Volume 6 (2015): 96-107.

Prehensive transduction: Techno-aesthetics in new media art

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

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

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

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

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

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

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

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

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

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

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

Volume 6 (2015): 96-107.

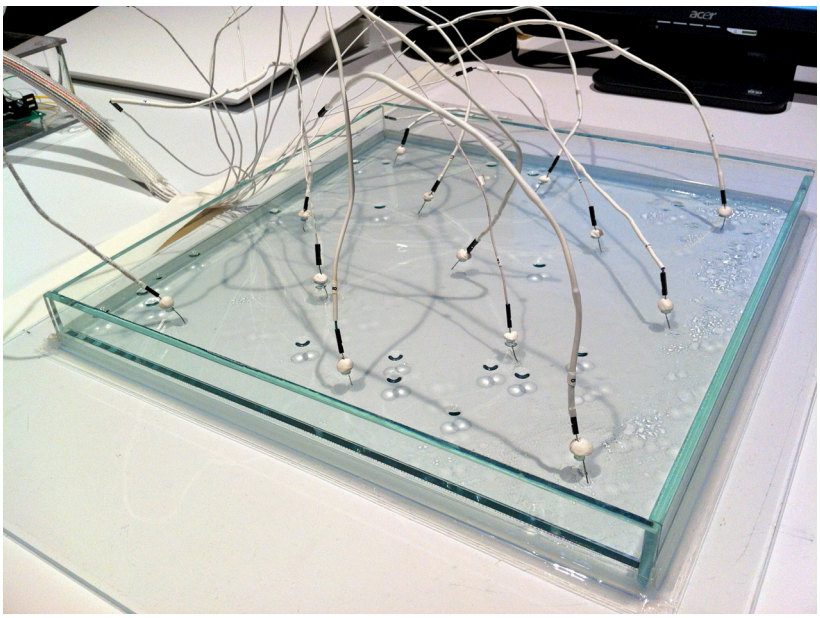
The operation of individuation is modulated through information, but it is not just a process of call and response, for there is an internal resonance of each individual. In the living individual, internal resonance is how the living being systematically individuates on an ongoing basis. Simondon writes:

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

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

Biopoiesis

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



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

Figure 1

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

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

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

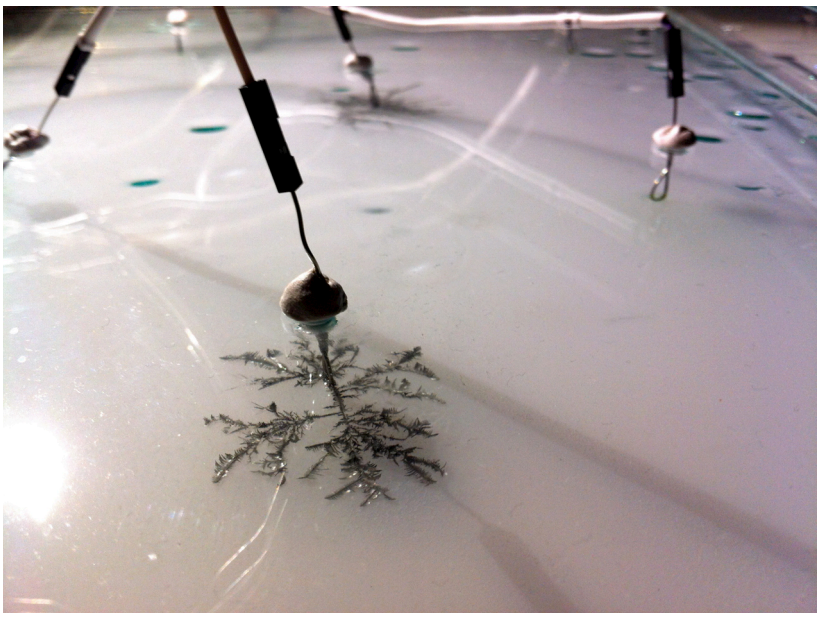


Figure 2

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

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

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

Volume 6 (2015): 96-107.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Volume 6 (2015): 96-107.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Volume 6 (2015): 96-107.

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

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

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

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

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

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

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

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

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

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

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

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

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

Conclusion

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

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

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

Volume 6 (2015): 96-107.

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

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

Acknowledgments

I would like to thank Carlos Castellanos and Steven J. Barnes for allowing me to write about their work. Their quick answers, sharing of a forthcoming article and images, and generous spirit was of great assistance.

Bibliography

Ash, J. (2014) Technology and affect: Towards a theory of inorganically organized objects. *Emotion Space and Society*, 14, 84-90.

Castellanos, C. and Barnes, S. J. (2014) Biopoiesis: Cybernetics, Art and Ambiguity. *Leonardo*, forthcoming.

Combes, M. (2013) *Gilbert Simondon and the Philosophy of the Transindividual*. Cambridge, MA: The MIT Press.

De Boever, A., Murray, A., Roffe, J., & Woodward, A. (Eds.) (2012) *Gilbert Simondon: Being and Technology*. Edinburgh: Edinburgh University Press.

De Vries, M. J., Feenberg, A., De Boever, A., and Hoel, A. S. (2014). Book Symposium on The Philosophy of Simondon: Between Technology and Individuation. *Philosophy & Technology*, 1-26.

Deleuze, G. (1993) *The Fold: Leibniz and the Baroque*. Minneapolis: University of Minnesota Press.

Deroo, E. (2011) On the effects of a fictitious encounter between Alfred North Whitehead and Gilbert Simondon. In V. Petrov (Ed.) *Ontological Landscapes: Recent Thought on Conceptual Interfaces Between Science and Philosophy* (295-310). Piscataway, NJ: Transaction Books.

Massumi, B. (2011) *Semblance and Event: Activist Philosophy and the Occurrent Arts*. Cambridge, MA: The MIT Press.

Oliveira, A., and Rebolledo, F. (2011) The Associated Milieu: A Machinic Assemblage between Artwork and Viewer. *The International Journal of the Arts in Society*, 5(5), 21-224.

Sauvagnargues, A, (2012) Simondon, Deleuze, and the Construction of Transcendental Empiricism. *Pli: The Warwick Journal of Philosophy*, 1–22.

Shaviro, S. (2009) *Without Criteria: Kant, Whitehead, Deleuze, and Aesthetics*. Cambridge, MA: The MIT Press.

Simondon, G. (1980) *On the Mode of Existence of Technical Objects*, Trans. Ninian Mellamphy, unpublished. London, ON: University of Western Ontario.
Simondon, G. (1992) The Genesis of the Individual. *Incorporations*, 6, 296-319.
Simondon, G. (2012) On Techno-Aesthetics. *Parrhesia*, 14, 1-8.
Stengers, I. (2011) *Thinking with Whitehead: A Free and Wild Creation of Concepts*. Cambridge, MA: Harvard University Press.
Stengers, I. (2008) A constructivist reading of Process and Reality. *Theory, Culture & Society*, 25(4), 91-110.
Whitehead, A.N. (1929) *Process and Reality: An Essay in Cosmology*. New York and Cambridge: Macmillan.