' (Ferré, 1995: 26).

Such instrumental perspectives understand technology in terms of its relevance for situations which are usually understood as essentially human in nature. Although this definition doesn't rule out non-instinctive tool use in other species, due to the relative unsophistication of this (e.g. lack of application of scientific thinking) it tends to be absorbed into humanistic accounts or ignored altogether. Thus from these perspectives technology is subsumed into other more fundamental humanistic modes of understanding such as its value for the common good (Utilitarianism), effectiveness at solving problems (instrumentalism) or as socially constructed as in nominalism where denominated technological objects are understood only by those properties which are seen to be appropriate for the conceiver.

Although it may be the case that such reductions are rare what the philosophy of technology generally attempts to describe, and which these positions don't address, is in what way technology can be understood to *exist* apart from the human.

In particular the philosophy of technology has generally been associated with a group of twentieth century philosophers who on witnessing the widespread development and implementation of mainly thermodynamic technology saw in it not just the means to human ends but a phenomenon with a power of its own that in some way stood apart from humankind and even nature, that is to say that it had its own essence.

Of this group of first-generation philosophers of technology I will briefly discuss two of the most prominent: Heidegger and Ellul.

7.2 : First Generation Philosophy of Technology

7.2.1: Heidegger & Technology

In his influential essay 'The Question Concerning Technology' Heidegger (1977) also begins his analysis of technology by considering it from instrumental and anthropological perspectives and although he sees these as being 'correct' he also argues that both approaches fail to uncover the 'essence' of technology.

To uncover this essence requires further investigation into the correctness of the instrumental definition to understand 'what is the instrumental itself?' (Heidegger, 1977: 6). This enquiry reveals that what is really under discussion is the nature of causality. That is, instrumental talk is a way of referring to means and ends, which are causal terms. But what kind of causality, Heidegger asks, is instrumentality?

His reply is that instrumentality is a *way of revealing*, a way of bringing-forth and most significantly: 'It is the realm of revealing, i.e. of truth' (Heidegger, 1977: 12).

The connection Heidegger makes between revealing and truth emerges from his understanding of the Greek word *techne* which is also connected to *episteme* in that both words refer to knowledge: 'Both words are names for knowing in the widest sense' (Heidegger, 1977: 13).

Thus more significantly than technology being a pragmatic means to an end (as in manufacturing) is that it is also a mode of revealing, not just in the sense that making something is to reveal something that was not there before, but in the epistemic sense that it is the condition under which understandings and knowings of Being arise. Additionally Heidegger argues that modern technology, which is indissociable from the projects and understandings of the physical sciences, results in a different kind of revealing to that of precedent technology.

Where older technology is connected with *bringing-forth* in acts of *poiesis*, that is through artisanal and artistic creation, modern techno-science involves a *challenging* of nature. This challenging refers to the ways that modern technology goes beyond working in harmony with nature *as it is found* and requires its constant reorganisation and stockpiling as resource for utilisation in human projects. Modern technology is concerned with dominating nature as efficiently as possible for rational human ends with little value placed on other concerns.

In one famous example Heidegger describes a dam on the Rhine as reducing the great river to a mere component of a power plant:

'What the river is now, namely, a water power supplier, derives from out of the essence of the power station. In order that we may even remotely consider the monstrousness that reigns here, let us ponder for a moment the

contrast that speaks out of the two titles, "The Rhine" as dammed up into the *power* works, and "The Rhine" as uttered out of the *art* work, in Hölderlin's hymn by that name. But, it will be replied, the Rhine is still a river in a landscape, is it not? Perhaps. But how? In no other way than as an object on call for inspection by a tour group ordered there by the vacation industry.' (Heidegger, 1977: 16)

In the passage that follows there can be little doubt that Heidegger's conception of what constitutes modern technology is not just thermodynamic but also cybernetic. Technology in the modern age certainly exploits the natural world as a supply of raw material and power for production but just as significant is its organisation via control and regulation. That such control and regulation have come to direct all aspects of modern life reflects the global scope of cybernetics.

Furthermore Heidegger describes the way in which modern technology, in its relation to the development of modern physics, enables the reduction of nature to a 'reporting' of itself as a system of information. The relationship of cybernetics with modern science (technoscience) is understood by Heidegger as a self-sufficient, positive feedback loop and therefore in danger of eluding control.

Indeed it seems to be the combination of this reduction and the re-organisation of nature by technoscientific planning to which Heidegger particularly objects. A windmill utilises the natural power of wind yet leaves that power unaffected and works within the limitations of its natural occurrence, whereas a damming project re-organises the flow and route of the river in such a way the water becomes a quantifiable stockpile for future energy production within a wider technical system.

It is this circumscription of natural phenomena within broader technical systems which Heidegger refers to with the term *Gestell* (*enframing)* which is

also 'that way of revealing which holds sway in the essence of modern technology and which is itself nothing technological.' (Heidegger, 1977: 20)

This is to say that *enframing* describes the technological mode of truth (revealing or 'un-concealment', *a-letheia*), which is the way that actuality is constrained to be a 'standing reserve' for use for rational ends. It is *enframing* which Heidegger identifies as the essence of technology even though it is itself 'nothing technological'. Although this essence physically emerged in the eighteenth century through the development and use of industrial and scientific technology it was present and theoretically dominant in the seventeenth century because of the widespread acceptance of mechanistic causality, thus:

> 'In Enframing, that unconcealment comes to pass in conformity with which the work of modern technology reveals the real as standing reserve.' (Heidegger, 1977: 21)

For Heidegger truth is the manner the world is revealed for us, that is how it appears to us and how we understand it. To understand it as mechanistic and fully calculable – that is, as informational – does not require any actualisation of industrial technology. But with such actualisation comes the great danger not only of the destruction of natural phenomena but that man also comes to understand himself as a mere standing reserve at the disposal of technological systemisation, as one amongst many beings-in-reserve.

There is then a historical dimension to Heidegger's account in which the essence of technology is understood as a 'destining of revealing', that over time, this particular technological enframing not only becomes the dominant way of understanding the real but the horizon of the possible ways by which man engages with Being:

> 'What is dangerous is not technology. There is no demonry of technology, but rather there is the mystery of its essence. The essence of technology, as a destining of revealing, is the danger.' (Heidegger, 1977: 28)

The threat then is that the possibility for Being to disclose itself to man in any other way than as standing reserve, due to this event of technological enframing, becomes more remote over time leading to a world where man is increasingly integrated into technological systems with no understanding of his being other than through instrumentality and as a resource for technological systemisation.

For Heidegger this onto-destinal process endangers man's essence as it impedes him from entering 'into a more original revealing and hence experience the call to a more primal truth' (Heidegger, 1977: 28).

This is not to understand this process as being one of causal technological determinism, for Heidegger is not claiming that certain technological developments cause certain cultural outcomes. Rather he claims that mans place amongst beings is determined by a specific metaphysical enframing due to modern technoscience.

Subsequently, Heidegger's solution for escaping enframing is also metaphysical in that he suggests what is needed is the development of a 'free relation' to technology. By this Heidegger means the development of an understanding of what the essence of technology is so that it's no longer seen as fundamentally important but 'remains dependent upon something higher' (Heidegger, 1966: 54 quoted in Feenberg, 1999: 185).

The something higher is Being and what the 'free relation' to technology enables is that man enter into a relationship with Being which reveals the essence of another mode of truth. That is, it is a relation where the revealing-concealing nature of technology is understood thus enabling the disclosure of truth.

This essence would be one where Being is not experienced as a calculable standing reserve but is known via meditation, art and poetry. That's not to say that technology should be dispensed with. Heidegger is not motivated to argue for a world without technology, only that our relation to it must change and

through that change we would develop and use more artisanal technology (such as the windmill described earlier) and, presumably, avoid the runaway reinforcement of technoscientific enframing, enthralled by its self-determined 'successes'.

One of the reasons Heidegger's philosophy of technology has remained so influential is that it draws together some of the more traditional ways of thinking about technology even if only to ultimately go beyond them. He accepts both the instrumental and anthropological descriptions of technology as 'correct' even if they fail to describe technology's essence. He also acknowledges that technology is a historical phenomenon, emerging from as far back as Ancient Greece. His position also understands technology ontologically in the sense that in its modern form it substantially stands in opposition to man and nature in a way that operates differently to Aristotle's traditional modalities of causation, replacing these with a more cybernetic account of goal-directed positive feedback. As a mode of revealing Heidegger is clear that the essence of technology is also epistemologically conditioning, a situation which ultimately has ethical consequences.

What Heidegger's account also has in common with other so-called first-generation philosophers of technology is that he also describes man's relation to technology as one involving alienation. His description of alienation, as we will see, is different from those given by Marx and Simondon however. For Heidegger technology is alienating for man because it distances him from the essence of truth. As we have seen this is because technology both provides its own configuration of truth (that is the way that beings manifest themselves, as standing reserve, for example) but also conceals man from his own essence by doing so.

What ultimately enables such a substantive account is that Heidegger's account is transcendental in the sense that it describes the conditions of

possibility for the revealing of beings as governed by modern technology and understands this as what is essentially important about it. Accordingly in this account heterogeneous instances of actual technology have little import other than as symptoms of the deeper problem of the technological condition in which mankind finds itself, hence the surprising ability for Heidegger to understand concentration camps and industrial agriculture as part of the same historical process of enframing.

The conditions of possibility that Heidegger describes are famously not technological but are epistemological and therefore ontological in that they concern revealing and unconcealment. In particular, with his conception of technoscience, this conditioning has an essentially cybernetic processual character.

7.2.2: Jacques Ellul

Another influential first-generation philosopher of technology is Jacques Ellul. He also shared a similarly cautionary outlook regarding modern technology and cautioned about what he saw as its determining drive for ever-greater efficiency, that is, *operational effectiveness*.

Although he argues that he develops his theory by way of empirical investigation Ellul's conclusion are not so far from Heidegger's in that he sees mankind as collectively conditioned by *technique* or 'technological civilisation' in much the same way as Heidegger argues that mankind is captured by enframing.

For Ellul *technique* is defined as 'the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity' (Ellul, 1964: xxv). As such *technique* is not understood principally as a form of unveiling. Perhaps due to his considerable interest in

sociology, Ellul doesn't consider *technique* as an essence but nevertheless as a conditioning influence that invades every aspect of the life of Western civilisation.

Ellul sees *technique* as forming a system which has a structuring effect on human society, to such an extent in fact that its goal can be seen as the removal of human interference within that system. In a passage which explicitly references cybernetics when describing the automatic piloting of aircraft he writes:

> 'This progressive elimination of man from the circuit must inexorably continue. Is the elimination of man so unavoidably necessary? Certainly! Freeing man from toil is in itself an ideal. Beyond this, every intervention of man, however educated or used to machinery he may be, is a source of error and unpredictability.' (Ellul, 1964: 136)

Like Heidegger, Ellul identifies the root of the problem with *technique* as its reductionism towards calculation and automation, the perfection of which, as implied above, mankind is an impediment to. Like Heidegger he also describes the roots of *technique* as emerging from ancient Greece and flowering during the Industrial Revolution when *technique* exploded 'in every country and in every human endeavour' (Ellul, 1964: 42). Ellul can be seen as being more pessimistic than Heidegger however. Due to its metaphysical nature the possibility for a different relation to technology is contained in Heidegger's theorisation of it. However Ellul doesn't understand technology in terms of a relation to truth. For him technique is truly determining of culture in a causal sense in that since the industrial revolution it has become self-augmenting in that it develops 'without decisive intervention from man' (Ellul, 1964: 87). This has occurred due to the widespread penetration of technique into all aspects of cultural life meaning that technology now structures cultural life to such an extent that any change in technology necessitates a cultural transformation.

Given this Ellul's theorisation doesn't contain a redemptive aspect. He tends to be pessimistic about the chances of escape from this situation without some form of divine intercession.

7.3: Critical Theory of Technology

If we are to arrive at an understanding of the significant currents running through the philosophy of technology, we must also consider the critical theory of the Frankfurt School. To do this I will briefly consider the position of Herbert Marcuse who understood technology as symptomatic of a greater structuring force, that of instrumental reason.

Although Marcuse understands technology as having a formative role socially, particularly that of subordinating humans and nature to the ends required by systemisation, he doesn't essentialize this as Heidegger does, and thus, although he emphasizes the same functionalist tendency to determination as does Ellul, he offers a challenge to the latter's understanding of this having passed the point of no return. Instead he understands technology as one way society is organised through power and domination thus opening up the possibility of the creation of other kinds of technologies that support different social values which aren't so instrumental and exploitative. It is through this opening that Andrew Feenberg utilizes Marcuse's thought to help establish his social constructivist project. Such a constructivism thus necessarily denies the cybernetically positive developmental power of technology in order to counter determinism. In doing so it also avoids essentializing technology.

For now I just want to highlight that aspect of what might be called the first-generation of thinkers of modern technology which involves, loosely, thinking technology as having an essence which it reveals in the operations by which it structures reality. Technology is thus understood both ontologically (essentially) as well as epistemologically (in that it reveals). With all of the

thinkers considered thus far the essence of technology or *technique* is equated to a self-amplifying operation of control and efficiency via rationalisation, measurement and calculation.

Similarly these thinkers see technology as both symptom and perpetrator of a more fundamental operation that stands ontologically opposed to an essential humanism. In each case it is a return to a humanism that is seen as the cure: Heidegger argues for a more poetic relation between man and world, Ellul vainly seeks the answer in both Christian spirituality and Left-wing politics both of which he sees as having themselves been compromised by the very *technique* he hopes they might answer. Marcuse and Feenberg both propose a form of constructivism whereby ethical values are materialised in technology.[31]

As we will see Simondon is also concerned with these issues although develops a different response.

7.4: Second Generation Philosophy of Technology

7.4.1: Empirical Philosophy of Technology

It's necessary to also mention a second group of philosophers of technology who followed those discussed above.

These philosophers can be understood as constituting an empirical turn in the study of technology in that they 'look at concrete empirical manifestations of different technologies' (Achterhuis, 2001: 3).

This turn moved away from the essentialist approach that was the hallmark of the first-generation thinkers and instead investigated concrete instances of technology in terms not only of the various transformative effects they have on

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[31] We will discuss Feenberg's constructivism in more detail below.

the world but also in order to understand the heterogeneous aspects of social reality which shaped their development.

Thus unlike the earlier philosophers who give a broadly linear causal description leading from technical essence to technical society these philosophers attempt accounts which allow for a more co-constitutive relation between technology and society. As such many of the thinkers who fall under this description have strong links with Social Constructivism.

I won't describe these thinkers here in depth as we are here focussed on Simondon's work but some key names that can be associated with the empirical turn are Bruno Latour, Andrew Feenberg, Donna Haraway and Don Ihde. Each of these thinkers has quite different ways of articulating the relationships between technology, society, culture and nature but each of them sees the relationships as co-constructive in some manner.

What I want to argue in this and the following chapter is not only that Simondon develops a unique philosophy of technology that directly responds to those broad questions regarding the challenge of modern technology we witnessed with Heidegger and Ellul. But additionally that Simondon also develops his thinking in an empirical manner which considers the concrete being of technical phenomena in a way that significantly predates those philosophers associated with the empirical turn.

However, and vitally, Simondon charts a philosophy of technology that navigates a course which can't be subsumed to any of these positions. He avoids essentializing technology although it has its own mode of existence. This modality means that he can avoid constructivism without lapsing into determinism.

Simondon is able to achieve this due to the unique place that technology has within his broader investigations into physical, vital and psycho-social individuation we've outlined in previous chapters.

7.5: Simondon's Philosophy of Technology

In this section I will discuss the philosophy of technology developed by Gilbert Simondon, predominantly in his 1958 book *The Mode of Existence of Technical Objects*.

Simondon's work on technology complements and builds upon his work in other areas and is a further application of his relational ontology and theory of individuation. In fact, technology holds a special place in his thought as it is the domain that traverses all three of the regimes of individuation that constitute nature for Simondon.

Technology occupies a complicated place in Simondon's work not only because of this unique ontological status but also because it plays an important role in his account of social transformation.

Unlike Heidegger and Ellul he avoids essentializing technoscience as a self-generating and cybernetically positive process due to the ontogenetic nature of his realism. That is to say that for Simondon the generative development of technology is not determined by an essence because although it has a mode of individuation this modality involves the admixture of all three regimes of individuation.

We will begin this account by describing Simondon's account of concrete technical objects.

7.5.1: Concretization and the Associated Milieu

For Simondon, the development of technical lineages should not be understood through functional or instrumental progression (e.g. interpreting the history of recording devices as a lineage) but through the development of internal

operations. Thus steam trains are not of the same lineage as electric trains, even though they fulfil the same function, because their actual technical mechanisms have developed from different origins. This already disables a species of essentialism that settles essences around a homogeneous lineage.

Instead technical development should be understood as a development that is led by the technical structure itself, which in the course of its operation unveils and concretizes previously undiscovered synergies and relationships.

This mode of existence is framed as the process of a technical object's development via the notion of concretization, which can be understood as a directed and unifying transduction[32] within the regime of physical matter which shares some similarities with that of vital individuation. Simondon describes a concrete technical object as:

> 'one which is no longer divided against itself, one in which no secondary effect either compromises the functioning of the whole or is omitted from that functioning . . . The essence of the concretization of a technical object is the organizing of functional sub-systems into the total functioning . . . Each structure fulfils a number of functions; but in the abstract technical object each structure fulfils 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: 31)

The shift from abstract to concrete is key here. The abstract form of a technical object is that of a technical object that has 'an intrinsic perfection of its own that needs to be constituted as a closed system in order to function' (Simondon, 1980: 14). Such abstraction describes the object as being hypertelic in that being closed it is abstracted both from its genesis and the possibility for further pluri-functional development. Simondon uses the example of the move from

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[32] For a definition and discussion of transduction see chapter 3 (74-80).

water-cooling to air-cooling systems in combustion engines to demonstrate this shift:

> 'Although a water-cooled engine consists of two systems that are perfectly suited to carrying out their specific functions, when linked there is a degree of disparity between them. Simondon refers to the joining of conflicting technical individuals as creating a 'series of problems to be resolved.' (Simondon, 1980: 14)

The concretization process is that by which such problems are resolved. Thus, the development of air-cooled engines, by the addition of gills to the cylinder, is seen as a measure of concretization because the engine's cooling function is no longer provided by a separate closed water-cooling system, which requires its own conditions for operation that conflict with the operation of the engine, but as part of the normal operation of the single technical system.

Additionally, a further degree of concretization can be discerned because the same gills that are used for air-cooling also act as structural supports for the cylinder head. We therefore witness in this progression a move from conjoined abstract structures which are problematic, to a single pluri-functional concrete system.

Another aspect of the definition of an invented technical individual (ITI) is that, as part of the organization of functional sub-systems into a total functioning, an associated milieu is also invented and maintained.

It is important that the specific meaning Simondon gives to the term 'invention' is grasped here. Invention does not refer to the traditional hylemorphic notion in which a subject has an idea and then builds something that corresponds to that idea; rather it is the 'birth' of a new environment or 'regime of functioning' (Massumi, 2010: 39) brought about by the operation of recurrent causality involving the actual operation of the technical individual itself. We can think this a bit more clearly by referring back to the discussion of

Imagination et invention in chapter 6 (185-194). There invention was described as the completion of the cycle of the image for a psychic individual and indeed Simondon is not claiming that technical invention occurs without the aid of the thinking living being but rather that the recurrent physical causality has an important role to play as well. The individuation of the technological object thus involves a total functioning which includes both the individuation of the object as well as the concretization of its operation in thought *qua* image. First, the physical causal recurrence itself is operational in the constitution of the image itself as image; in this sense the imagination itself must be thought of as constituted through causal processes that are physical. But also such invention can be strongly emergent in nature in that the result, the nature of this new regime of operation, is not wholly foreseeable by the human inventor.

The invention occurs because a jump is made, that is both ontological and also often epistemological, and this jump is justified by the relationship which is instituted within the environment it creates (Simondon, 1980: 59).

Again the notion of invention described in relation to technical objects is very similar to that which was described involving both physical and vital individuation. In relation to the latter Simondon writes:

> 'The state of a living being is as a problem to resolve which the individual becomes the solution to through successive arrangements of structures and functions [. . .]. The development may then appear to be the successive invention of functions and structures that solve, step by step, the problem carried internally as a message by the individual.' (Simondon, 1964: 223)

Just as the progression of individuation in the living involves the resolution of a disparity by an invention which is constructive and 'incorporates the poles of the disparity that is the problem' (Simondon, 1964: 241) so what we find in the development of the technical lineage is the progressive resolution of problems through concretisation.

Additionally, just as with physical and vital individuation, Simondon is clear that technical invention requires that any problem that is resolved will result in the technical individual being partly constituted in a relationship with a new environment and not just in the abstract individual being 'added to'.

This new environment is what is named the ITI's *associated milieu*. When discussing the associated milieu Simondon writes:

> '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: 60)

Of particular importance in reading this passage is how the word 'natural' is understood. As we have seen in Simondon's ontology, nature consists of three regimes of individuation: the physical, the vital and the psycho-social. Therefore it is possible to interpret this passage as stipulating that a technology's associated milieu can be constituted in relation to any of these regimes. However, in *The Mode of Existence of Technical Objects* the description of concretization presented gives an overwhelming impression that by 'nature' in this passage Simondon is limiting his scope to the regime of physical individuation. This impression is emphasized by the disdain with which Simondon greets the intrusion of cultural factors into technical concretizations – witness his scorn for decorative fins, power-steering and starter motors for automobiles which he explains away as advertising driven gimmicks – which

either add abstraction and disparity to a technical individual or disrupt its concreteness.

Such abstraction entails that the automobile becomes hypertelic: 'The automobile, this technical object that is so charged with psychic and social implications, is not suitable for technical progress' (Simondon, 1980: 21).

The concretization process, which Simondon describes as the true evolutionary principle of technical objects (which he also calls mechanology), also operates separately to economic and cultural concerns and can't be reduced to 'anterior scientific principles' (Simondon, 1980: 48). It is the study of technical individuals that aids the discovery of synergies, boundaries and indetermination in their operations which lead to the possibilities for further invention.

Mechanology is also framed as a type of scientific development in that it reveals previously hidden virtualities and makes them available for further concretization. There is thus, to some extent, a resemblance between mechanology and technoscience. As Bernard Stiegler writes:

'If a mechanology is necessary, this is because the laws of physics, no more than those of sociology or psychology, or all of these as a whole cannot suffice to explain the phenomenon of the technical object qua the genesis of an individual and production of an order.' (Stiegler, 1998: 76)

This account of mechanology as a scientific investigation again emphasizes the distance Simondon keeps the process from cultural influence. Given the non-separation of culture, which Simondon calls the psycho-social, from nature in Simondon's ontology why is there this apparent denial of culture's involvement in mechanology and the concretization of technical individuals in *The Mode of Existence of Technical Objects*?

Because of this distancing it is tempting to see mechanology as a process of purification as described by Latour (1993) in *We Have Never Been Modern*; that is, as a process that constructs an account of nature purified of any social involvement and vice versa.

This sense of mechanology as a purified process can also be discerned in Paul Dumouchel's summation of Simondon's position:

> 'It is not because of the uses we put it to that modern technology radically transforms the world, but because technology gives existence to phenomena which were not there before and because technical individuals provide the conditions of the processes which constitute them. Thus there is no alternative technology which contains different values with respect to nature. What technology teaches us is that there is no "nature" in the sense of a set of events and processes which are essentially different from those which are produced artificially. According to Simondon there is no technology which can respect what is, for technology is essentially the coming into existence of the virtual.' (Dumouchel, 1995: 268)

Dumouchel makes clear that any leap of invention requires the existence of the technical object. There is a sense in which the technical object comes first and transitions occur around it. But these developments progress through an internal logic divorced from the normative domain. As a purified account of technical development Simondon's account is important for its description of the operational development of technical individuals.

In the next chapter I will demonstrate that not only is the involvement of the psycho-social regime not contradictory to this account but actually necessary given the recent proliferation of technologies whose operation relies on their relation with the psycho-social. In fact this is implied in his account given in *Imagination et invention* of the technical artefact as *image-object* and thus involved in a necessarily psycho-social conditioning. One way we can

understand Simondon's continuing assertion for the purity of the technical mode of individuation is so as to make clear that the causality of this operation is understood as not necessarily determined by cultural influence: that is that it is a particular mode of physical individuation with a certain amount of *autonomy*.

Given Dumouchel's assertion above that technology doesn't mark out a set of 'events and processes' which differentiate it from nature or indeed that there is no alternative technology within which inhere alternative values we can already discern a sharp distinction from the first generation of philosophers of technology such as Heidegger, Ellul and Marcuse. However I don't think Simondon's position is as straightforward as Dumouchel's description. To understand why we will first turn to the claim Simondon makes for a distinction between the natural and artificial.

7.5.2: Natural and Artificial

Although Dumouchel is correct regarding the indiscernibility of the natural from the technical for Simondon, the latter does however describe a clear distinction between the natural and the artificial.

Simondon explains this distinction by comparing two different examples. One is the concretisation of a technical object that, although initially developed to operate within the conditions of a laboratory, progresses to be able to operate outside of this regulated environment. The second example is that of a plant which is only able to live tended to in a greenhouse.

In the first example Simondon argues that the concretising process which enables the technical object to operate independently of the laboratory conditions on which it was originally reliant is akin to a process of naturalisation in that it has developed from a primitive and artificial state to

'more and more to resemble a natural object' (Simondon, 1980: 47). By this Simondon means that the technical object has become more autonomous in its operation and can regulate itself dynamically in regard to its relations with other objects and its environment. Because of the autonomy which concretization gives technical objects Simondon argues that we can go so far as to understand them as natural through analogy:

> 'Because the mode of existence of the concrete technical object is analogous to that of a spontaneously produced natural object, we can legitimately consider them as natural objects; this means that we can submit them to inductive study.' (Simondon, 1980: 48)

To be a natural object then is related not to the origin of the object or its determination but the extent to which it operates in conjunction with its environment. This means it is best understood topologically (see chapter 5), which is therefore another element of Simondon's anti-essentialist operations. As we have seen a technical object with an associated milieu creates, in part at least, the conditions necessary for its own operation. As such it can be said to be naturalized. The more open this technical object is to a broad range of environmental conditions the more naturalised it can be understood to be. To say it is naturalised is not, of course, to say a technical object is also vital.

It's also clear that such technical objects are worthy of 'inductive study' due to the possible unique potentialities their operations may reveal. He also warns against reductionism by asserting that it is through empirical study (mechanology) that the mode of operation of technical structures can come to be understood, and not through the application of 'certain anterior scientific principles' (Simondon, 1980: 48).

The second example discussed is of a plant that has been developed in a greenhouse environment on which it relies, along with the intervention of people, for its on-going survival and reproduction. For Simondon this is an

example of *artificialisation*. Despite the organic origin of the plant Simondon points to the fact that its natural status of having an integrated pluri-functionality in relation to its environment has been destroyed thus rendering it artificial:

> 'the essential artificiality of the object resides in the fact that man has to intervene in order to keep the object in existence by protecting it from the natural world and by giving it a status as well as existence.' (Simondon, 1980: 46)

As the plant becomes more reliant on the 'artificial regulation of the greenhouse' it can even become more and more *abstract* as it can be manipulated so that rather than being a unified system of coherent functions, individual functions (e.g. flowering, bearing fruit) could be enhanced by man to the neglect of others. From this we can understand that the abstract is not the opposite of the concrete but a specific domain of the concrete that has been emphasised thus causing a de-phasing.

It is not the case, however, that through increasing concretisation the technical object might become vital, nor that a plant rendered artificial through growing in a greenhouse could exist as non-vital. As we saw in Chapter 5, for an individual to be vital requires both the maintenance of itself as an ongoing 'theater of individuation' (Simondon, 2005: 27) as well as a certain topological relation between interiority and exteriority. We also saw that Simondon maintained that technical objects are not capable of these operations, which is one of the reasons he thought the cyberneticist analogy of humans with robots was mistaken.

Similarly, a living plant, however artificial, is still individuating in the vital mode. What Simondon deems as natural then is closely related to that entity's level of autonomy in relation to the environment it is situated in for its operation.

It is perhaps worth revisiting Dumouchel's quote again to question whether Simondon's view of technology actually leads to his conclusion that 'there is no alternative technology which contains different values with respect to nature' (Dumouchel, 1995: 268). Much depends on how the natural is defined and Simondon's distinction of natural from artificial indicates that Dumouchel must be mistaken when he claims:

> 'According to Simondon there is no technology which can respect what is, for technology is essentially the coming into existence of the virtual.' (Dumouchel, 1995: 268)

Simondon's discussion of the natural and artificial indicates that he does attach a greater value to autonomous and concrete individuals described as natural over abstract and artificial ones. As we will see this distinction is at the heart of his aesthetics and will enable him to make judgments about different technological instances.

We will bracket this concern for now and continue this investigation by contrasting Simondon's notion of concretisation with how it has been utilised by the second-generation philosopher of technology Andrew Feenberg.

7.5.3: Andrew Feenberg's Humanist Account of Concretization

Though by no means asserting concretization as a democratic socialist theory, Andrew Feenberg uses it to support the political idea that 'socialist demands for environmentally sound technology and humane, democratic, and safe work are not extrinsic to the logic of technology but respond to the inner tendency of technical development to construct synergistic totalities of natural, human and technical elements.' (Feenberg, 2002: 188)

His proposal is for a concretization whose scope is expanded beyond Simondon's to include within its operation the aims of critical politics. It is

then a techno-social form of concretization. This is one where social rules and constraints are embedded into technology, from which they are often forgotten or even assumed to be part of the object's 'inevitable technical destiny'. For Feenberg social values are another area of virtuality which can be concretized into technical objects as what he describes as a 'technological unconscious'.

The inclusion of these concerns into the operation of technology does not require that these technologies need become less productive. Indeed the social codes incorporated into any technology could just as well be capitalist in nature as critical. Importantly, Feenberg maintains that the choice of social codes concretized into technology is essentially a political choice and is evidence of technology's ambivalence.

For Feenberg, technological systems help structure our everyday life but are open to concretization according to a different trajectory than that supplied by contemporary capitalist operations; through the condensation of more social aspects such as an appreciation of 'workers' skills, human communication, and environmental limits' (Feenberg, 1996) into their actual operational structure.

If there are invariably social aspects involved in concretization this would seem to contradict the purified account of technical concretization that Simondon described above. It is true that if we wished to maintain this purified position, we could just maintain that any such introduction of social concerns into technological development is *de facto* strictly not mechanological. One of the arguments of this thesis is to show that the operation of contemporary techno-social networks makes this position untenable. However, this does not mean that we must therefore agree with Feenberg's position that an ethics of technological development be founded on a humanist 'politics of technological transformation.' Instead we will argue that the broadening of the operation of mechanology to include the psycho-social is still in accordance with Simondon's overall ethics of operation and concretization. That is to say that

this operation is not to be subordinated to humanist values but that values will be derived from the operation of individuation itself.

Before we can address this argument however it will be necessary to more fully describe how Simondon understands technology's role in relation to a new form of humanism and encyclopedism[33] as well as in relation to both Marxism and Capitalism. It is important to understand that the account of technicity given so far is only partial and that it must be integrated within his broader project to be properly understood.

7.5.4: Simondon and Human Progress

So far we have described that part of Simondon's philosophy of technology which investigates the nature of operation of technical individuals and how this relate to technical lineages. As we will now discover this is just one aspect of Simondon's account of technicity which, to be properly understood, must be situated within his wider philosophical project.

In his text *The Limits of Human Progress: A Critical Study*, Simondon (2010) sketches an account of human cultural progress as developing in the same genetic manner as technological development: as the progressive operation of concretizing relations between differing domains in order to resolve disparities.

To be a universal account Simondon states that it must take into consideration 'the entire system of activity and existence constituted by what man produces and what man is' (Simondon, 2010a, 230). As such Simondon's project should be understood as encylopedic. To achieve this broad scope he

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[33] Simondon's entire project is underpinned by the aim to forge a new genetic encylopedism which takes as its goal the thinking of the genesis of *all* things. It should by now be clear, given the scope of this thesis, that his work on the different regimes of individuation is central to this encyclopedic project. As we will see his work on technology connects this project to a new description of humanism in that its aim is specifically to combat a certain form of alienation. In 7.5.4 we will see how Simondon theorises both of these projects within a broad account of cultural individuation.

divides these activities and their products into ontological domains (e.g. language, ethics, religion as well as the technical). These domains come into problematic relation with one another and produce emergent concretizations. For Simondon, during different historical periods the concentration of human activity occurs within different domains. For example, in ancient classical civilizations there was a concentration of activity on language development whereas in the medieval period development mainly concentrated in the religious domain. During the current period, Simondon contends, the concentration of activity focuses on developments within the technological domain.

As with mechanology, development within each domain is described transductively in terms of concretization and saturation. Importantly, progress within any domain occurs between humanity and the concretizations of that domain that have already occurred and with which humanity is said to form a system. The further development of this system requires that it isn't saturated but remains in a state of internal resonance thus engendering further progression.

The saturation of any domain leads to its stagnation. This is because saturation consists in the complete determination of all available potentialities or 'virtualities' for development in any given system. Thus regarding the domain of language at the close of the ancient world Simondon asserts:

> 'it became purely a matter for grammarians and formalist logicians seeking etymological rectitude in naming. Surely, a grammar or a formal logic do not reflect man, or at the least reflect only the smallest part of man, one that should not be inflated.' (Simondon, 2010a: 231)

From this, as we shall see, an ethics may be derived from Simondon's epistemology.

7.5.5: The Aesthetic Dimension of Judgment

Though we live in a world currently heavily invested in the development of the technical domain there is no reason to believe that this process will not also reach saturation and the focus for investigation shift to another domain. However, Simondon also notes that the chances of humanity becoming alienated from technological concretizations are less likely than from those of the domains of language and religion because:

> 'Technology is even more primitive than religion: it connects with the elaboration and satisfaction of biological desires themselves . . . Thus there is at least the chance that the seeds of the decentring of man, and thence of the alienation of the objective concretizations which he produces, may be feebler in technology than in language and religion.' (Simondon, 2010a: 232)

Simondon claims that technology's importance for human progress derives from its close relation to biological desire. This is one reason why he argues so strongly for the development of a technological culture.

Although the development of technology occurs via the progressive uncovering and utilization of virtualities this operation must also be contextualized within this broader account of human progress which requires an on-going internal resonance between all domains, as well as 'durable overlappings' between them.

Simondon maintains that this is achieved via reflexive, philosophical thought which, as the 'conscious form of the internal resonance formed by man and the objective concretization', can prevent alienation between man and technology by ensuring that technological progress becomes an 'integral part of human progress, by forming a system with man.' (Simondon, 2010a: 235)

To understand more completely how Simondon reaches this conclusion it is useful to reference an important section in *The Mode of Existence of Technical Objects* in which he describes the genesis of technicity more fully. Although in *The Limits of Human Progress* Simondon describes how he understands cultural development as occurring via the shifting of phases in different domains he doesn't describe their genesis in that text, and consequently how they are organised developmentally and how this has normative consequences.

Once again, just as with physical, vital and psycho-social individuation, in this text Simondon stresses the phase-shift as the schema by which 'the temporal development of a living reality proceeds' or, in other words, how the development of the human mode of being in relation to the world progresses.

Unlike with dialectics, Simondon's account doesn't require negation to propel becoming, the engine being the division of phases and the subsequent relation between phases. Thus rather than the sense of inevitable onwards progression that dialectics describes the schema based on phase-shifts is an account which can describe development as constituted by a number of different phases which fall in and out of balance with one another around a central point of equilibrium. As described in the *Limits of Human Progress* different phases are dominant at various times throughout history but can fall from prominence or even divide further, depending on the extent of their saturation and relation with other domains.

Central to understanding the role that technicity plays for Simondon is the account of its emergence as a phase of man's relation to the world. According to Simondon prior to there being any historical cultural progression, that is prior to there being any phase activity relating to man's being in the world, man existed in a 'magical' mode of being. This magical mode of being is *the* primal *vital* mode of man-world relation and describes a mode of being prior to the division of world into subject and object or fragment and universal. The use

of the term 'magic' to describe this may be misleading given the connotation it has with sorcery and witchcraft.

That is not to say that this magical mode isn't structured. Although there is no subject-object division Simondon argues there is a reticular structure involving privileged places and times which correspond to 'the most primitive and most fecund of organizations' (Simondon, 2001: 164). What Simondon has in mind here are conspicuous topographic elements such as mountains, hills and rivers and temporal phenomena such as solstices and full-moons. Simondon suggests that such phenomena are 'privileged' and 'localize and focalize the attitude of the living vis-à-vis its milieu' (Simondon, 2001: 164).

It is this 'initial active centre' (Simondon, 2001: 159) of the magical unity of the man-world relation that is central to the mythic narrative of Simondon's account and from which technicity gains its significance.

The magical mode is understood as a pre-individual state from which the various phases of culture individuate. It is the de-phasing of this primal mode of human-world relation which initially results in the creation of the phases of technicity and religion. These phases describe two different ways of relating to the world which result from the de-phasing of the reticular structuration so that figure and ground become 'detached from the universe to which they adhered' (Simondon, 2001: 167).

Simondon situates these two phases at the poles of various oppositions. Thus the religious phase is concerned with the subjective and focuses on the universal ground of experience as a unity (ubiquity and eternity). In opposition to this technicity is concerned with the objective aspect of experience, its focus is with the figural and singular as previously represented as key-points. A technical object is located at a historical time and space, it lacks the quality of universality; it operates by direct contact and deals with the figural rather than the ground. In fact it is one of the qualities of the technical device that as a

singularity it can be detached from the ground and operate in multiple places (through duplication) and times. The religious relation, however, is concerned precisely with that which is universal and understood as ground.

The religious and technical phases are linked by aesthetic thinking, which acts as a neutral point between them. Importantly for Simondon aesthetic thought:

> 'is not a phase but, rather, a permanent reminder of the rupture of the unity of the magical mode of being and a search for a future unity.' (Simondon, 2001: 160)

Additionally the religious and technical phases are themselves also each split into practical and theoretical modes. The gap between the theoretical modes of religious and technical thought is where scientific knowledge develops as a relation. Similarly ethics develops as the mediating relation between their practical modes.

An upshot of the ordering of this development in phasing is that aesthetic thought is therefore more primitive than both scientific and ethical thought. The reason being that the latter both require the additional division of religious and technical phases into practical and theoretical modes before they can emerge.

Additionally, as made clear in *The Limits of Human Progress,* Simondon understands technicity to be more primitive than religious thought as it is situated more intimately with biological desires. Thus we are already able to discern that the aesthetics of technicity will play a significant role for Simondon as it is closely situated to the initial mode of magical unity.

To more fully understand how Simondon's genetic philosophy produces a novel way of thinking technology both universally as well as in its singular

instantiations it is worth briefly pausing our account of it here to contrast it with the first-generation philosophers of technology described earlier.

Although Simondon is quite correctly often opposed to philosophers such as Heidegger and Ellul because of his optimism about the social role of technology that is not to say that he is uncritical of its theoretical or practical implementations.

For example he is aware of the limitations of the reductive and fragmentary nature of technical schemas of thought, such as Descarte's mechanism which prompts him to assert:

> 'The application of schemas drawn from technics does not 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.' (Simondon, 2001: 175)

As such he understands technical schemas of thought as inductive due to their proceeding from the particular to the universal, from the finite to the infinite and thus running the risk of universalising that which does not take account of the reality of a unity. That is to say, no one schema *should* achieve abstract perfection, or become 'hypertelic'.

The same applies in the practical domain where technical approaches to ethics such as Utilitarianism, which divide the unity of life into moments which can be analyzed via a utility calculation, are also guilty of such reductive abstraction .

As exemplified in *The Limits of Human Progress* Simondon is also concerned with a more universal account of technicity's overall position within the human-world system of the totality of functional operations of individuation.

Although, as we saw in the first part of this chapter, Simondon is emphatically concerned with the operational reality of concrete technology this

is but one aspect of a broader analysis concerned with humanity's mode of relation with the world. At the very least Simondon's universal diagnosis is for the need for a balancing of the various phases he describes which is the goal of his encyclopedic project. Thus unlike Ellul he thinks that our relationship with technology doesn't necessarily have to be one defined by efficiency but can be part of a new form of humanism.

In *The Limits of Human Progress* Simondon makes clear that it is the role of philosophical thought to maintain an internal resonance between man and the various domains, and in *The Mode of Existence of Technical Objects* he also charges thought with the responsibility for the balancing of the totality of the 'genetic ensemble' in order to maintain a unity:

> 'This is precisely the goal to be reached: reflexive thinking has a mission to redress and refine the successive waves of genesis by which the primitive unity of the relation of man to the world becomes divided and comes to sustain science and ethics through technics and religion, between which aesthetic thinking develops.' (Simondon, 2001: 161)

The role of philosophical thought, guided by aesthetics, is to have a regulative effect on human relation with the world. Simondon understands such a project as requiring a genetic encyclopedism by which this relation can be understood as one of individuation. What is central for him, as shown above, is that for the human the aesthetic dimension is the most fundamental as it is this which most ably facilitates the appreciation of unity.

Having situated technicity as one phase amongst others in a genetic development we will now turn to an analysis of the development of technicity and how progress is understood within that phase.

7.5.6: Technical Progress and Culture

In the introduction to *On the Mode of Existence of Technical Objects* Simondon specifies that the main problem he wishes to address in that work is that of the growing disparity between a reality in which technical objects play a more and more significant part in human life and the ancient culture by which this reality is governed which 'has become a system of defence designed to safeguard man from technics' (Simondon, 1958: 9).

In the first part of this chapter we described Simondon's theory of the mode of existence of technology as being one involving the progressive concretisation of technical lineages. It is precisely this developmental progression which has led not only to the increasing individualizing of technical realities but also a transformation of mankind's relation to them, a transformation to which culture has failed to react, a situation Simondon succinctly describes as:

> 'The reality governed is made up of man and machines; the code is based on the experience of man working with tools; this very experience is both weakened and remote, because those who use the code have not, like Cincinnatus, just left the handles of the plough. To put it simply, the symbol is weakening and the reality is absent.' (Simondon, 1958: 7)

The absent reality is that of one where the common situation is of tool use. Technology no longer just involves tools but has undergone a progression from technical elements to technical individuals to the self-regulating ensembles of technical individuals, that is, broadly speaking, from workshops to factories to networks.

This development can be explained as that from simple tools and instruments which extend the functionality and perception of the human body to technical individuals which rather than extending one aspect of the human (or even animals in the case of tractors or windmills for power supply) replace it for the completion of tool bearing tasks altogether. An example of this is the

Jacquard loom with its punched-card system which superseded the handicraft of loom weaving. Following on from this Simondon argues the twentieth century has seen the development of technical ensembles which utilise information feedback to regulate systems and networks of technical individuals.

Simply put Simondon's argument is that contemporary culture is out of phase with technical progression which has led to it holding 'two contradictory attitudes' to technology, either considering it a threat that stands against humanity or as neutral matter which is ascribed meaning and value by humanity. Simondon's aim is to demonstrate that both of these positions are incorrect and that there is a pressing need for culture to understand technology in its technicity.

That in the contemporary world culture and technics are out of phase does not mean that technology should be understood as a threat, rather that a rebalancing needs to occur. The historical description Simondon gives of the relation of technical progression and culture is one of recurring concretisation and de-phasing, which needn't always be negative. In the eighteenth century the development of more refined tools and instruments through improved engineering led to an increase in optimism about overall progress. And the nineteenth century development of technical individuals as power sources was also seen as 'not a frustration' as long as they didn't replace man as the primary tool-bearing technical individual. In these eras technicity and culture can be understood as in-phase, with technical progress also involving a progression for the people who used machines.

It is when technical individuals begin to displace man and make of him a mere spectator or manager that another notion of progress diverges from that of the craftsman, that is of the 'cosmic' notion of man's progressive understanding and domination of Nature.

It is at this point we witness in Simondon's understanding a coincidence with Heidegger and Ellul's fears regarding domineering technological rationality. Although, as Simondon points out, initially this progression was welcomed as a 'general advancement of humanity' (Simondon, 2001: 117), despite the fact that it was a regression for those craftsmen whose livelihood was usurped or who experienced deskilling through mechanisation.

It is however in the twentieth century that these dual notions of progress are understood to be out of phase with culture. At the level of human-technical relations Simondon discerns the development of alienation whilst also acknowledging along with the first-generation philosophers of technology that there is a certain technocratic will-to-power at play that is exploitative of the natural environment.

We will investigate each of these problems in turn.

7.5.7: Technology and Alienation

It is to a great extent in opposition to Marx's theory of alienation that Simondon sets out his own. Both thinkers situate the development new forms of alienation with the movement of labour practices from artisanal workshops to factories in which production is mechanized through the use of self-regulating technical individuals operating in ensembles.

Rather unfairly Simondon describes Marx's alienation as fundamentally legal and economic in that it is the worker's lack of ownership of the means of production that is productive of alienation (Marx, 1988: 69-89). Against this Simondon wishes to oppose a more fundamental kind of alienation:

> 'Beneath this legal and economic relationship with ownership there exists
> an even more profound and more essential relationship, that of the
> continuity between the human individual and the technical individual, or

of the discontinuity between these two beings . . . Alienation does not emerge solely because in the nineteenth century the human individual as a worker is no longer the owner of his means of production, whereas in the eighteenth century the craftsman was the owner of his instruments of production and of his tools . . . It emerges also outside of any collective relationship with the means of production, at a strictly individual, physiological and psychological level.' (Simondon, 2001: 117-118)

To reduce Marx's theory of alienation to a matter of ownership and economics is undoubtedly to commit an injustice to a subject which Marx theorised throughout his life. As such it is worth briefly outlining Marx's understanding of the term in order to more clearly see how Simondon's elision of many aspects of Marx's theory points to a lacuna in his own.

The argument in this section is that Simondon's reduction is mainly due to a focus on the concept of alienation as it is developed in Marx's earlier writing. Even then it is still a harsh evaluation of Marx's theory to say it only concerns ownership. Additionally, I will briefly touch on Marx's later theory which at times comes surprisingly close to Simondon's own formulation.

My brief exposition is indebted to Amy Wendling's (2009) excellent study *Karl Marx on Technology and Alienation* which argues that a significant reason for the difference between Marx's early and late theory of alienation is the result of a shift from a humanistic understanding to what she describes as a thermodynamic one.

There is good reason to suppose that it is Marx's earlier theorisation of alienation which Simondon has in mind with his criticisms. In this early formulation, which is found in the *Economic and Philosophic Manuscripts of 1844,* Marx sets forth a broadly 'humanist' theory of alienation, strongly influenced by Hegel and Rousseau, which involves 'four main aspects' (Meszaros, 1970:14):

First, that Man is alienated from nature in the sense that he is alienated from the product of his labour which, because of his situation as a waged worker, is not his to enjoy:

> '[T]he object that labour produces, its product, stands opposed to it as something alien, as a power independent of the producer. The product of labour is labour embodied and made material in an object, it is the objectification of labour . . . In the sphere of political economy, this realization of labour appears as a loss of reality for the worker, objectification as loss of and bondage to the object, and appropriation as estrangement, as alienation.' (Marx, 1959: Section 5)

This relates to the second aspect of alienation which holds that Man is alienated from his own productive activity as he can't enjoy its results other than in the abstract sense via the sale of the objects produced. This is to say that the mode of capitalist production entails that labour is no longer enjoyed by the worker as a fulfilling activity but is transformed into an activity necessary to meet the needs of physical survival via a wage. The enforced and stultifying nature of this form of labour is also described as alienating in that it prevents the experience of work as a creative and self-actualizing activity.

The third aspect builds on the previous ones by arguing that alienation so described does not concern just the individual but is social in character. Marx uses the concept of 'species-being' to make this point arguing that although labour may be alienating for the individual undertaking it, it occurs within a world that has been constructed by a society also in such an alienated position. As such mankind's essential nature appears to himself as wholly alienated.

Intimately related to this is the fourth aspect of Marx's early theory of alienation which holds that Man is also alienated from other men. Marx makes this clear when he writes: 'What applies to man's relation to his work, to the product of his labour and to himself, also holds of man's relation to the other

man, and to the other man's labour and object of labour. In fact, the proposition that man's species nature is estranged from him means that one is estranged from the other, as each of them is from man's essential nature' (Marx, 1959: 77).

A psychological aspect to alienation called false-consciousness is also developed in this respect which involves the misunderstanding by Man of their own essential being, instead accepting their situation under capitalism as one that is naturally given. It is from this that Marx develops the powerful concept of ideology.

Simondon's criticisms of Marxism seem focused upon the early theory of alienation sketched above. First, Simondon is scathing of not just the focus on labour as the prime relation between man and world but particularly its hylemorphic definition as the imposition of form on matter. It is undoubtedly the case that in Marx's early writing the notion of labour developed is influenced by Aristotle in that it involves both this hylemorphic definition of labour but also that such labour is a means to self-actualisation, a notion Simondon would no doubt find too essentialist. Wendling also makes clear that Marx's theory of alienation is developed upon the theory of 'just exchange' as developed in Aristotle's *Ethics* (Wendell, 2009: 25-27). Given this Aristotelian influence it is clear why Simondon disputes the marxist account. However it should also be clear that the early Marx's formulation of alienation shouldn't be reduced to just economism as Simondon does, for Marx's critique is also political. As Combes (2013: 73) remarks:

'While it is true that Marx often relies heavily on the analyses of economists, we must recall that he consistently defines his own project in terms of "critique of the political economy," which critique aims to make apparent the mystifying character of the point of view of economists.'

That alienation is not just economic, even in the early Marx, is evidenced by the recognition of one of its aspects involving the quality of the workers activity. That is that it is important for Marx that such activity involves 'self-actualization, undertaken in freedom from physical need' (Wendling, 2009: 16). That the notion of self-actualisation may be too Aristotelian and essentialist for Simondon may be the case but it does point to a criticism that is not purely economic.

In Marx's later work, particularly *Capital*, although economics undoubtedly plays a determining role in the production of alienation there is also a focus on the role that technology also has. Undoubtedly in doing this Marx comes closer to Simondon's notion of alienation in that he also recognises the extent to which machines contribute to deskilling and repetitive and unrewarding labour.

Significantly the later Marx also moves away from the humanism and hylemorphism of his earlier work towards a more scientific understanding which utilises thermodynamics and technology. As such Marx comes much closer to Simondon.

In this reworking Marx moves away from understanding labour as the human imposition of form on nature and instead describes a labour-power which is one power amongst others *within* nature. As an activity then, labour-power involves the transference of energy in accordance with the laws of thermodynamics just like any other activity such as that carried out by machines.

As Wendell explains this thermodynamic understanding of labour means that:

'Labor changes from a creative endeavor wrought by human spirit on inanimate nature, as conceived in Aristotle, Hegel, Smith, and Locke, into a mere conversion of energy in which nature goes to work on itself. Labor is no longer a spiritual, form-giving activity that infuses matter; it is merely a

part of the transformations of a *natura naturans*. In a related change in thermodynamically influenced physiology, the notion of a vital force or animating spirit is progressively eliminated from explanations of human activity.' (Wendell, 2009: 61)

One implication of this flattening of all activity by thermodynamic theory is that the humanist understanding of alienation loses its power. Stripped of its creative essence human labour becomes just another force, no more or less significant than that undertaken by machines or animals. The humanist position from which the abstract nature of labour or its alienated dimension is judged is thus forfeited.

Of course, what Marx is attempting in *Capital*, and also by describing labour in this thermodynamic way, is to tease out the contradictions of capitalism from within its own logic. As thermodynamics was the scientific complement to the capitalist worldview it is also utilised to draw out the contradictions of this worldview. So just as Marx depersonalizes human labour as mere labour-power he simultaneously retains a more humanistic description of it as living-labour and uses this to criticise the impersonal nature of the thermodynamic perspective. This retention of the humanist critique of alienation 'locates Marx with the romantic, humanist resistance to the flattening of human beings, their instruments, their products, and nature itself onto an equitable ontological plane' (Wendell, 2009: 63).

Although it is not necessary to detail Marx's criticisms here it is worthwhile noting that although the later Marx comes closer to Simondon with the utilisation of thermodynamics, the commensuration of forces that Marx describes in doing so is not something that Simondon would concede. In fact it predates the same kind of issue Simondon finds wanting in cybernetics with its identification of machines and humans. Indeed Simondon's description of

alienation, as we will see, is very much based on the differences between man and technology and how they come into relationship.

Although, as we hope to have demonstrated, Simondon's description of Marx's alienation as fundamentally based on economics and legal ownership is reductive, it is hopefully clearer that Simondon's opposition to Marxism rests on its fundamentally hylemorphic character. The very notion of labour that Marx proposes is too hylemorphic to be included in Simondonian ontology and it is undoubtedly true that Marx understood capital to be too overdetermining. What Simondon is attempting to articulate is a completely different paradigm to that of labour, where not only is the operational nature of the human-technical and human-nature relationships primary but, because of this, it has significant implications for the nature of a collectivity which is not based on the hylemorphic understanding of class or species-being.

However despite this overcoming of the Marxist understanding by Simondon this encounter between the two thinkers also raises further questions regarding Simondon's thought such as what, if any, importance does he attach to the political and economic sphere?

It is at the level of the operational relation of the technical individual with the human individual at which Simondon's more fundamental form of alienation occurs. As we have already seen the technical-human relation is, for Simondon, one of the two modes (the other being the religious), which is closest to the initial phase-shift from the magical mode. Given the importance of the magical mode for him it is clear why he values this relation as more important than that of alienation derived economically.

It is not then a question of ownership that is fundamentally important but that 'man can be coupled with the machine as one equal with another, as a being who participates in its regulation, and not only as a being who directs or

makes use of it by incorporating it into ensembles, or as a being who serves it by providing materials and elements' (Simondon, 2001: 119-120).

In chapter two we looked at the differences between machine and human memory which Simondon argued undermined some cyberneticians' analogical identification of the two. Where the machine can retain 'very complex, detailed, precise monomorphic documents' (Simondon, 2012: 75) humans excel at the memory of patterns, forms and meanings. It is the synergetic conjunction of the operation of these two forms of memory that Simondon presents as an example of the kind of operational continuity he describes as 'profound and essential', although he is clear that it is not just the function of memory that need be involved: 'coupling occurs when a single and complete function is carried out by the two beings'.

Despite Simondon's concerns regarding cybernetics' mis-identification of organisms with machines this coupling is undoubtedly cybernetically inspired not just because of the importance Simondon gives to informational regulation but also the confluence of recursive causality and finality:

'In self-regulated functioning, all causality has a sense of finality, and all finality has a sense of causality.' (Simondon, 2001: 119)

Indeed it is difficult for this author to read Simondon's description of human-machine coupling without recollecting William Gibson's famous description of children playing in a video-game arcade:

'I could see in the physical intensity of their postures how rapt the kids inside were. It was like one of those closed systems out of a Pynchon novel: a feedback loop with photons coming off the screens into the kids' eyes, neurones moving through their bodies, and electrons moving through the video game.' (Gibson, in McCaffery 1992: 272)

The presence of such recursive causality should not be understood as occurring only with advanced informational technology. Such human-technology causal recursion is present in the use of even the most basic tools such as planing a piece of wood where the craftsperson can gauge the resistance of the grain of a piece of wood from the feedback she feels through the tool. Alienation describes a poverty of the integration of psycho-somatic aspects of the person (e.g. affect, emotion, perception) in the recursive operational continuity of the human-machine relation.

According to this analysis both the owners of technology and the labour force are equally alienated for neither maintains such a relationship of continuity with technical individuals. The problem for each of these is different and rests on a basic misunderstanding of the informational aspects of modern technological individuals (such as control mechanisms and indeterminacy) and ensembles which puts both out of step with technological reality:

> 'Labour has an understanding of elements, and capital has an understanding of ensembles; but bringing together the understanding of elements and the understanding of ensembles does not create an understanding of the *intermediary and unmixed* being which is the technical individual. Element, individual and ensemble follow one another on a temporal line; the man-of-elements slow in relation to the individual; but the man-of-ensembles who has not understood the individual is not ahead in relation to the individual.' (Simondon, 2001: 118)

As such neither a proposed collectivisation of the means of production (such as proposed by Lenin, for example) nor a Feenbergian humanism offers a solution to this kind of alienation as they don't address a transformation of the human-technology coupling at a level which would transform the quality of its operation.

Such is Simondon's concern for the quality of the human-machine coupling he also understands the machine as impoverished (Simondon calls it a form of enslavement) if its relationship with the human is weak in this sense.

Simondon was swift to recognise the significance of the informational aspect of modern technology and its importance for human-technology relations as well as its import for a 'technological philosophy'. That cultural understanding remained out of step with these developments was extremely damaging as it meant that technology continued to be understood in the nineteenth century technocratic mode as 'a philosophy of human power through technics' (Simondon, 2001: 126).

In an excoriating passage Simondon comes close to a Heideggerian critique of technocratism both for its will-to-power but also for its destructive attitude to nature. It is precisely the failure to understand the informational aspect of technology (that it is open to both indeterminancy and regulation in ensembles), that results in a technocratism that is autocratic in that it merely sees the relation between technology and nature through the lens of domination and enslavement. This misunderstanding is compounded by maintaining an understanding of technology through the schema of thermodynamic heat engines which sees it as substantial and operationally deterministic.

As such Simondon fully understands why some substantive theorists of technology are threatened by it and fully acknowledges its 'enslaving violence'. He also admits that:

'To this phase [industrial thermodynamic] corresponds the dramatic and impassioned idea of progress as the rape of nature, the conquest of the world, the exploitation of energies. The will for power is expressed in the technicist and technocratic excessiveness of the thermodynamic era, which has taken a direction both prophetic and cataclysmal.' (Simondon, 1980: 8)

We find here then a tension between Simondon's positive genetic account of progress in which technology unveils and makes use of previously hidden potentials and this description of a technocratic cataclysm which is 'guilty of a violation of the sacred' (Simondon, 2001: 127).

We have already seen that Simondon has described a sense of the sacred as those key-points that give a reticulated structure to the magical mode of human-nature relation. We can also discern another sense in this passage when he links it to the Earth's 'natural integrity':

> 'To build a bridge over an arm of the sea, to link an island to the mainland, to cut through an isthmus, is to change the configuration of the earth, to violate its natural integrity.' (Simondon, 2001: 127)

It is the notion of integrity in this passage which is indicative of the aesthetic proposal Simondon will utilise to resolve this tension. So although Dumouchel's assertion that 'there is no "nature" in the sense of events and processes which are essentially different from those which are produced artificially' (Dumouchel, 1995: 268) does describe the mode of genetic development that is technological it fails to take into account this aesthetic dimension which the sacredness associated with 'natural integrity' implies. It is this respectfulness to the natural that prevents Simondon's account of technical invention from being unconstrained by ethical values. We will explore the role that the aesthetic plays in resolving some of the tensions in Simondon's account shortly.

7.5.8: Resolutions

So far in our analysis of Simondon's account of technology we have described the problematical relations between the human-technology (alienation) and nature-technology (cataclysm) pairings. Ultimately the resolution for these

problems will be found in the more fundamental relationship of the human-nature pairing.

In this section we will describe Simondon's attempt to overcome these problems.

It is the figure of the technician which Simondon holds up as the exemplar of overcoming human-technology alienation. The technician is someone who exists 'at the same level' as the technological in that she is integral to its regulation and coupled with it in such a way that the human-machine couple forms a functional and operational whole that would be impossible without the coupling.

An important part of this coupling is the aspect of meaning which only the technician can introduce. As a concretization of forms machines are not able to interpret functions but are the result of concretization according to the human understanding of schemata of operation. As such it is only the technician that can link machines together due to the analogical use of thought which enables the human to think the technological in its genetic becoming, that is to say, as invention:

> 'To invent is to make one's thought work as a machine works, neither according to causality, which is too fragmentary, nor according to purpose, which is too unitary, but according to the dynamism of lived functioning, understood as a product, and understood also in its genesis. The machine is a being that works. Its mechanisms gives material expression to a coherent dynamism that once existed in thought, and that was thought.' (Simondon, 2001: 138)

As I described in the chapter on psychic and collective individuation (185-194), as well as being a process that involves the discovery and *actualisation* of new potentials invention is simultaneously the stage of actualisation in the cycle of the mental image as described in *Imagination et invention*. We are now in a

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position to more clearly articulate technical invention with imagination. In the cycle of the image there is a gradual concretisation of images from that of the development of a world to systemisation using schemata. In technical invention there is a reciprocal relationship between imagination and technical objects in that such objects can help develop schemata of understanding which can, in attempting to overcome problems, lead to the invention of new technical image-objects. The cycle of image-objects is thus part of the same objective individuating process as that of technical objects. As such although invention requires the presence of a real problem it also requires the application of the thought of the inventor to lead the problematical structure to a resolution.

It is in regulation and invention understood as the development and maintenance of the concretised relations of human and technology where Simondon finds the overcoming of alienation. This overcoming is made more likely with the development of informational, networked technologies. Whereas thermodynamic machines, due to their relative concrescence, are more limited in the amount of information they produce which requires interpretation, the development of reticulated ensembles requires a greater role for technical interpretation to ensure regulation. What's more any increase in information from machines also increases the amount of possible indeterminacy in operation and thus the potential for further invention.

Such indeterminacy in the machines operation is what Simondon refers to as its 'openness' and is that which he feels contemporary culture misunderstands about it, instead seeing technology as closed and substantial. This attitude is one that Simondon deems unfair and which he likens to taking a reductive attitude to a painting such that one only understands it as 'an expanse of dry, cracked paint on a stretched canvas' (Simondon, 2001: 146).

The requirement to instigate a culture with an adequate appreciation and understanding of machines leads Simondon to propose the needs for

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mechanologists who would hold the position of sociologists or psychologists of machines in that their role would be to ensure the cultural position of technical realties.[34]

We can also discern here a crucial difference that separates Simondon's conclusions regarding technology from Heidegger and Ellul's. Where these two philosophers understand the dangers of contemporary cybernetic technology as either a removal of the human with all its fallibility from the system to achieve a perfection of automation or similarly the reduction of the human for systemic purposes as 'standing reserve', Simondon sees in the informational nature of cybernetic technology an indeterminism which is its saving grace. Unlike with the more determined nature of thermodynamic technology he perceives the possibility for indeterminacy with the human's relationship with informational technology. He is undoubtedly cautious of a will to the reduction of man to the status of machine he finds in Wiener's work[35] (and which Ellul also identifies) and instead argues that the human has an important place amongst the machines.

In Heidegger's case the alienation we experience in regards to modern technology is from lacking an understanding of the essence of technology and thus being in an un-free relation to it. For Heidegger technology has a conditioning effect on how we understand beings, whereas for Simondon it is rather the potential for the establishment of a new kind of unity. As such technology for Simondon describes an 'unconcealment' of a rather different kind than Heidegger's.

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[34] It is interesting that Simondon chooses the pairing sociologist-psychologist in this context given it is exactly this pairing he understands as the over-determined poles of the transindividual relation. That he has done so perhaps indicates the important place that technology can play in constituting transindividuality as well as the way that reticulated informational networks might constitute a kind of transindividual relation themselves.

[35] This thesis of Wiener's is discussed in chapter 2 and is readily found in Wiener's key works *Cybernetics or Control and Communication in the Animal and the Machine(1965)* and *The Human Use of Human Beings: Cybernetics and Society (1989).*

Although, like Heidegger, Simondon is interested in how technology transforms humanity's relation with the world his concern is not strictly metaphysical in Heidegger's sense but refers to the nature of the operational and therefore causal connection that holds between them.

It's true that with his description of the damming of the Rhine Heidegger is concerned with the transformation of a natural phenomenon. The reason for this is not so much because of the disruption of 'natural integrity' but the transformation of the mode-of-revealing mankind has in relation to the world.

Despite the description that Simondon gives of the cataclysmic effects of thermodynamic technology on nature his final analysis is far from being as pessimistic as Heidegger's.

Just as Simondon looks to informational technology to alleviate alienation he also claims that the development of technical ensembles governed by informational theory leads to a more stabilizing form of technology and must be recognized as having the potential for supporting a different relation between nature and technology:

'The machine, as an element in the technical ensemble, becomes the effective unit which augments the quantity of information, increases negentropy, and opposes the degradation of energy. The machine is a result of organization and information; it resembles life and cooperates with life in its opposition to disorder and to the levelling out of all things that tend to deprive the world of its powers of change. The machine is something which fights against the death of the universe; it slows down, as life does, the degradation of energy, and becomes a stabilizer of the world. Such a modification of the philosophic view of technical objects heralds the possibility of making the technical being part of culture . . . Today, technicality tends to reside in ensembles. For this reason, it can become a foundation for culture, to which it will bring a unifying and stabilizing

power, making culture respond to the reality which it expresses and which it governs.' (Simondon, 1980: 9)

In this statement we can discern a rebuttal of Heidegger's antipathy to technological culture. Simondon not only points to the stabilizing effect technology can have for a culture but, more than this, that technology in its capacity as 'natural object' is actually a tool to combat entropy (once again we can discern at play a neotenic effect here).

Central to this understanding is the reticulated nature of technical ensembles and how this is understood analogically to the magical mode of human-world relation.

Following the initial de-phasing of magical unity we saw that the human relation to its milieu splits into the phases of technicity and religion. Simondon also describes this split as that into figure and ground such that technics 'retains the figural characteristics of the primitive complex of man and the world, while religiosity retains the ground characteristics' (Simondon, 2001: 173).

Whist religion maintains the ground characteristics such as describing a relation with universality and totality (for instance via deontological ethics), technics is figural in that its focus is on operations and structures related to particular sites and is thus detached from the fundamental magical unity from which technicity emerges.

It is this figural quality which describes technicity's role in the dislocation of reticulated key-points, as understood within the magical unity, into 'detached' singular sites which have lost a close relationship with the ground. It is the quality of technological individuals that they are not fixed to the ground but also multipliable and plural which makes them particularly disruptive for unity. Thus just as concretisation marks a progress in the unity of functioning of a particular technical object, the overall progress of technological development is understood as a move away from overall unity. Technicity is concerned with

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operations that occur at a particular time and in a particular place such that 'adding technical objects one to another can neither re-make the world nor regain contact with the world in its unity, which was the aim of magical thinking' (Simondon, 2001: 174). Despite this Simondon does see networked informational technology as an opportunity to reverse this situation. To understand how it is necessary to engage with that which balances the religious and technical domains which is the aesthetic relation.

7.5.9: The Role of the Aesthetic

Simondon is clear that the technicist drive that is so alienating of technology for both man and nature is at the extreme technical pole of the technology-religion relation. It marks a position concerned only with the technical and is therefore out of balance with both the universal attitude of religion as well as any ground. It is for this reason that the technicist attitude, which reaches its peak with the development of thermodynamic technical individuals in the 20th century, is viewed as so cataclysmic, for such is its concentration on exploiting the potentials of the natural environment it neglects the quality of its aesthetic insertion into that environment. It is also therefore particularly out of balance with other domains.

For Simondon aesthetics is not primarily concerned with representation. For him all objects have aesthetic qualities the extent of which depends on the manner with which they are embedded in the world, which he describes as the 'aesthetic impression'. This impression:

> '[…] implies feeling the complete perfection of an act, a perfection that objectively gives it a radiance and an authority by which it becomes a noteworthy point of lived reality, a node of experienced reality. The act is a remarkable point of the network of human life inserted in the world; from this remarkable point to others a superior kinship is created which

reconstitutes an analogue of the magical network of the universe.'
(Simondon, 2001: 180)

This reticulation of acts of aesthetic impressions thus constitutes an analogue of the networked structure of key points in the magical universe although not at the level of magical unity but as situated in the relation between the subjective (religious) and objective (technical).

Thus for Simondon an aesthetic object straddles these two domains, enabling a balance, where the objective use of a technique (e.g. building churches/shrines etc) can engage the subject with universal qualities (e.g. a religious attitude) whilst remaining of the world. The aesthetic enables a re-connection of figure with ground although not through the dissolution of the subject-object division; hence the merely analogous quality of the network of aesthetic impressions to that of magical unity.

In this aesthetic appreciation of technicity we can discern also an approach towards an ethics. In a letter to Jacques Derrida he outlines the importance of what he calls techno-aesthetics:

'The techno-aesthetic feeling seems to be a category that is more primitive than the aesthetic feeling alone, or than the technical aspect considered from the angle of functionality alone (which is an impoverishing perspective).' (Simondon, 2012: 6)

The primitiveness of the techno-aesthetic originates from how it connects and intersects between the subjective and objective, the figural and ground, the singular and the universal, the technical and the natural in what Simondon calls 'an intercategorial axiology' (Simondon, 2012: 2).

In the letter Simondon provides a range of examples of the unifying nature of the techno-aesthetic in the relation of technicity with both the human and natural world.

Of the Garabit viaduct he writes, once more indicating the value of pluri-functionality, that;

> 'It's beautiful also because it's in the middle of nature. The viaduct traverses nature and is traversed by it . . . This is an example of a techno-aesthetic work: perfectly functional, successful, and beautiful. It's technical and aesthetic at the same time: aesthetic because it's technical, and technical because it's aesthetic. There is intercategorial fusion.' (Simondon, 2012: 2)

However it is not just the functionality which is aesthetic here but also the way that the viaduct's structure complements the environment in which it is placed such that there is an aesthetic concretisation. It is a matter of how the technical object complements that which is there already so that the coupling not only works at a technical and functional level but also at an environmental level.

Such an understanding, that is sympathetic to technical operation and its complementary integration into a natural environment, thus provides a way to compare Simondon's judgment on technical structures to Heidegger's. Both thinkers ultimately reject an unbridled technicity for similar reasons: Simondon's account of cataclysm is not too far from Heidegger's 'standing reserve' and Simondon's account of alienation could also be incorporated into Heidegger's critique.

There is also undoubtedly a similarity between the two thinkers in that both offer a critique of technicity concerned with an intertwining of the aesthetic with functionality. Thus we see in Heidegger's example of the windmill as an 'acceptable' technological object, in that it doesn't disrupt the natural phenomenon it utilises, a similarity to Simondon's thought. But the difference between the two thinkers is more apparent when we consider Heidegger's horror at cases where the 'essence' of the natural phenomenon is sullied by technology such as when the Rhine's mythic symbolism is destroyed by a dam which reduces it to just being a functional part of a hydro-electric project.

Where Heidegger signals a refusal here, Simondon offers a subtler response, because for him the techno-aesthetic itself is situated so closely to both the magical and religious experience. Because of this the aesthetic is not primarily about contemplation, which is ultimately Heidegger's retreat position, but is rather concerned with operation, this leads him to a very different understanding.

> '. . . contemplation is not techno-aesthetics' primary category. It's in usage, in action, that it becomes something orgasmic, a tactile means and motor of stimulation. When a nut that is stuck becomes unstuck, one experiences a motoric pleasure, a certain instrumentalized joy, a communication - mediated by the tool - with the thing on which the tool is working.' (Simondon, 2012: 3)

Simondon's judgment of a dam would not be made on the fact that it blocks a river but on *how* it did so, on the quality of the integration of the dams structure with the functional operation of both dam and river. For it is the coupling of dam and river which would concern Simondon both at the level of pluri-functionality (witness his awe at the Guimabal turbine) and also at how the technical object intervenes in the environment qua environment; that is not only complements that which is already there, as we saw with the Garabit viaduct, but makes of that place a key-point where it 'completes and expresses the world' (Simondon, 2001: 185).

Technical objects for Simondon are 'mediators between Nature and the human' (Simondon, 2001: 9). As such even the smallest act has aesthetic meaning, as the example of the loosening of a tightened nut makes clear. The fundamentality of the techno-aesthetic, that it occurs at such a primitive level that it doesn't require contemplation, but 'connects with the elaboration and satisfaction of biological desires themselves' (Simondon, 2010a: 232) is truly where Simondon diverges from Heidegger.

'The aesthèsis, the fundamental perceptive intuition, is part of a culture. It acts like a pre-selector, separating the acceptable from the unacceptable, and determining whether one will accept or refuse.' (Simondon, 2012: 4)

His proposal for the overcoming of alienation is also directly related to the techno-aesthetic. Just as the aesthetic pleasure of using basic tools such as wrenches or drills relies on the operation of a recursive causality between human and world mediated by the tool, so Simondon's proposal for the alleviation of alienation demands the technical object remain a mediator for human-world informational recursion, that is also to say it remains *meaningful*. Thus Simondon can say of the aesthetic object that 'it is never, properly speaking, the object that is beautiful: it is the encounter, operating concerning [à propos] the object, between an aspect of the real world and a human gesture' (Simondon, 2001: 191).

As an encounter the beautiful and the 'rupture in the unity of the magical mode' is always found in the process of mediation as an impression, thus artworks and technical objects become sites which attract such encounters. The aesthetic encounter always concerns an operation which mediates between the singular act and the original unity of the magical, it is at once situated between that which is particular and that which would be universal. As such Simondon's aesthetic always concerns a unifying movement, whether that of the pluri-functional and concrete or of the inter-categoriality that occurs in a technical act.

As mentioned above the reticulation of aesthetic objects creates an analogue of the key points of magical unity. Simondon was impressed by the development of technical networks whose structure he considered as being isomorphic to sacred reality. As Chabot explains, in a later course Simondon taught titled *Psycho-sociologie de la technicité* (Psycho-sociology of technology) he describes how newer informational and networked technologies are

organised in a similar structural way to that of magical unity in that there are key nodes in networks which can be influential at a distance:

> 'Each technical object becomes a terminal. From this point on, essential activities are centered on relayed communications and remotely controlled actions, which suppose the existence of a centre or centres, privileged points, zones of influence.' (Chabot, 2013)

In this way Simondon extends his techno-aesthetic to include not just how singular technical objects might balance inter-categorically but also how networks of technical objects, operating using informational circuits can enable a harmonization between technology, the environment and life.

The aesthetic tendency is 'the ecumenism of thought' in that it always tends towards unification, it is a synthesising operation by which the development of a reticulated structure in one domain aligns with that developed in another. It is perhaps unsurprising then that Simondon recognised in the literal reticular structure of informational ensembles a resemblance of the reticulated structure of magical unity to which aesthetic thought asymptotically aspires.

7.6: Conclusion

Having now described the major aspects of Simondon's philosophy of technology in this conclusion I want to explore the tension which holds between what could be understood as two different ethical perspectives described.

On the one hand there is the productive account Simondon gives of the mode of existence of technical objects as progressive invention through the on-going concretisation of potentials and virtuality. From this perspective we can see how Simondon could be understood (as I have taken Dumouchel as doing) as arguing for the impossibility of holding a normative position regarding

technology for the progressive becoming which describes technicity cancels this possibility. Such individuation entails the requirement of an intercategorial axiology, in which value develops ontogenetically. And this perspective can also be discerned in the core argument of *The Mode of Existence of Technical Objects* which is that culture is lagging behind technicity and thus responsible for a new kind of alienation.

On the other hand we also find in Simondon an account which focuses on regulation, both in the special place he reserves for the notion of the magical unity as a perfect state of unification but also in his account of techno-aesthetics and his proposed solution for alienation through the establishment of a specific mode of human-machine coupling. This aspect of his philosophy also underpins his genetic encyclopedism, one of whose aims is to help keep in balance the various cultural phases described in *The Limits of Human Progress.*

The question I wish to address here is how much of a problem is the tension between these two perspectives for Simondon or can it be resolved in a satisfactory manner? Is the importance of invention in Simondon's ontology really inconsistent with the significance he gives to regulation? It is interesting within the confines of this project that this question mirrors Kant's problem with which we began this investigation which was of how to explain the apparently teleological nature of the organism in a mechanistic universe. My answer to this will be that this tension can be resolved by being clear that when Simondon discusses regulation through recursive causality he is not mistaken as proposing a teleological explanation. That is to say that our reformed description of causality is able to aid a resolution of this tension.

To begin addressing this I first want to look at how an ethics based purely on becoming would look like for Simondon. For this account I will draw heavily on Muriel Combes who points out in her wonderful essay that Simondon did indeed give a description of just such an account of ethics in the

conclusion of *L'individu et sa genese physico-biologique* which was modified to the corresponding section in *L'individuation psychique et collective*. The account Simondon describes is not one of fixed norms (such as we find with Feenberg for instance) but in norms which themselves individuate 'under the pressure of becoming' (Combes, 2013: 64).

The mode of individuation of norms is via an 'amplifying transfer' which describes the process by which acts and values relate to one another in a reticulated process of resonance. As Combes observes:

'In such an ethics, the subject lives on by affirming its relative character, or more precisely, its relational character, by inscribing its acts into the network of other acts as much as it can.' (Combes, 2013: 65)

Importantly such a theory of ethics proceeds clearly as an operation of physical individuation. As Combes writes: 'We can no longer distinguish between the level of sense or meaning and that of *physis*' (Combes, 2013: 64). As such this is a coherent approach for an ethics of individuation because it doesn't rely on any fixed normative values.

In the chapter on Powers I made the move of arguing that in a Simondonian ontology we need to think powers by way of operation. That is to say that, when considering the powers an entity has or could possibly have, we must understand the operations by which they emerge. What is important in understanding the individuation of ethics is that its mode of operation *necessarily* involves a reticular structure. As Simondon writes:

'Ethical reality is indeed structured in a network, which is to say, there is a resonance of acts in relation to others, not through their implicit or explicit norms, but directly within the system they form, which is becoming of being.' (Simondon, 1964 as quoted in Combes, 2013: 66)

Moreover, we may now flesh out the operative nature of this system further by also drawing on Simondon's theories of the image-cycle and the transindividual which we looked at in chapter 6.

The transindividual relation is one of collective resonance. As we saw this relation can result in a more or less coherent social structuration (in-groups or out-groups). We also described in that chapter the important role of the image in invention, which involved the externalization of the image as image-object. As such the image-object is always already imbued with values and meaning as well as having causal power in structuring the transindividual relation through their role in transforming the human's relationship with nature:

> '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. Every image is susceptible to incorporation in a process of materialising or idealising recurrence.' (Simondon, 2008: 13)

The mode of operation by which ethical norms individuate is one that must involve this circular causality which flows between image and image-object, which it must be remembered is a process that involves the mental at all its stages (e.g. affect, sensation, emotion, conceptual) as well as the transindividual. As such we can understand Simondon's project truly as a reformed socio-cybernetics wholly founded on his reformed notion of information operating across all regimes of individuation. Crucially, such operation is always differentiated, that is, it always operates topologically such that resonance 'phenomena' entail an intercategorial axiology.

Ethics then must be a process of collective transformation and Simondon understands this as meaning both that norms develop through a process of resonance but also that the reticular nature of newer technologies can change the nature of this resonance and thus necessarily entail a transformation of values.

Where does this leave the regulatory side of Simondon's account? Simondon's focus on operation and the development of recurrence at all levels requires a consideration of the regulatory *nature* of such operation.

The regulatory nature of a reticular structure is clear as Combes points out:

'Although we may change tools or construct a tool ourselves, "we cannot change networks or construct a network ourselves."' (Simondon, 2001: 221) (Combes, 2013: 67)

It seems to me that Simondon's techno-aesthetics and its focus on 'intercategorial fusion' then, far from involving a tension with the productive aspect of his technical philosophy, complements it. If operation is that which is primary then our ethics and aesthetics should be concerned with the quality of the reality of such operation and if operational realties also involve self-regulatory functions then these should be judged as such. As Simondon asserts, all such self-regulatory functioning involves causality that 'has a sense of finality' but this 'sense' does not make it teleological, that is understood as determining. This would be to make such power hypertelic and normative and to forget the ontogenetic process of individuation from which it emerged and which it can be disindividuated from. Simondon's theory of individuation is inventive and as we've seen it is inventive of realities at new levels which operate as unities and thus can be understood as finalities. What Simondon makes clear is that such finality emerges from recurrent causality. It is real but, as our previous investigation of causality showed, it is neither necessary nor determinative.

Simondon's aesthetics and ethics however involves an appreciation of the coherence of the operational realities of such unities whether for an understanding of technical ensembles or the reticulated nature of ethical amplification.

Simondon might sometimes seem in danger of focussing on the power of the magical unity given the importance he gives it at times for arguing for what

is desirable. The historical reality of such a mode of relation is questionable but isn't necessary for justifying the importance of reticularity for structuring at all levels of reality.

Is it possible we could jettison this focus on the mythical magical unity whilst retaining an understanding of the notion of the importance of operational unity? Such a move might then allow us to be less critical of Marx's theory of alienation, for example, which could surely fit within a Simondonian style of socio-cybernetics that also recognised the economic as a key domain.

To contrast Heidegger and Simondon again: it is thermodynamic and cybernetic technology that is dangerous for Heidegger, implying as it does a certain mode (self-amplifying, according to Ellul) of revealing. For Simondon this understanding is weak as it emphasizes two particular technological schemas which are by no means the end point of a certain branch of epistemology. As his reformulation of the notion of information makes clear it is possible to go beyond these schemata and think and invent technology which is productive of a completely different form of relation of the human with the world, that is as a coherent dynamism that sits, as we have argued causality must, between total indeterminism and determinism.

Hopefully I have demonstrated that the inventive and regulatory aspects of Simondon's ontogenetic account must not necessarily result in an irresolvable tension. One could describe the resolution as that of regulation being the result of invention. Invention and regulation that are in the end co-constitutive just as operation and structure are.

Such operations of invention and regulation must then also be involved in aesthetic and ethical understanding.

Additionally, we have now established how it is that technology holds such a unique position within Simondon's ontology as it is involved in causal

recursions that involves all three of the regimes of individuation and brings them together in new unities of operation.

The revealing processes associated with technology do not just occur in relation to the physical regime but also to the psycho-social regime of individuation. Once this is accepted, a new recursive level can be added to Simondon's account so that it acquires greater resonances with today's technological situation. It is to this we will turn next.

Chapter 8: A Politics of Sensibility

'To be able to see the details of variations in the market and the beginnings of political revolutions, to predict them, and even control them, is definitely a case of Promethean fire. Big Data can be used for good or bad, but either way it brings us to interesting times. We're going to reinvent what it means to have a human society.' - Sandy Pentland, 2012

In this chapter we will contrast Simondon's ontogenetic approach for theorising technology with the work of two contemporary theorists: Bruno Latour and Bernard Stiegler. As well as identifying in what ways Simondon's work outflanks their work we will also attempt to think how Simondon might offer a different approach for thinking about networked digital technology.

8.1: Bruno Latour

In the first chapter we set out the problem that beset Kant regarding judging organic products which are experienced as self-organizing via the category of causality alone.

A consequence of his Copernican revolution is that organic products, unlike other entities, don't conform 'to the constitution of our faculty of intuition' (CPR Bxvii). As a result of this inability to understand natural kinds by the conditioning *a priori* laws of intuition alone, non-determinant regulative principles are required.

It is Kant's Copernican revolution that is understood by Bruno Latour as a defining moment in the history of modernism for it is with Kant that:

'Things-in-themselves become inaccessible while, symmetrically, the transcendental subject becomes infinitely remote from the world.' (Latour, 1993: 56)

Unlike Kant's problem, which concerns the judging of the natural purpose of organic products from the perspective of a transcendental subject, Latour's problem concerns the character of objects in general given their dependence on just such a transcendental subject. He thereby undertakes a reorientation of Kant's antinomy from being one between the organic and mechanical to one between the natural and the artificial. Additionally, for him, objects are not differentiated according to this distinction but can be quasi-objects which are objects that are partly social (artificial) and partly natural: rather than organic products, it is technological objects in particular that he is referring to here.

To understand what the significance of these quasi-objects is we must explain Latour's account of modernism.

For him modernism describes two different sets of practices: purification and translation.

The practice of purification is that which 'creates two entirely distinct ontological zones (Latour, 1993: 10)' which are of nonhuman Nature and Human culture. The importance of Kant is that he is the first to undertake the complete separation into these zones with his Copernican revolution. For Latour this dichotomy describes the 'modern critical stance' (Latour, 1993: 11) which undertakes the work of purification. This work has three approaches for explaining the world: naturalization, socialization and discourse. The first two approaches reside on opposing poles of the dichotomy with scientific naturalism, on the one hand, explaining the world in terms of mechanism and the laws of Nature and, on the other, the human cultural and social explanations from whence freedom, intentionality and values are situated. The first dichotomy of modernism is defined by the incommensurability of these approaches.

Latour describes how this incommensurability is apparent in the problems social science faced when it tried to 'do for science what Durkheim had done

for religion' (Latour,1993: 54) which was to subsume it under sociological explanation. In attempting to do this they found themselves face-to-face with the uncomfortable proposition that this would require the dissolution of faith in the existence of objective reality as described by the hard sciences. The impossibility of the subsumption of explanation to either side of the Nature-Human dichotomy thus left the modernizing project with a dualism where explanation for any aspect of the world must be translated to one or the other of its sides.

The third approach undertaken by modernism was that of discourse, which instead of seeking explanations at either of the poles described focused on one of the mediators purification utilized, that is, language. In this approach the operation of discourse becomes the prime site for explanation through such practices as semiotics and deconstruction. Although situated between the nature-human divide it actually fails to describe the mediations of quasi-objects but instead charts the mediations of language itself given the assumption of the withdrawal of nature, on the one hand, and the social constitution of linguistic practises on the other. Yet language as a natural capacity of rational animals marks a certain 'quasi-objectality' in it.

Having described the first dichotomy of modernism we must now describe the second before turning to Latour's proposed response to modernism. The second dichotomy marks the distinction between the practice of purification we have just explained and the practices of translation. Moreover, as we shall shortly see, it marks these in a specific medium, i.e. language, as its name implies, which is itself, according to Latour, a medium of purification (Latour 1993, 57). It is precisely this recovery of a mediating instance – here, language – under one or the other of the poles of modernism that Latour's 'non-modernism' (8.2) will contest.

Translation describes for Latour the mediating processes by which quasi-objects are both constructed and influence one another. These quasi-objects are hybrids of nature and culture which operate in relations of mediation called networks. These networks describe the connections between the various things which come into relation to transform a given situation.

For example if giving an account of the damage to the ozone layer one would 'link in one continuous chain the chemistry of the upper atmosphere, scientific and industrial strategies, the preoccupations of heads of state, the anxieties of ecologists' (Latour, 1993: 11). Such an account would differ from that given by the work of purification, mixing as it does that which we have seen is incommensurable, namely, naturalized and sociological accounts.

The paradox of modernity is that as the number of these hybrid quasi-objects have increased through translation the further apart have grown the poles of purification by which explanations of them are given. Modernism has attempted to ignore this paradox by denying the importance of these hybrids as realities in themselves. For it, explanations of these hybrids are not to be found in the mediations between them as real things but in the 'pure forms' (Latour, 1993: 78) of explanation developed via purification such as 'epistemes, mental structures, cultural categories, intersubjectivity, language' (Latour, 1993: 57). Instead of developing explanations by tracking mediations the purified account operates through these 'intermediaries' which sort phenomena to either the pole of nature or that of society.

What's more, rather than these two practices of purification and translation just occurring transversally to one another they are actually linked as the progressive work of purification enables the development of ever more kinds of quasi-objects in the form of technologies through the industrial application of purified natural science. Additionally these technologies, especially in the form of scientific instruments, enable the development of purification.

Despite this, Latour maintains, that the modernist project cannot itself account for the 'irruption of objects into the human collective' (Latour, 1993: 21) for although the moderns obviously accept there has been an increase in technological objects (translation) and a Nature-Social division (purification) they 'have never been explicit about the relation between the two sets of practices' (Latour, 1993 :51). It is the making clear of this relation which Latour terms non-modernism.

8.1.1: Non-Modernism

How then can such modernism be overcome? How can we return technology to its 'ontological dignity' (Latour, 2002: 252)? How can we resolve the paradox of the modernist constitution?

Latour's response is to look for inspiration in the method of anthropological ethnography, which is capable of describing the entirety of Nature-Culture as simultaneously real, social and narrated rather than as reducing or 'purifying' the one into the other:

> 'The ethnologist will certainly not write three separate books: one dealing with knowledge, another with power, yet another with practices. She will write a single book . . .' (Latour, 1993: 14)

As such Latour proposes that a method is required that, like the anthropological method, will take into account all the relations involved in defining any situation it studies. This involves stressing the relations between both the practices of purification and translation and in doing so 'accommodate the hybrids and give them a place, a name, a home, a philosophy, an ontology and . . . a new constitution' (Latour, 1993: 51).

The method Latour develops is to begin any investigation from the hybrids themselves and trace the network of relations they create without the need to

purify any explanation of what is discovered. What Latour proposes is a 'Copernican counter-revolution' (Latour, 1993: 79) which takes the quasi-objects and mediators as the starting point and focus of any investigation and from which any notions of objective Nature or Subject/Society might emerge rather than being the transcendental conditions for understanding in the first place:

> 'If we seek to deploy the Middle Kingdom for itself, we are obliged to invert the general form of the explanations . . . The explanations no longer proceed from pure forms toward phenomena, but from the centre towards the extremes.' (Latour, 1993: 78)

In this proposal for a Constructivism based on some kind of genetic development Latour echoes Simondon. Similarly, Latour makes the case for the need for a different ontology, albeit one that differs considerably from Simondon's.

At the heart of Latour's ontology is the notion of the actor or actant. For him all quasi-objects and quasi-subjects are actors in the sense that they all have agency:

> 'I suddenly understood that the non-human characters had their own adventures that we could track, so long as we abandoned the illusion that they were ontologically different from the human characters. The only thing that counted was their agency, their power to act and the diverse figurations they were given.' (Latour, 2012: 6-7)

One could perhaps summarize Latour's project, with apologies to Husserl, as: 'To the actors themselves'. But unlike the phenomenologist Latour proposes a method of description which gets to the reality of the actors under

consideration and not the reduced experience of them which makes phenomenology merely a purified approach.[36]

By agency Latour does not mean that all technical objects are imbued with intentionality rather that when actors come into relation with one another they transform one another. They have a 'relational materiality'.

Thus Latour is able to define an actant with the broad definition of:

'Any element which bends space around itself, makes other elements dependent upon itself and translates their will into a language of its own.' (Callon & Latour, 1981: 286)

It is through this process of translation or mediation that actors are both formed and give form to other actors. Thus if we are to describe any actor we must necessarily also describe the network of relations it has with any other actors for these will in-form what they are to some degree just insofar as they do it.

Latour's method then is to track the network of actors and their mediations for this is how reality is constituted and transformed. We must not mistake this reality for the purified descriptions that have been given of it. Due to the modernist Nature-Society split such descriptions are necessarily always partial and falling either side of this split or reduced just to the mediation of discourse. Latour describes the poles of Nature and Society as huge tectonic plates which have emerged from the magma of mediating activity below (Latour, 1993: 87). They should not be seen as causes but as effects - it is this reversal that describes his Copernican counter revolution. For if we are to follow his method we will find that the actors are not purified entities but that different aspects of their description cross the Nature-Society divide.

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[36] For Latour phenomenology is a furthering of the paradox of Kant's Copernican Revolution in that it 'transforms a distinction, a separation, a contradiction, into an insurmountable tension between object and subject' (Latour, 1993: 58).

To be true to reality, just like the anthropologist, we must give as full a description as possible using as many practices as possible even if that means our descriptions are simultaneously natural, social and discursive. Such practices are just ways of carving up the world into purified chunks, whereas what Latour is aiming for is a more complete account by stressing the relations between them:

> 'We have both [moderns and non-moderns] always built communities of natures and societies. There is only one, symmetrical anthropology.' (Latour, 1993: 103)

As noted above there are some similarities between Latour's and Simondon's projects. Both have the avowed aim of demonstrating the importance of technology in the face of it being either misunderstood or wrongly ignored due to reasons that are ultimately metaphysical. Simondon's *bête noire* is hylemorphism (amongst others of course) whilst for Latour it is the purification of modernism. But despite both proposing a kind of relational constructivism their differing ontologies lead to dissimilar consequences.

8.1.2: Agency and Causality

As we have already mentioned it is the actor that is central to Latour's proposed ontology:

> 'We start from the *vinculum* itself, from passages and relations, not accepting as a starting point any being that does not emerge from this relation that is at once collective, real and discursive.' (Latour, 1993: 129)

An actor is so described because of its ability to transform and to be transformed. There are echoes of the Eleatic stranger's test for reality here, which we described in chapter 4, and according to which an entity can be called real if:

'it has any capacity at all, either by nature to do something to something else or to have even the smallest thing done to it by even the most trivial thing, even if it only happens once.' (Plato, *Sophist* 247e)

Should we therefore understand Latour as a powers theorist in that his fundamental understanding of what constitutes an entity is its power to act? Although this may seem an oblique strategy if an actor is an actor due to its 'power to act' (Latour, 2012: 7) then surely it is appropriate to interrogate his ontology in the same way as we did other powers based metaphysics.

The core concern in that chapter was regarding how powers metaphysics dealt with the questions of cause, relation and ground. These are all questions that Latour's Actor-Network theory also needs to address if it is to offer a credible realism.

As already noted Latour's concept of translation is both relational and causal in nature. Actors are such that they are permanently involved in processes of mediation with other actors. In fact Latour develops a range of terms he uses to describe the various processes of mediation in which actors are involved: e.g. delegation, prescription, fold, inscription, translation. What all of these terms describe are ways that actors mediate one another.

Thus in describing a network using Actor Network Theory (ANT) a theorist might utilize a number of different terms for the mediations involved. For example a washing machine translates or inscribes the actions of hand-washing clothes into a machine process. In turn the machine, perhaps due to its speed and ease of use might well prescribe back to its users new behaviours related to washing clothes or new values regarding hygiene, cleanliness or housework. What would be attempted to describe here is how such mediations involve causality involving different types of actors (e.g. people, clothes, machines, detergent, values). As such the explanation is not just cultural, physical or discursive. It involves aspects of all of these.

In this network of different kinds of mediation Latour is pointing to something important. It certainly is true that different kinds of things can be involved in related causal processes. However unlike the powers theorists discussed in chapter 4 he fails to offer a convincing account of the causal processes involved. These words seem to elide this crucial part of the story. Latour is right to talk of hybrids and mixing but his ontology remains too underdetermined to offer a convincing account of how this actually operates.

One explanation for this is that Latour's anthropological method is actually an avoidance of developing a truly ontological approach (such as Simondon's) and instead just draws together explanations garnered from a range of practices, like an ethnologist in the field, in the hope they will be sufficient for a consistent explanation.

The problem with this seems twofold. First, this does not give us a causal story at a granular level of detail. Second, it is still not clear how the different explanations may be connected without a coherent ontology.

In *We Have Never Been Modern* it seems that it is mediation that is to offer this explanation:

'The world of meaning and the world of being are one and the same world, that of translation, substitution, delegation, passing.' (Latour, 1993: 129)

However this seems to elide what the reality of mediation is that it can claim to bring meaning and being together without detailing how. In short, Latour's network anthropology lacks a theory of ontogenesis that describes not just how actors emerge in the first place but also how they are causally related.

At its heart Latour's anthropological approach retains the modernist division it rails against because it fails to link the different practices of explanation into a unifying axiomatic of ontogenesis. It is precisely this which makes Simondon's account so much more resilient.

In his later work Latour appears to be attempting to address this lack by developing an account of multiple modes of existences, which he calls a multi-realism:

> 'My hypothesis is that each of these modes makes it possible to respect, in the empirical areas I have pursued up to now, a certain tonality in the experience, the felicity or infelicity conditions particular to each case, and especially (here is where things become dangerous) a specific ontology. In fact, each mode requires us to encounter distinct beings which must be addressed in their own languages. The classic question of philosophy, "what is the essence of technology, science, religion, and so on?" then becomes "what are the beings appropriate to technology, science, religion, and how have the Moderns tried to approach them?' (Latour, 2012: 1-2)

This approach sees the continuation of Latour's anthropological method. His hope is to return to experience in order to try and identify these different modes and the theories that are appropriate to them. As such it sounds like a form of multi-disciplinarity situated within the unifying rubric of the descriptive science of anthropology.

A question worth asking here is does such an approach live up to the claims of his Copernican counter-revolution, for it would seem to be the various empirical areas of explanation which are determining of ontology rather than such explanations arising from the hybrids themselves. This would seem then to be a kind of re-formed Aristotelean substance, independent of its predicates, developed upon as this range of modes of individuation with discourses appropriate for each one. Again, however, as is often common with cross-disciplinary exercises, there is little that connects them *as such*: the genesis and actuality of objects themselves is still lacking.

Such an exercise appears as a new system of purification, sorting entities into these different modes through intermediation (i.e. discursive practice)

rather than the proposed tracking of networks of mediators. As such this runs contrary to the kind of counter-revolution we understand Simondon as developing; that of tracking the genetic development of individuation from the pre-individual onwards in such a way that the connections between epistemology and ontology remain coherent and robust.

With such attention given to discourse it is perhaps unsurprising that Latour has sometimes been mistaken for a social constructionist, something that frustrates some of his followers. For example, Cordella and Shaikh bemoan the case that too many researchers use ANT for an interpretivist approach when they should 'allow the actants to "speak" for themselves, and not put words in their mouths' (2006: 17). To do this, they add, researchers should use 'the ontological dimension of ANT' (2006: 17), although it is not clear how distinct this ontological dimension is from the discursive, owing precisely to Latour's anthropological method.

Additionally, returning again to the comparison with the powers theorists we looked at in chapter 4, Latour also completely omits the question of ground and individuation as for him the network of actors always already exists.

8.1.3: Agency and the Human

Latour's attribution of agency to all entities raises further questions. First, he fails to give an adequate account of agency which distinguishes this property between the various actors capable of demonstrating it. As we noted above agency is that power an entity has to act; but what kind of power this is for any given actor is concealed behind the generalization of terms such as mediation and translation.

It is instructive to examine Latour's brief discussion of the human in *We Have Never Been Modern* to expand on this concept. Like Simondon, and as a

constructivist, it should not be surprising that Latour doesn't believe in a human essence. It is instead clear that like all other actors the human is a mediator. That is to say that it shouldn't be defined by freedom, at least in the Cartesian sense, as this is to return to the subject-object dualism that beset modernism. Instead humans are entangled with all the other actors in the world as mediators just like them:

> 'The human is in the delegation itself, in the pass, in the sending, in the continuous exchange of forms.' (Latour, 1993: 138)

If we are generous, as readers of Simondon, we might be able to forgive the implicit hylemorphism in this statement. Perhaps Latour could be interpreted as meaning 'exchange of forms' in the sense Simondon uses terms such as modulation of information. However due to the lack of detail Latour provides on this issue we can't be sure. Neither does his definition of the human help clarify the situation:

> 'A weaver of morphisms - isn't that enough of a definition?' (Latour, 1993: 137)

In answer to this, if we are to follow Simondon, we must reply 'no'. Man is not just one mediator amongst others. To claim this is to do a disservice to both human and non-human. Simondon's project, especially in *The Mode of Existence of Technical Objects* is similar to Latour's in that both seek a more developed recognition of the technical. However what Simondon develops goes deeper than just recognizing some level of technological agency in an expanded anthropology.

Anthropology is a problem for Simondon and in some respects his and Latour's concern with this domain share common concerns. Rather than being the solution for a dualistic modernism however, Simondon understands anthropology in terms similar to that by which Latour understands modernism itself. For Simondon anthropology denotes both those attempts to define the

human as either essentially psychic (e.g. psychology) or social (e.g. sociology) and by doing so as distinct from other animals, as well as that tendency to reduce technology to just a means for humans ends. As such it broadly describes the two dichotomies that Latour describes as modernism, that is those between nature/culture and nature-culture/technology. I say broadly as obviously Simondon's ontology accounts for the difference between and actuality of nature and culture differently to Latour.

Can we draw from this a criticism of Latour's use of anthropology to resist a modernism that contains those two dichotomies that also constitute anthropology for Simondon? As this thesis has made clear Simondon's broad ontological investigation into individuation takes him far beyond a reinvigorated anthropology (in Latour's sense).

Simondon's project involves the instigation of what Barthélémy (2010) calls a 'difficult humanism' which has as its goal a response to the two tendencies described above. On the first point it should be clear from previous chapters that Simondon doesn't recognize a distinction between humans and animals on the grounds of psychology for he fully allows that animals can find themselves in psychical situations because psychic individuation is a development from the vital regime and thus necessarily not restricted exclusively to humans. On the second point, as we have also described, Simondon's understanding of technics goes far beyond seeing it merely as a means, since it famously has its own 'mode of being' and remains always in excess of its particular uses.

What distinguishes Simondon even more from Latour however is the positive aspect of the former's project, which calls for an understanding of the relations that operate between culture, nature, and technology. It is charting this in a genetic manner which constitutes his new encyclopedic project which has as its goal the overcoming of the alienation described in chapter 7.

For Simondon humanism is something that requires frequent re-invention for the human is constantly becoming as it finds itself in new situations, not least in relation to technology. With the development of both thermodynamic and informational technologies Simondon discerns the need for a new thinking of the culture-technology relation so as to overcome alienation. This also requires an understanding of the part technology plays in establishing transindividual relations as well as the development of the role of conceptual ideation through analogy in invention. As Barthélémy succinctly describes it:

> 'Simondon reminds us that the whole of Encyclopedism aimed to liberate man from a determinate alienation, and the question today is one of combating a new form of alienation (new because it is machine-induced) with a new Encyclopedism (new because it is genetic).' (Barthélémy, 2010: 245)

Due to the flattening nature of the reduction of all entities to actants as well as a lack of clarity regarding causality Latour's philosophy of technology is remarkably unambitious. From his perspective there isn't really too much to be worried about. The modernist fears that have abounded regarding technologies are merely the results of purified myths. For example he swiftly dismisses Ellul's concerns:

> 'Protecting human beings from the domination of machines and technocrats is a laudable enterprise, but if the machines are full of human beings who find their salvation there, such a protection is merely absurd.' (Latour, 1993: 124)

Once it is understood there are just networks of actors then such a substantive understanding of technology must be refused. In truth there have been no epochal jumps just the gradual prolongation of networks and 'the innovation of lengthened networks is important, but it is hardly a reason to make such a great fuss' (Latour, 1993: 124).

For Latour the difference between the non-moderns and moderns is down to the length of the networks the latter have constructed. That these networks are sometimes thought of as totalities is a mistake: 'Since this enlistment of new beings had enormous scaling effects by causing relations to vary from local to global, but we continue to think about them in terms of the old opposite categories of universal and contingent, we tend to transform the lengthened networks of Westerners into systematic and global totalities' (Latour, 1993: 117).

There is a tendency in Latour's work to resist systematization and reduce everything to actants in networks. This results in a neglect of the operative nature of reality that Simondon describes in his allagmatics. An important consequence of this is that it leads to an uncomplicated and unquestioning ethical perspective on technology where what is most valued is the continuing development of fresh mediations:

> 'Every concept, every institution, every practice that interferes with the continuous deployment of collectives and their experimentation with hybrids will be deemed dangerous, harmful, and — we may as well say it — immoral. The work of mediation becomes the very centre of the double power, natural and social.' (Latour, 1993: 139)

Unlike Simondon's more balanced aesthetic approach which enables an identification of man-technology and technology-nature combinations which are alienating or catastrophic, Latour seems reluctant to pass judgment as such concepts are too universal.

Besides, as a mediator technology is too disruptive and contingent to be able to be the subject of morality. Technology always presents us with unforeseen consequences which are impossible to judge prior to the event and thus it should not be subordinated to morality: 'As it is often said, morality is

less preoccupied with values than with preventing too ready an access to ends' (Latour, 2002: 257).

Instead Latour is content to settle for a democratic solution to questions of which networks to build, but the *demos* he calls for is of a new kind where 'things' also have a voice, where *all* actants are represented. This begs the question of *how* things are represented. The answer to which would seem to be based on Latour's now broadened anthropology.

But isn't this problematic? Can the things really be said to represent themselves when the method by which they do so remains anthropocentric, however well intentioned? At least Simondon is honest in that he explicitly seeks an aesthetic balance between culture and technology and technology and nature at all levels. Latour's democracy, like all democracies, is open to abuse by those stronger actors who wield more power in 'tests of strength'.

Latour's democracy and networks in drawing attention to the reality of technology simultaneously feels like its defanging. Although, just like Simondon, he recognises that technology is in some sense 'made of subjects' (Latour, 1993: 196) he understands this as its domestication whereas Simondon understands it as a problem in need of resolution (much like Stiegler sees technology as *pharmakon* as we will see now).

8.2: Bernard Stiegler: Technics and Time

Given the breadth of Bernard Stiegler's oeuvre it is difficult to offer a detailed summation of his overall project. In this section we will aim to highlight those aspects of his project which we understand as either directly influenced by Simondon or which seek to extend Simondon's project to include contemporary digital technology.

In anglophone culture Stiegler is best known for his *Technics and Time* series of books. In this series he develops most of the core concepts which continue to inform his more recent politically engaged work.

As with both Simondon and Latour, one of Stiegler's central concerns is the marginalization of technics in philosophical thought. In the first book of the series Stiegler seeks to counter this tendency by demonstrating the importance of technics for the constitution of humanity, in particular that this involves the fundamentality of technics for human temporality.

Stiegler argues that the human lacks both essence and origin. It is technics, understood as a supplement in relation to this lack, which drives the process of the co-invention of the technical with the human:

> 'The technical inventing the human, the human inventing the technical. Technics as inventive as well as invented. This hypothesis destroys the traditional thought of technics, from Plato to Heidegger and beyond.' (Stiegler, 1998: 137)

Simondon's work is crucial for Stiegler's description of the genealogical development of this co-constitutive relation because it enables an account of technics as quasi-independent, due to it having its own mode of individuation, whilst also being co-related with the human.

This co-originary relation means that technics plays a prominent role in all aspects of human affairs. It will be one of Stiegler's aims to give an account of the multifarious ways that the human and technics interact in what he calls a 'general organology'.

As Stiegler mentions in the quotation above this relation also challenges traditional ways that technology has been thought. It does so by undermining those critiques of technology which understand technology as destroying a more originary mode of relation of the human with the world. Thus

Heidegger's claims that technology is a mode of truth which endangers man from experiencing the call 'to a more primal truth' (Heidegger, 1977: 28) is undermined because, for Stiegler, there is no more fundamental relation with the world which doesn't involve technics.

The co-constitution of the human and technics is also a process of exteriorization: human subjectivity is constructed in a process of exteriorization in relation technics.

> 'There is no interiority that precedes exteriorization, but to the contrary exteriorization constitutes the interior as such, that is to say, distinguishes and configures it in the very course of what Leroi-Gourhan describes as a process of exteriorization where this configuring distinction, which is constantly displacing itself, each time setting up new relations between the psychical individuals and the collective ones – new processes of the formation of psychical and social individuation, in the sense Gilbert Simondon confers to this expression while stipulating that memory is the 'associated milieu' of this individuation.' (Stiegler, 2010: 70)

Simondon's influence is clear here with the importance Stiegler gives to the notion of an 'associated milieu', however we can also see how the exteriorization process is also reminiscent of the process of the image-cycle that Simondon developed. A key difference between the two thinkers is that Simondon doesn't describe technics as being originary for the human, for him the human inhabited a non-technical magical world prior to technical development. This also means that, for Simondon, technics doesn't constitute the pre-individual for the human as it does for Stiegler, but for itself, for its own mode of individuation. This means that for Stiegler the history of the human is also the history of technology and vice versa. As such he cannot describe a *real* history of technology which is in any sense independent of, even if co-extensive with, recorded human culture. His is therefore necessarily an

anthropological theory of technology in contrast to Simondon's more precisely described technological and ontogenetic account.

Since its establishment with the development of flint tools two million years ago, the history of the exteriorisation process has simultaneously been the history of the individuation of the mental (*the 'who'*) in relation to that which it is exterior (*the 'what'*), which for Stiegler is technics.

To understand the importance of exteriorisation for the development of the mind for Stiegler one also has to understand his concept of epiphylogenesis.

Developed from both anthropological and zoological accounts of human development epiphylogenesis is the theory that human development is not just one of genetic development but that it is deeply implicated with technics as 'the pursuit of life by other means' (Stiegler, 2009: 163). That is, that human development is profoundly influenced by the environmental presence of technics, of the sedimentations of epigenesis in its milieu, which leads to a 'break with pure life, in that in the latter, epigenesis is precisely what is not conserved' (Stiegler, 1998,140). The preservation of the epigenetic, which also has its own developmental dynamic (the technical tendency), enables new forms of reflexivity and anticipation which help overcome the retentional finitude of the biological organism as well as enable it to develop new temporal relations.

By anticipation is meant the 'realization of a possibility that is not determined by a biological program' (Stiegler, 1998, 151). Stiegler also uses the term protention to describe this anticipatory capability that technics helps to establish through being an intergenerational mnesic support.

Thus the history of technics is also the history of the development of human memory via exteriorisation, an exteriorization which Stiegler, following Husserl's classification, calls tertiary retention.

Stiegler develops the concept of tertiary retention in *Technics and Time, 3* by developing Husserl's notions of retention and protention from *Logical Investigations*. In his analysis of the temporality of consciousness Husserl identifies a temporal object as that which 'is constituted only in its duration' (Stiegler, 2011: 13). The example used is that of a melody which is constituted through time and as such 'manifests itself in disappearing' (Stiegler, 2011: 14). Such temporal objects maintain phenomenological unity over the course of their duration and Husserl names the maintenance of this unity primary retention. Without this retention the melody would not be experienced qua melody but as a series of instants. Primary retention is the phenomenological maintenance of the past part of the melody for its listener during the duration of its performance.

Secondary retention refers to the effect primary retention has on subsequent experience. That is to say that the retention of the previous experience of a temporal object has a conditioning effect on ensuing experience. This effect is recognisable in that succeeding listenings of the same melody are never experienced as identical. A previous hearing of a melody, as well as any other music, will have changed present experience.

To these two retentions Stiegler adds tertiary retention which is 'an artificial memory presented in a support medium' (Stiegler, 2011: 23). This refers to the already-there of material culture (including technical objects) which acts as an 'intergenerational support of memory' (Stiegler, 2010: 9).

Stiegler argues that primary retention is always already dependent on secondary retention, which in turn relies on the already-there of tertiary retentions, which is technicity. Therefore there is never a separation of the *who?* from the *what?*, the living from its non-living milieu.

It must be understood that epiphylogenesis doesn't just mean a prosthetic extension of memory.[37] The profundity of epiphylogenesis lies in it being a transductive process where the *who?* and the *what?* co-individuate. This means that prior to the process of exteriorization there is no interiority:

> 'the issue is therefore neither that of an interiority nor that of exteriority— but that of an originary complex in which the two terms, far from being opposed, compose with one another (and by the same token are posed, in a single stroke, in a single movement).' (Steigler, 1998: 152)

Therefore what are commonly described as mental phenomena, such as gesture, language, numbers and memory are the result of an exteriorisation process.

Stiegler recognises the importance of the body and gesture for the exteriorization process as well as for the phenomenological constitution of time. A gesture is anticipatory in that it only exists through the possibilities created by that which is external (the tools and prosthetics that constitute tertiary retentions) and which increases the possibilities for action in its milieu.

> 'There is no anticipation, no time outside of this passage outside, of this putting-outside-of-self and of this alienation of the human and its memory that "exteriorization" is.' (Steigler, 1998: 152)

Similarly the development of and capacity for mathematical manipulation also arose from a process of external manipulation that has become mirrored 'internally'.

> 'In point of fact, number in general can only be conceived of as being determined within a system of traces, any notation system constituting itself through the external manipulation of symbols: there is no mental calculation not resulting from the secondary interiorization of a calculation

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[37] For example as the *active externalism* of Andy Clark and David Chalmers *Extended Mind Thesis* runs the risk of reduction to. In this thesis objects in the environment are seen as being functional extensions of the mind rather than strictly co-constitutional as Stiegler argues.

by symbolic manipulation, that is to say through manual behaviours.'
(Stiegler, 2011, 52)

In Stiegler's description we have a detailed account of the development and extent of the co-individuation of the *who?* with the *what?*, which demonstrates that the mental always stands in a constitutional relation to an exterior. In particular the phenomenological richness that we experience, the complexity of language and numeracy, is explained by the anticipatory relationship maintained with an exterior milieu comprised of technics.

In this description of exteriorisation we discern a very similar account to that given by Simondon of invention in his theory of the image-cycle. Although Stiegler, like Latour, relies more on anthropology (Leroi-Gourhan) and, unlike Latour, on phenomenology (Husserl) than the biological sciences which Simondon utilises, there is a commonality in their projects in that both wish to demonstrate the causal relation between ideation, biogenesis and the physical world.

Additionally, as we will see when considering his political thought, Stiegler also utilises Simondon's notion of transindividuation in order to explicate the social implications of this co-constitutional relation.

Stiegler pays particular attention to developing an account of the operation of media technologies in this co-constitutional relation with a focus on the development of time-consciousness in relation to orthography, cinematography and digital networks. From the perspective of thinking Stiegler as a post-Simondonian thinker[38] we can understand him as describing a new kind of alienation in relation to these contemporary technologies that builds on Simondon's own account of alienation.

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[38] I'm aware of the limited nature of this perspective. It would be just as easy to think of Stiegler as post-Derridean or post-Heideggerian. However for the purposes of a thesis on Simondon such a perspective seems justified.

8.2.1: For a New Critique of Political Economy

In *Technics and Time, 2: Disorientation* Stiegler develops an account of the industrialisation of memory due to the convergence of modes of cultural production and consumption utilising digital networks with capitalist economic imperatives. He sees in this synthesis the danger of a 'psychopower' which subordinates social and cultural individuation to determination by speculative economic concerns. To understand the developmental logic of this over-determination we will briefly present the argument of probably his most polemical work to date, *For A New Critique of Political Economy* (2010).

A concept crucial for understanding the industrialisation of memory is that of grammatization which is 'the process through which the flows and continuities which weave our existences are *discretized*' (Stiegler, 2010: 31). Grammatization involves the technical exteriorization of the various kinds of memory. Thus the reproduction of gestures by automated machines, such as for example with powered looms and punch-cards, is one example of grammatization where the workers gestures are discretized and recorded in the holes of punch cards. Stiegler describes this kind of technical object as mnemotechnics.

Technical history is, for Stiegler, a history of the grammatisation of the different kinds of memory by various types of technology. Thus both language and numeracy are types of grammatization that support different kinds of psycho-social individuation.

Stiegler also follows Simondon in his understanding of proletarianization as that which occurs when the workers knowledge is subsumed into the technical object:

'The proletarian, we read in Gilbert Simondon, is a *disindividuated* worker, a laborer whose knowledge has passed into the machine in such a way that it is no longer the worker who is individuated through bearing tools and putting them into practice.' (Steigler, 2010 :37)

This loss of knowledge is described by Stiegler as a loss of *savoir-faire.*

It is the synthesis of converged digitized media with a neoliberal mode of economic production which Stiegler sees as posing an altogether more widespread form of proletarianization which extends from alienating the knowledge of the worker to all other forms of knowledge including the cultural.

For Stiegler the progression of the grammatization process into the social and cultural entails an even more profound loss of knowledge, that is the proletarianization of *savoir-vivre.*[39] Stiegler's argument here reiterates aspects of various critical engagements with contemporary digital culture including those of immaterial labour (Lazzarato, Terranova), attention economy and neuroscience (Carr) and the control society (Deleuze).

Stiegler's fear is that just as the grammatization of workers knowledge and skills led to work becoming disindividuating labour and with workers reduced to being mere servants of technical individuals so the grammatization of culture in the service of marketing will lead to a hyperindustrial consumerist control society.

'Within the current capitalism typical of control societies, the function of culture has been reduced to socializing production by standardizing consumer behaviour, culture thereby becoming the agent par excellence of this control.' (Stiegler, 2011 : 26)

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[39] By *Savoir-vivre Stiegler* is referring to behaviour that is more cultural and general in kind and not that associated just with working practices (*savoir-faire*). An example would be that of the development of the idea of 'lifestyles' as marketing creations to drive consumption.

The overdetermination of contemporary Western culture by corporate marketing in the service of capitalist economics is therefore leading to social homogenization bereft of any transindividuating capability.

The transindividuating potential of the social is undermined by a short-circuiting of the collective desire for long-term shared aims into individualized and easily satisfied, short-term drives. Given that all individuals undergo the same conditioning the inevitable result is the production of a monoculture of neo-liberal subjectivity.

Where Simondon sought to address the problem of culture lagging behind the development of technology in such a way that it misunderstands it and sees it as a threat, Stiegler points to the advancement and domination of economics as the main problem:

> 'In the twentieth century, however, the economic system having taken a step beyond all the other systems, and being charged with the task of unifying them *by finitizing them,* that is submitting them to a process of generalised "monetization" . . . it is *infinitive consistence* (the law of desire), constituting the condition of any genuine co-individuation of the three organological levels, which finds itself destroyed.' (Stiegler, 2010: 106)

Such a situation is necessarily self-destructive. If all desire is attenuated then it becomes short-term which means the destruction of desire regarding a long-term horizon. Such short-termism ultimately leads to a '*liquidation of social relations*' (Stiegler, 2010: 57). Here Stiegler's critique shares aspects of Marcuse's critique of capitalism due to desublimation[40] in that desire no longer aims for the infinite (though it may never be attained) but as drive is instead easily, if unsatisfactorily, sated through consumption.

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[40] Marcuse develops his ideas in several places, most notably in *One–Dimensional Man* (1991) but also in his essay *The Containment of Social Change in Industrial Society* (2001) where he writes: 'repressive desublimation, is characterized by the contraction rather than the extension of erotic energy by its contraction to sexuality – that is to say by a contraction and reduction rather than strengthening of the life instincts' (Marcuse, 2001: 91).

The question of grammatization thus leads for Stiegler to the need for a new political economy which must address the problems of the industrialization of protention and subsequent dissolution of libidinal energy.

In order to do this Stiegler proposes the need for a general organology which bears a considerable resemblance to Simondon's *allagmatics* in that it is a theory of 'the transductive relations between the three levels' (Stiegler, 2010: 117) which are the psychosomatic, the technical (or pharmacological) and the social.

Although, as the name suggests, Stiegler generally proposes his organology as describing the relations between various types of organs (bodily, artificial and social) he is clear that there 'are tendencies and counter tendencies proper to each of the three organological levels' which come into transductive relation. As such, like Simondon, Stiegler's investigation aims for a processual account of and between the psychosomatic, social and technical.

Stiegler is also clear that although these levels have distinct 'tendencies', these are causally interwoven. Therefore the technological level is able to be understood as *pharmakological* because its influence on the psycho-somatic level can lead to either psychic proletarianization and thus social disindividuation or psychic individuation leading to social transindividuation. The question of a political economy involves then the tracing of the relations between organological levels in order to understand the pharmacological dimensions of any mnemotechnics and the possibility for any subsequent therapeutics.

By 'therapeutics', Stiegler refers to the ways by which the poisonous aspects of any *pharmakon* can be remedied and psychic and transindividual individuation encouraged. He identifies a number of areas where he sees the digital networked mnemotechnics of the contemporary technical level as having a toxic effect on both the psychosomatic and social levels. For example, a core area of concern is with the purported transformation in the nature of attention

which, due to their excessive contact with these technologies, is particularly experienced by younger generations. This has led to a reduction in the ability for 'deep attention' and with this the ability for the maturation of thought and socialization. This problem is exacerbated by the short-circuiting of desire that the penetration of economics markets into these networks produces, as described above. Such a combination has led, Stiegler maintains, to the increase in attention disorders such as ADHD.[41]

Stiegler sees in such transformations a need for a 'battle for intelligence' which he proposes should be undertaken through a 'psychopolitics' which also, since the psychic is not reducible to the life of the concept, implies a 'noopolitics' which, following Simondon's observation that a psychic individuation is simultaneously also transindividual, politicizes the location of the concept.

Unlike Latour's democratic 'parliament of things', Stiegler's political solution to what he sees as a catastrophic situation for humanity requires a range of strategies that correspond to different relations across the organology.

For example, one strategy is to circumvent those aspects of network culture controlled and exploited by capitalist interests. Stiegler describes this strategy as 'taking care' in that what is being fought is a '*struggle against the careless tendency* inherent in that *pharmakon* that is capital, and *thus to take care of the world*' (Stiegler, 2010: 108).

The overall goal of these strategies is to establish a long-term common desire for a renewed techno-social project that aims to constitute what he calls 'long circuits' of transindividuation. Such long circuits are what he has understood as being short-circuited by the current dominant forms of

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[41] Stiegler describes this connection at some length in *Taking Care of Youth and Generations (2010)*. E.g: 'the psychosocial state of the world is equally ubiquitously . . . being overtaken by a colossal deficit of attention, an immense neglect in the *global attention deficit disorder*, stemming directly from the proliferation of psychotechnologies that no political power can control' (57).

grammatisation. What Stiegler has in mind with this is how a change in the dominant mode of recording, storing and replaying the various kinds of human memory (e.g. gesture, language, photography, video) can disrupt and change social individuation in such a way that it acquires a new political and semantic character.

As for Simondon, this political project must ultimately be based in aesthetics for sensation, as the basis for noetic life, is indissolubly social and the foundation for the development of culture. In particular what culture means is the establishment of consistences, that is non-existent yet *consisting* infinitive ideas at which desire can aim: for example the idea of justice. Such consistences are required to play a regulative role in sustaining of belief for the long-term stability of social individuation.

> 'There is practice and culture because there is ancestry and inherited obligations that, far from being the opposite of the freedom of singular time, are, as pre-individual funds, the condition of such freedom. This is what forms itself as — and forms — consistences. These "forms", which are however wholly informed by the material constraints of tertiary retention permitting their stabilization and transmission, metastabilize themselves as a process of psychic and collective individuation.' (Stiegler, 2011: 118)

Such consistences must neither be understood as theologically given nor reducible to calculation (and therefore to economy).

The problem then is one of the maintenance of such consistences through changes in the technical aspects of organology when desire necessarily is originarily technical and any change in grammatization conditions in turn cause adaptations to psycho-social individuation.

There is thus a tension in Stiegler's thought between the required maintenance of consistences and the plasticity of composition that the history of epiphylogenesis describes. This requirement for consistences could be

understood as a plea for the conservation of enlightenment rationality and values. Certainly some of Stiegler's concerns about declining educational standards could be interpreted in this way. However this might be an unfair reading. Like Simondon, Stiegler proposes an ontology based on composition and invention which understands as a requirement for transindividuation the need for these fictional consistences upon which collective desire can take aim:

> '*Noetic* life is *intrinsically* fictive, fictional, and, as such, *to be decided*, decided *in the political economy* of the *libidinal and spiritual* economy that a city constitutes - it is deciding to *realize a fiction.* It is wanting to believe in a fiction: law, insofar as it is a difference we must *make.* Or to put it another way: it is to have *imagination* - or, yet again, *to invent.'* (Stiegler, 2011: 147)

Once more what we find at stake is a matter concerning the nature of causality in that such questions ultimately concern the ability to predict and anticipate the nature of any invention. With Latour we witness a prohibition on prohibition in that the law is not to deny actors their ability to act. Stiegler is wary of such a *laissez-faire* attitude. For him the claim that the unpredictability of the technical tendency means 'that it is not possible to predict the technical future, nor is it possible to build any kind of political will or bring it into reality' (Stiegler, 2010: 124) is based on a confusion. Although the technical tendency (its mode of individuation) may be impossible to predict the *technical fact* can be negotiated as it requires 'compromises between technical tendencies and social systems, which are themselves organizations resulting from tendencies and counter-tendencies constituting them as metastable systems' (Stiegler, 2010: 125).

As such he is entirely consistent that noetic individuation is absolutely central for our ability to enter into such negotiations and we need to take care of our ability to think and communicate complex ideas as well as resist a decline into a drive-based libidinal economy.

So to what extent can Stiegler be understood as developing Simondon's project and in what ways does he diverge from it? Stiegler's project is undoubtedly a significant intervention in the philosophy of technology which borrows some key concepts from Simondon (e.g. metastability, transindividuation and aspects of the image-cycle). However Stiegler uses these concepts for quite a different end to Simondon. Although he also proposes a kind of technological alienation he does so via the reduction of the human-technology relation to one based on a phenomenological account of memory. Additionally, although Simondon, through his theory of the image-cycle, does propose mental schemas that are understood as having a regulatory purpose he does not propose these as fictions which must be *decided* upon like Stiegler does. Simondon's schemas are not invented through a process of the voluntary selection of fictions but through an ontogenetic process of epistemological development. As we have seen Stiegler's organology shares some aspects of Simondon's mechanology but ultimately betrays Simondon's core insight that the technological mode of individuation is in a very real way independent and not a co-constitution of a *who?* with a *what?*

Stiegler makes an important contribution for thinking about the psychic and collective implications of information technologies. Although he is correct to make a case for a new form of alienation or proletarianization it can often seem in his writing that the toxic aspect of this technology is exaggerated at the expense of a more balanced approach. Often Stiegler seems inclined to accept the doom-laden prognostications of digital naysayers, such as Nicholas Carr, as universally applicable without allowing consideration for a more balanced investigation that a genetic approach should give. However, Stiegler's strength is also in that he sees far more clearly than Simondon the cultural and economic aspects in play in the conditioning of the techno-social. This is undoubtedly due to the social nature of much computing. This does not mean

Simondon is wrong, as I'll argue in the next section, just that contemporary technology requires an extension of his concept of the associated milieu.

Although Stiegler presents a convincing narrative of the implosive decadence of contemporary society his concentrated focus on just the human retentional economy rather than technologies relations with a broader conception of the human may be misleading. We will investigate this, the anthropologism Stiegler, in the end, shares with Latour, in the next section.

8.3: Software

In the previous chapter we looked at Simondon's account of technical associated milieus which were described as the relation a technical object has with the physical environment. Additionally we noted that Simondon was often critical of the intrusion of cultural factors upon the process of technical concretization. I have argued therefore that Stiegler's project can partly be understood as a response to this by describing the necessarily social aspects of contemporary individuations involving technology.

In the final part of this thesis I want to think about how some examples of contemporary software-based technology can be understood from a Simondonian perspective as well as what implications this ontic domain has for Simondon's approach.

Matthew Fuller, the media theorist, suggests the establishment of the discipline of Software Studies would show 'the conditions of possibility that software establishes' (Fuller, 2008: 2). This resonates with Simondon's mechanology, especially its emphasis on the previously undiscovered synergies and relationships that technological development reveal. To maintain a Simondonian perspective software will be considered in terms of its *operation*. Although much has been written about how software can be defined

(Mackenzie, 2006; Fuller, 2008; Galloway, 2004), for example regarding its materiality as code (Hayles, 2002), we will, following Simondon's method, focus on its operation, thus not separating it from its instantiation within a working technological situation.

The initial questions I want to ask are: 'As a technology, what is software's relationship to the regime of the psycho-social?' and 'Can this give us a way of understanding what differentiates software from the kind of mechanisms on which Simondon focused?' In asking these questions it is hoped that means of extending our understanding of technology through a Simondonian ontology will become clear.

We will use as a our example Urs Bruegger's and Karin Knorr Cetina's discussion of the networked operation of the Foreign Exchange Market, a system which is an example of techno-social concretization underpinned by software (2002a, 2002b).

The market is comprised and maintained by the global interactions (via a multitude of devices) of traders with a software-based system which records, structures and displays these interactions back to the traders:

> 'Like an array of crystals acting as lenses that collect light, focusing it on one point, the systems collect and focus activities, interests, and events on the surface of computer screens. The screens themselves are identically replicated in all connected institutions and trading floors, forming, as it were, one huge compound mirroring device and site.' (2002a)

It is the relationship that the traders have with the market as it appears on the screen which interests the authors. The screen is not just a medium to receive information but 'is a building site on which a whole economic and epistemological world is erected' (2002a: 395). The traders interact with this world as if with a living organism (the authors describe this as a postsocial relationship).

The development and operation of this market system will be theorized in a Simondonian way as not only a process of concretization but also the development of an associated milieu. Bruegger and Knorr Cetina describe the market prior to computerization:

> 'Before the introduction of the screen, interbank currency markets were network-markets: transactions were conducted in the bilateral mould via the phone or telex, and most of the traders' time was spent finding out 'where the market was'. Any coordination that did come about was limited to those moments and parties involved in particular connections. The market nested in territorial space; it lay hidden in a transnational banking network of institutions that did not share the same information.' (2002b)

From just this short passage we can discern that one disparity that resided in the previous system was the tension between the information held about markets at the local level and the global reach of the market. It was then a problem of the speed of global information sharing which required resolution via concretization. However:

> 'After the introduction of screens, the market became fully available and identified as a separate entity in its own right for the first time – with prices, interests and the relevant information all visually indicated on screen. The market on screen is a 'whole' market and a global presence; it subdivides into different information feeds and dealing systems, but these are configured to form a global picture framed by the boundaries of the screen, which also serves as a medium for transactions.' (2002b)

With the development of the computerized market-system there is an overcoming of the local-global disparity by the construction of a single, global market. The resolution of this disparity can be understood as a concretization.

What marks the market-system out as a true Invented Technical Individual is the creation and maintenance of an associated milieu. What makes the associated milieu of this particular individual significant is that it is constituted by activity from the psycho-social regime and not, as with Simondon's usual examples, the physical regime.

From Simondon's text we can discern three general requirements for the stipulation of an Invented Technical Individual having an associated milieu. These are that:

i.   the operation of the ITI partially determines the necessary conditions for its ongoing operation

ii.   a satisfactory environment for the technical object is created by some transformation of a part of the natural world

iii. ITI's operate with a level of indeterminacy which enables them to adapt to their environment.

What is the Invented Technical Individual in this example? It is the market-system, which is the whole network of devices and instantiated software as well as the traders interacting with it. Without these traders the individual would not exist because its associated milieu (the market-world) would not be operational. Although we can imagine the network operating without any trader interactions it is only with these interactions that the system operates fully as a system and original virtualities are uncovered.

In relation to the first requirement listed above the operation of the market-system creates and maintains the market-world ('market on screen') with which the traders interact and which is a necessary condition for the system's continued operation.

The part of the natural world that is transformed to create the satisfactory environment (second requirement) is the trading activity that is mediated by

the instantiated operation of the software. As mentioned previously, in Simondon's own examples the portion of the natural world transformed was always part of the physical regime of individuation. In this example I suggest the associated milieu is, at least partially, constituted by activity from the regime of the psycho-social.

The third requirement refers to how an ITI and the associated milieu it creates and requires for its continued operation integrates with the environment in which it operates. As Simondon writes:

> 'the 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: 54)

For Simondon different technical individuals require differing levels of openness and adaptability to their working environments depending on their function. For example a traction engine must be able to operate on various inclines and in different climatic extremes and so requires a different level of openness and adaptability compared to a similar engine operating in relatively stable factory conditions.

It's clear that an extraordinary amount of technical infrastructure needs to be in place for the market-system to exist (e.g. global networks, server farms, computing hardware and software). However, this form of technology also requires engagement from the psycho-social in order to generate an associated milieu and become truly technological. This does not just mean economic, political and institutional structures but also the *affective* engagement of the

traders themselves. This kind of engagement is demonstrated by one trader who, when asked what the market was for them, responded:

> 'Everything. Everything. How loudly he's screaming, how excited he gets, who's selling, who's buying, where, which centre, what central banks are doing, what the large funds are doing, what the press is saying, what's happening to the CDU, what the Malaysian prime minister is saying, it's everything - everything all the time.' (2002b)

An aspect of this technology then, is that the cognitive and affective reactions of those who use it become part of its immediate operational structure. That such software based technology operates in conjunction with an associated milieu constituted from the regime of the psycho-social might seem to indicate a problem with Simondon's attempts to keep the mode of technical individuation purified from cultural influences; however it would be wrongheaded to think this. As we have seen with Simondon's theory of the image-cycle the human is intimately involved with technical invention. Why then this concern with disallowing cultural influence in the first part of *The Mode of Existence of Technical Objects*?[42] Simply, Simondon's concern in that part of the book was with establishing the mode of technical individuation as at least quasi-independent from human influence, that is, as a tendency in its own right. He thus needed to demonstrate the possibility of independence of this mode of individuation. Such independence of the individual from that which it is individuated enabled Simondon to escape the anthropological tendency in theorising technology which were not compatible with his ontogenetic account.

What we witness with software systems such as the Financial Market is the co-individuation of a technical system with the psychic and psychosocial individuation of the markets. The software-hardware (technological aspect) is causally effective in enabling a transindividual modulation of the market traders

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[42] This resistance to cultural influence in technical individuation was discussed in Chapter 7 (211) in relation to the development of automobiles.

in a very real way. Both in behaviour but also in affective relation with the market itself.

Although Stiegler certainly moves in the direction of understanding contemporary media as related to a cultural associated milieu his description is limited to a focus on the mnesic aspects of this relation. That is to say that Stiegler not only understands the pre-individual as technical but by doing so asserts that it is tertiary retention. It is, of course, this role of technics as tertiary retention that gives it its power, through being economically subordinated, to condition anticipation.

What this story misses however is the relation technics has with the full range of layers of human sensation and not just those stratified in memory. Simondon's account of the individuation of the psychic is developed via a 'gradient of becoming' of transductive relations between levels (affect, sensation, perception, emotion, memory). It is through this becoming that the established phenomenological subject, such as Stiegler describes it, comes to be and must also be maintained. By restricting his account to just memory Stiegler narrows the nature of the human-technics relation thus making of it an anthropological theorisation of technology.

It is by developing this line of investigation that Mark Hansen utilizes Simondon for thinking contemporary digital technology. He argues that Stiegler's account of technics is 'characterised by a temporal synchronization between consciousness and technical object' (Hansen, 2012: 51). That is to say that Stiegler focuses on the ways by which the operation of technical objects relates to the perceptual ratios of the phenomenological subject. However, this is a limited description for it not only fails to think the 'sub-perceptual dimensions of human experience' but also technical processes that necessarily occur beneath the threshold of perception.

If this is a restricted and therefore insufficient account of the relation, what then must be included in a sufficient one? After examining Mark Hansen's proposals in this regard, I will consider these proposals in the light of the contemporary enthusiasm for Big Data.

Amongst those who address these shortcomings, Hansen develops the notion of 'operational blindness' which is 'the ineliminable temporal gap separating the operation of a technically-distributed system-environment hybrid from any subsequent cognitive or perceptual account of its operation in consciousness' (Hansen, 2012: 43). In other words the operation of such technology occurs at a level prior to that of perceptual consciousness and thus it cannot be accounted for by Stiegler's analysis which focuses on the effects of media on an already constituted protentional consciousness. What this points to is a mode of individuation operating at the sensual level which doesn't necessarily involve mnesic consciousness.

Following Simondon's stipulation of the necessarily open nature of systems (in contrast to autopoietic closed systems - as discussed in chapter 4 (139)) Hansen develops the idea of system-environment hybrid which reflects the 'double relationship' that any system necessarily has with both an associated milieu as well it pre-individual environment. What 'operational blindness' describes is the way that digital technologies can operate in our environment in such a way that the nature of their operation are inaccessible (perceptually or cognitively) until at least a later time.

Hansen uses the example of Étienne-Jules Marey's chronophotographic images which 'give us data about our perceptual processes' but because they are 'temporally distanced from the operationality that the data measures, this data can never obtain the status of lived experience' (Hansen, 2012: 43).

Returning to our example of the computerised financial markets we can point to the ever increasing speed of data networks as well as the increasing use

of automated algorithms which undertake trading at speeds[43] far higher than human cognition can follow.

For example in his article on what has become known as High Frequency Trading Alberto Toscano writes:

> 'We thus confront a compression of market-making transactions to speeds far below the threshold of individual human cognition, and an asymptotic acceleration of market turnover. The fastest trading chip executes a transaction in 740 nanoseconds (or 0.00074 milliseconds) while human reaction time to a visual stimulus is around 190 milliseconds.' (Toscano, 2013)

What can also be seen in this increase of data processing speed above that of perception and therefore cognition is the re-enlivening of a socio-cybernetic project predicated on the capture and analysis of what has come to be known as Big Data.

Such data is sourced from the myriad ways that human behaviour can be recorded and then algorithmically parsed to produce probabilistic outcomes. The idea then is that through manipulation of behaviour other outcomes can be made more probable. As such Big Data holds not just that it is what people do rather than what they believe that is important but that it is actually more indicative of what people actually want than that they believe they do. Thus one proponent of Big Data, Sandy Pentland, claims in a neo-Wienerian tone:

> 'Understanding these human-machine systems is what's going to make our future social systems stable and safe. We are getting beyond complexity, data science and web science, because we are including people

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[43] Network speed, along with processor speeds, are constantly being improved for example, in 2006 the Philadelphia Stock Exchange relocated most of its trading engines '80 miles — and three milliseconds — from Philadelphia, and into NJ2, where . . . the time to communicate between servers is down to a millionth of a second' (Vanderbilt, 2009). These types of improvement are not concretizations however as they do not lead to further qualitative developments of the system.

as a key part of these systems. 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.' (Pentland: 2012)[44]

Evidently such a project goes beyond the scope of Stiegler's analysis of the dangers of contemporary media. Where for him the danger lies in the reconfiguration of protentions for a constituted phenomenological subject, what is at stake here is the 'engineering of the pre-individual' of our sensibility prior to the constitution of the phenomenological subject. Thus if a political response is required to what is presented as an apolitical project, it isn't the one that Stiegler proposes of a 'battle for intelligence' but rather one for sensibility, for it is at this more fundamental level where the psycho-social is being transformed. As Hansen argues:

> 'Rather than furnishing a recorded surrogate for that experience, as nineteenth- and twentieth-century recording media certainly did, twenty-first-century media exercises its force by influencing *how experience occurs*. Rather than intervening at the level of memory itself, twenty-first-century media impacts the distinct and quasi-autonomous microagencies that underlie memory's integrated function, as well as other environmental dimensions that bear on that function.' (Hansen, 2012: 56)

We may recall that Simondon himself welcomed what he saw as the stabilizing potential of networks for society; yet we might wonder had he not been disposed to such an accommodation, what might have constituted a Simondonian critique? His critique of Wiener's application of cybernetics to

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[44] The project of Big Data is a continuation and development of a number of developments in social computing over the past thirty years including Web Squared (O'Reilly & Battelle, 2009), the Interent of Things (Ashton, 2009) and Ubiquitous Computing (Weiser, 1991).

the organization of society rested on the bad analogy that is made between humans and machines as well as the important difference regarding the nature of information. In Pentland's reformation of socio-cybernetics an attempt has been made to put the human back in the system: it is after all human behaviour that provides the data. However the collection of data pertaining to behaviour is evidently a reduction into quantifiable form of the complex processes involved in the development of behaviour. Additionally what Pentland is suggesting is also the reduction of the social to the probabilistic representation of agency, which may be why such a proposal gains support from some theorists of actor-networks.[45]

If we recall the theory of the image-cycle as a description of Simondon's own reformed socio-cybernetics we can grasp how these proposed developments utilising new media technologies must be unsatisfactory.

First, what Pentland's project proposes is the application of a technical schema to the social. It thus proposes social-engineering in a very literal sense. In chapter two we described how Simondon understood how technology has often provided, via analogy, universal 'schemas of intelligibility' (Simondon, 2009, 17). Such schemas develop, by way of iterations of the image-cycle, so that the operation of understanding develops analogically with the operation of machines. With computing there is the development of a 'technical mentality' which augments the notion of negative feedback with programming logic and mathematical algorithms. Although this schema may be appropriate for modelling some physical behaviours to a standard appropriate for human predictive purposes (e.g. weather systems) it is questionable that it is applicable for the social regulation that Pentland proposes.

What such a proposal elides is the energetic aspect of social individuation which Simondon describes with his theory of transindividuation. It is precisely

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[45] Latour has made the connection himself between the increase in available social data and a sociology based on actants. For example see his Tarde's idea of Quantification (2009).

for this reason that an attempt at such an apolitical socio-cybernetic programme is destined to fail. Such a cybernetics premised on a futurology of Big Data suggests the establishment of an inter-individual social relation based on functional relationships between people without the kind of resonance required for transindividual becoming. At its heart such a proposal envisions the possibility of an ever-tightening restriction on the operation of the social such that ultimately it becomes hypertelic. As our analysis of Simondon and causality has hopefully made clear is such a conception is necessarily flawed. All systems retain a double relationship to both an associated milieu as well as the pre-individual. In other words although a system may operate in conjunction with its associated milieu in a near determined way it will also be open to energetic input from the pre-individual which can be a source of indeterminism.

Such an analysis opens up the question of politics and the nature of the transindividual relation that would be appropriate for this new technical transformation. This is a question that is beyond the scope of this dissertation but that in answering would require consideration of how such technological phenomenon as Big Data and operational blindness might be utilised to support the kind of consistences that Stiegler discusses as regulative for the social.

Undoubtedly the sheer range of digital technologies and their use in contemporary society complicates the provision of a universal account that covers them all. Such an account would require a typology of digital technologies similar to the way Simondon describes a range of technologies as tools, technical objects and technical individuals.

As such Stiegler's proposal for a general organology, as far as this echoes the requirement for an allagmatic account of the interweaving of processes and structures, describes an antidote to the kind of technicism that haunts contemporary techno-culture.

What we have tried to develop in this chapter is how Simondon's ontology allows for accounts of such technologies which outflanks both Latour's and Stiegler's. Latour's network theory looks weak due to the paucity of its description regarding agency. This may possibly be addressed in his latest project, *Modes of Existence,*[46] although this still looks to be too anthropological. On the other hand Stiegler develops a rich and detailed Simondonian inspired account but this is ultimately too reductive to do justice to Simondon's ontology. His move of limiting the human-technology relation to one concerning human memory and ignoring other aspects of experience is unnecessarily reductive and consequently leads to a politics with a similarly limited scope. What's more his account of epiphylogenesis, the co-constructive relation of the *who?* with the *what?,* leads him to producing an anthropological account of technology which betrays Simondon's initial insight regarding the inventive mode of technological individuation.

Given this the importance of Simondon's ontogenetic approach can be understood as how it makes possible an account of techno-genesis which is not dependent on an anthropology yet remains open enough to theorize the relation of technology with the human at all levels of its existence. At the same time he also avoids essentializing both technology and the human and developing a positive account based on invention which is also productive of a coherent ethics and aesthetics.

8.4: Conclusion

In this thesis I have attempted to develop an account of, and situate philosophically, Simondon's ontology with a particular concentration on causality and its application for technology.

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[46] See page 272 above.

At the heart of the thesis has been explicating Simondon's theory of transduction. In particular, to describe this as a mode of causality which is developed in comparison to Mumford and Anjum's (2011) Powers based theory. In doing so we aimed to explain the fundamental role of operation for Simondon both in the process of the development of form but also in the development of relation. The other central component of this account of causality is the importance of recursive causality which, as a development of cybernetic teleological causality, offers a realist answer to Kant's antinomy of teleological judgment.

The thesis has necessarily covered a broad range of material in order to fully develop the implications of Simondon's axiomatic philosophy. It's only because of this encyclopedic scope however that it is able to offer such a unique and powerful articulation of the relation of the physical, psychical and social.

What I hope to have captured and what is so exciting about the transductive method is the maintenance of an openness that 'systems' have to the broader pre-individual which guarantees the possibility for further invention and for the overcoming of any dualities encountered. This means that Simondon can remain a physicalist without being a materialist. That is, the focus on operation of the transductive method means that Simondon remains a realist about all the phenomena he describes (e.g. physical, vital, mental, psychosocial) without being substantialist.

It is important to insist on the non-technical nature of the pre-individual, unlike both Stiegler and Hansen who seem content to equate the two in some way. As we argued in chapter 3 the importance of the pre-individual for Simondon is not in asking *what* being is but rather *how* it is to which the answer was 'more than unity and more than identity', which is to say metastable. To limit the pre-individual to the technical thus is contradictory for ultimately it must be prior to any individual whether physical, vital or

technological such that if it is one of the above, neither is it prior. To say this is not to delimit the importance of technology for human individuation only to state that the pre-individual for humanity must not be limited *only* to the technological. Surely Simondon is explicit about this with his insistence on the pre-technological mode of magical unity he argues humanity had in relation to the world? To stipulate the pre-individual as technological is surely a betrayal of the purported aim of a non-essentialist account of the human and as Muriel Combes expresses so well 'for the question is less to know what *defines* human than to know what *makes for its becoming*' (Combes, 2013: 69). The non-technological ground therefore is required to do justice to the radical inventiveness Simondon's ontology describes.

This broad scope also means that despite the impressive technical knowledge that Simondon brings to his accounts of technical objects his work never lapses into an excessive technicism, and just as important, nor is it prevented from doing so by an overbearing humanism. It is perhaps due to the inventiveness of this philosophy and its tendency to step beyond whatever dualisms it encounters that Simondon isn't willing to settle for any pre-supposed political position. Although evidently concerned with the human situation the promise of his philosophy is not just the possibility of, but the absolute requirement for continual invention. As such his politics could be described, following Combes again, as what makes for the *becoming* of the transindividual as opposed to the adoption of more rigid hylemorphic schemas of organisation.

With *Allagmatics* as an analogical science Simondon manages to overcome the over-determining concept of information used in cybernetics as well also develop a method for the proper understanding of recursive causality as 'holistic function' (Simondon, 2005: 565). Such functioning also includes that of ideation and it is through Simondon's development of the theory of the image-cycle that he proposes a convincing linking of biogenesis and invention with

epistemological development through to transindividuation. By doing so Simondon is able to link ontogenesis with the development of life, ethics, epistemology and aesthetics. Which is to say he develops a systematic account of the world as open-system.

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