

# **Towards a Phenomenological Theory of Symbiogenic Experiences in the Interactive Arts**

A proposal for Ph.D. Dissertation by:

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## 1. Introduction

Themes of evolution and symbiosis are common ones in modern society, often engendering fascination and wonder in the popular culture. In a biological context, evolution can be characterized as changes in the inherited traits of a population of organisms through successive generations and has typically been considered to be synonymous with Darwinism. Beyond the use of the concept in the biological sciences, evolution is also powerful a metaphor that is employed in a range of diverse fields. In computer science and artificial intelligence (AI) for example, evolutionary metaphors such as genetic algorithms for “evolving” optimal solutions are used to describe techniques of optimization and search in digital computers.

In the opening chapter of her book *Symbiotic Planet: A New Look at Evolution* (Margulis, 1998), biologist Lynn Margulis observes that the concept of symbiosis, which describes the close interactions among species living in close physical contact with one another, “strikes us as an arcane concept and a specialized biological term” (p. 5). This is due, Margulis claims, to our ignorance of its “omnipresence” — noting how even our very own eyelashes are “festooned” with symbiotic life. The central theme of this opening chapter (entitled “Symbiosis Everywhere”) is that we cannot see the forest for the trees. Symbiotic life is all around us, part of our everyday environment — so much so that it recedes far into the background of our thinking.

Margulis' vision is encapsulated in her belief that symbiogenesis, or the merging of two distinct organisms to form a single organism, is a predominant force in evolution (Margulis, 1981, 1993; Margulis & Sagan, 1986). An evolutionary theory introduced in the early 20th century by Konstantin Mereschkowsky [21:34-50], Ivan E. Wallin [41] and others, symbiogenesis has been popularized and expanded in our era by Margulis. Considering the Darwinian model incomplete, she emphasizes cooperation and other complex symbiotic interactions between organisms that go beyond mere competition for resources. Margulis and Sagan note, for example, that "Life did not take over the globe by combat, but by networking" (Margulis & Sagan, 1986, p. 15). This more holistic approach has slowly but surely been gaining acceptance within the scientific community over the years.

Perhaps the true mark of how a concept gains traction however, is when it is taken up outside of its narrow discipline and applied to seemingly unrelated ones. Marked by the fact that human evolution is thought to have been influenced by technology (Ambrose, 2001), the arts and humanities have explored concepts of human-technology co-evolution from many different perspectives. In popular culture, both utopian technofantasies and dystopian visions of human-machine mergers have been popular themes in Hollywood films, television shows and science fiction novels for many years; sometimes even influencing mainstream scientific research (Thacker, 2000). While most of the relationships depicted cannot be characterized as symbiotic per se, and are in fact better characterized as Darwinian struggles for supremacy, the overarching theme of human-machine mergers is prevalent nevertheless.

From a biological perspective, co-evolution can be characterized as an evolutionary change in one organism or population of organisms, in response to a trait or behavior of a second organism or population of organisms, with these changes being passed genetically to succeeding generations. Ehrlich and Raven (1964) were the first in the scientific community to specifically mention the term. They define co-evolution (if somewhat ambiguously) as “patterns of interaction between two major groups of organisms with a close and evident ecological relationship” (p. 586). The focus of their study was on butterflies and their food plants, which they use as a model for describing how herbivores co-evolve with plants. Janzen (1980) defines co-evolution as “an evolutionary change in a trait of the individuals in one population in response to a trait of the individuals of a second population” (p. 611). In the arts and humanities however, the question of human-technology co-evolution is often more of an ontological one (that is, of the nature of being and existence). Philosophers and cultural studies scholars such as Katherine Hayles (1999, 2007) and Mark Hansen (2005, 2006, 2009) have often examined notions human-technology co-evolution. Contemporary interactive arts has been particularly influenced and inspired both by technological achievements and depictions of human-machine mergers in popular culture. Many interactive artists have often advanced or examined notions of connectivity and symbiosis, both physical and virtual (Goodall, 2005; Wilson, 2002, pp. 731-732). The interactions involved are often seen as leading to an expansion of human consciousness or a sharing of it with technology, but can be more generally be characterized as ways in which humans and machines influence or trigger structural changes in one another (Ascott, 2003).

As an interactive artist and researcher, I am interested in exploring these concepts from within an artistic context. Specifically, my dissertation will explicate how interactive arts can provoke or enable a bodily, felt sense of the co-evolutionary dynamic just described, thus bringing into greater consciousness the cooperative and symbiotic nature of our relationship with technology. I believe the field of interactive arts is uniquely suited to this type of inquiry, as it features a myriad of unusual forms of physical interaction and experiences. What has attracted me to the field are the types of works whose forms of interaction not only possess abilities to expand human consciousness but also to transform our experience of the world and of our being within it by encouraging us to enter into states of mutual influence with them. In doing so these works — to paraphrase artist and theorist Jack Burnham (1970) — possess the ability to alter human perception so as to enable us to see ourselves as inextricably linked to our (increasingly technologized) environment while also sensitizing us to aspects of this environment that would otherwise be ignored; a form of “symbiotic intelligence” between humans and technology. We are not separate from our technologies but like the environment, are continuous with it. I characterize this as a co-evolutionary dynamic between humans and technology. Fully appreciating this transformation of experience, which I am calling “symbiogenic”, and the role of interactive arts in it, necessitates a navigation of various theories of ontology. While a detailed account of Western ontological perspectives is beyond the scope of this dissertation proposal (and of the dissertation), I can briefly introduce four theoretical perspectives that have come to form the conceptual framework I utilize in my research:

- (1) What can broadly be characterized as *Posthumanist Philosophy* and theories of ontology, such as the work of Katherine Hayles, Andy Clark, Cary Wolfe and Mark Hansen. These thinkers explore the nature of our relationship to technology and its role in reconfiguring the human as a heterogenous de-centered subject, thus lessening its controlling position. They question the ontological divide that supposedly exists between humans and their technological creations.
- (2) *Phenomenology*, specifically the existentialist phenomenology of Maurice Merleau-Ponty and those who have extended his work such as Shaun Gallagher, Hubert Dreyfus and Don Ihde. These thinkers emphasize the crucial role of embodiment in the construction of experience, particularly with regard to technology.
- (3) *Cybernetics and Autopoiesis*. These perspectives emphasize the notion of reciprocal interplay and open-ended emergent interactions between system and environment as well as the notion that the environment and the organism are intertwined and cannot be understood except in relation to one another. In essence, it blurs the division between people and things that has been so common in Western thinking. Autopoiesis outlines the ways in which living systems and their environments co-determine and mutually specify one another. The cybernetic ontology, as described by Andrew Pickering (Pickering, 2007, 2010), is one that showcases a vision of the world as a “lively place of performatively interacting and endlessly emergent systems (of which we humans are just one sort)”.

(4) *Interactive Arts* practices that enable states of mutual influence with participants and encourage a “symbiotic intelligence” with the technological environment.

These works thematize reciprocal interplay with technology and engender a sense of embeddedness in the larger environment.

These approaches will be discussed in more detail in Section 2. Broadly speaking however, I can briefly state that they all emphasize the complex interdependent ways in which humans interrelate with technology and with their world, the importance of human embodied subjectivity and the embodied and situated nature of intelligence. Collectively, they encompass what I describe as a co-evolutionary ontology.

The goal of this research is not to provide a technical framework for something like interactive co-evolutionary systems, nor is it primarily concerned with outlining specific methods or techniques for changing one’s artistic practice (at least not directly). Rather, it is concerned with meanings of co-evolution of humans and technology and how they may be constructed through the development and first-person experience of interactive art systems. I will investigate multiple meanings and perspectives of human-technology co-evolution by using a common practice in philosophy and cultural studies of “unpacking” terms in order to use them more precisely. As a result of this research, a model of symbiogenic experiences will be articulated that fuses theoretical and experiential modes of inquiry to provide insights to both interactive artists and humanities scholars, particular those who have an interest in AI (and technology more broadly).

The ultimate goal of the research lies in providing a new framework from which to understand and approach interactive art practice and from which to study and analyze

it. My dissertation will begin to fill a gap between themes and concepts of co-evolution that are often either purely discursive or objective (as in the humanities and sciences respectively) and *experiences* of co-evolution (and the meaning applied to them) in an interactive arts context.

### **1.1 Defining Co-Evolution and Symbiogenic Experience**

While many artists and humanities scholars have explored ideas of human-technology co-evolution (Hansen, 2005, 2006, 2009; Haraway, 1991; Hayles, 1999, 2007, 2007; Mazlish, 1995; Stelarc, 1996, 1997), my interest lies in an aspect of this inquiry that has not been fully considered, namely how co-evolution may (or may not) be *felt* and *experienced* in an interactive arts context. What I propose is a study of if and how interactive art may go further and provoke or enable a bodily, felt sense of this dynamic, and thus bring into greater consciousness the cooperative and symbiotic nature of our embodied relationship with technology. To reiterate, my research seeks to address the question of how certain forms of interactive art may facilitate subjective experiences that elicit an embodied, felt sense and awareness of co-evolution with intelligent systems and technologies. Can these experiences reach the level of awareness, however transiently? How might interactive art enable this “felt sense”?

I believe that these experiences can be identified, but they currently lack a cohesive theoretical framework from which to study and analyze them. While further explicating this theoretical framework and articulating what symbiogenic experiences are is the goal of my dissertation, I can provisionally sketch out some possibilities and avenues for exploration here. It must first be said however that an inquiry that centers

around an “embodied felt sense” of co-evolution necessarily requires a rethinking of the concept of co-evolution; one that draws broadly from biological metaphor, is inspired by scientific research and is about investigating biological or cognitive processes from a first-person point of view. My research to this point has led me to conceive of a symbiogenic experience in an interactive arts context as one where mind, body and an increasingly technologized environment interrelate to give rise to a sensory experience where human conscious and pre-conscious processes can be thought of as locatable both within the traditional bounds of the subject and also dispersed without, in a myriad of intelligent technological structures. From a phenomenological perspective I have described this as *distributed intentionality* (Castellanos & Gromala, 2009). A theory of symbiogenic experiences then might be classified as either one or a combination of the following:

- *A theory that accounts for an awareness of an already existing co-evolutionary dynamic; an awareness made possible by the heightened, intensified experiences characteristic of the arts* (Dewey, 1958). In other words, human-technology co-evolution already exists and interactive art can make us more aware of it.
- *Increasing technological change is bringing about an almost imperceptible historical shift in our embodied relationship with technology (which can be characterized as co-evolutionary). Interactive art can give us a sort of advanced notice of it and a theory of symbiogenic experiences can help in discussing and analyzing it by developing a language and set of understandings.* A simple example would be the “horseless carriage” era of automobiles, where an

unfamiliar technology is described and discussed in familiar terms (and its accompany impact on society arguably obscured) until a new set of languages and understandings were developed.

- *A theory that identifies a contextual change, perhaps a tipping point where technological sophistication and saturation (as exemplified by the proliferation of intelligent technologies) has reached a certain level where we can then start to sense a corresponding change in our embodied relationship to technology (which we can refer to as co-evolutionary in nature). Interactive art can again help us become aware of this already existing dynamic that is nascent or incipient. This may be as simple as identifying a quantifiable change in the time we spend with intelligent technologies or the number of said technologies and analyzing it phenomenologically within an interactive arts context.*
- *A theory that provides a microscope-like lens that enables us to see elements of our relationship with technology that we otherwise would not see and in doing so may provide a different way of thinking about that relationship.*

Because I conceive of human-technology co-evolution as a dynamic where the interactions and co-functionings of humans and intelligent technologies are at a sufficient level of complexity and sophistication that we can begin to speak of them as the primary means by which humans connect to the larger environment and by which the cognitive and physiological possibilities of human beings can be opened up or expanded —

particularly if “correlated with the most creative, culturally and technologically catalyzed interactional possibilities” (Hansen, 2009) that are often characteristic of interactive arts — I will continue this inquiry by investigating other artists’ and researchers’ understandings of human-machine co-evolution and by constructing my own interactive systems.

## **1.2 The Role of Artistic Practice**

This research is conducted in the context of interactive art using interactive systems that I am currently in the process of creating. Two projects, *Biopoiesis* and *Protocol* are discussed in Section 3. These systems are intended to explore (and perhaps evoke) different facets of what I term symbiogenic experience. As a symbiogenic experience is a highly subjective phenomenon, analyzing it necessitates a methodology that takes experience — particularly mind/body experience — seriously. Thus, the focus of this research is on phenomenological study and assumes the form of artistic, theoretical and first-person explorations. Artworks are created mostly as experiments but also function as critical points to be made that can enact or embody a textual argument. Artistic practice functions as a way of putting theories to the ontological test and provides what Diane Gromala calls an *embodied tool-to-think-with*, a way developing new concepts and techniques and modifying existing ones (Gromala, 2007).

## **1.3 Research Questions**

My theoretical and artistic explorations of human-technology co-evolution have lead to the following central phenomenological question:

**Can certain forms of interactive art facilitate subjective experiences that elicit an embodied, felt sense and awareness of co-evolution with intelligent systems and technologies? And if so how?**

This question will be answered via phenomenological inquiry, philosophical analysis and critique undertaken within the context of interactive arts practice.

Several associated sub-questions naturally arise from such inquiry. Thus, I also ask:

- What are the aspects (e.g. temporal, gestural, etc) of what I call symbiogenic experience that (phenomenologically speaking) can help account for a sense of co-evolution as an embodied phenomenon?
- How may strategies or ways of facilitating this embodied felt sense be developed in and through the process of creating interactive artworks?
- What conceptual strategies and technological approaches may be most useful?

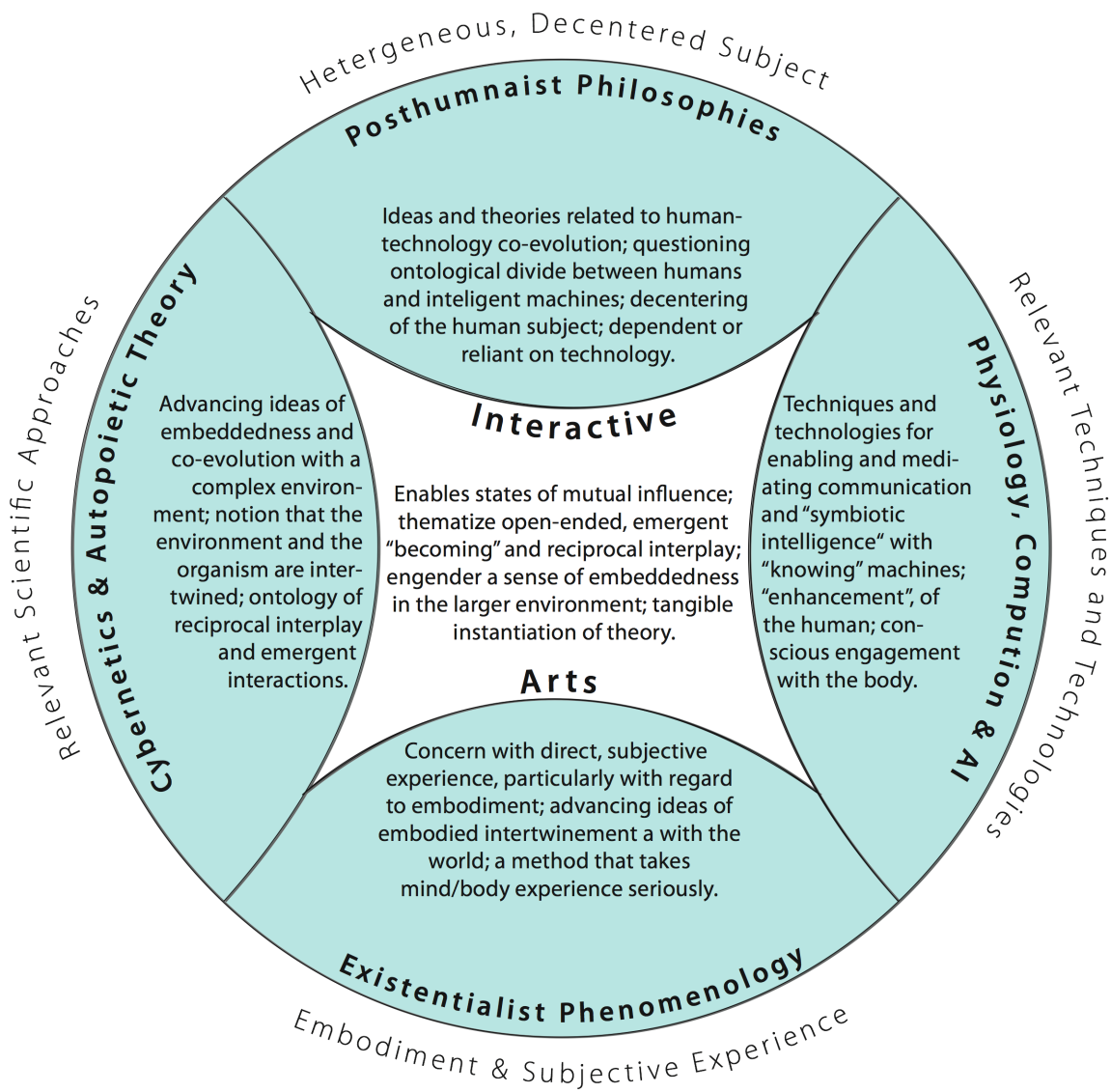
Answering these questions will also require that I undertake a process of descriptive analyses of pertinent works within the interactive arts field (discussed in Section 2) as well as theoretical argumentation in conjunction with first-person reflections and analysis of my own projects. Thus, I will be constructing interactive art systems, describing and analyzing my experience with them while further developing the necessary theoretical framework that will (hopefully) result in new perspectives from which to approach interactive art practice and offer new theoretical and practical approaches to its analysis.

#### **1.4 Scope & Limitations**

As mentioned above, questions of human-technology coupling and co-evolution have been considered by a wide range of artists and academics. In my research, I will not cover entire fields of intelligent systems, nor will I exhaust all different types of phenomenology and theories relating to co-evolution. I am investigating co-evolution from an interactive arts perspective in particular settings created from tangibly actualized interactive art systems. To help clarify this further, I will develop in my dissertation a taxonomy of artists and art projects that contain aspects — such as particular technologies, techniques or general themes — that I consider relevant to human-machine co-evolution and symbiogenic experience in the interactive arts.

## **2. Conceptual Framework**

This section provides an overview of the key areas of inquiry that have emerged as a framework for the development and evaluation of my theory of symbiogenic experiences. The diagram in Figure 1 outlines the principal theoretical perspectives and relevant technological aspects informing my inquiry and their relationships to one another. Interactive Arts is of course the focus of my research but the work of Merleau-Ponty and his embodied phenomenology provides significant inspiration to my work with bodily experience. Cybernetics and Autopoietic theory are also a significant inspiration, for like Merleau-Ponty, they offer an ontology of emergent becoming and intertwinement with the world. Cybernetics also, along with intelligent systems (roughly summed up here under the banner of AI) and various biomedical techniques (e.g. sensory substitution, physiological monitoring) provide relevant techniques and technologies used in my interactive artworks. Posthumanist theories of human-technology co-evolution have also served as inspiration.



**Figure 1.** Diagram showing the relationships between the key areas of this inquiry.

## 2.1 Interactive Arts

As telematic artist and theorist Roy Ascott has noted, interactive arts, perhaps more than any other previous forms of fine art, engage a participant’s sensory and embodied faculties (Ascott, 2003). Ascott describes interactive art as “characterised by a

systems approach to creation, in which interactivity and connectivity are the essential features, such that the behaviour of the system (the artwork, network, product or building) is responsive in important ways to the behaviour of its user (the viewer or consumer).” Noting its transformative potential, Ascott describes the interactive artwork as constituting a “structural coupling,” thus making the work “inherently cybernetic” (p. 281).

The “systems approach to creation” was analyzed in 1968 by art theorist Jack Burnham in his seminal paper, “Systems Esthetics” (Burnham, 1968). More specific to the discussion here, however, is Burnham’s analysis of the human-machine communication loop in his paper “The Aesthetics of Intelligent Systems” (Burnham, 1970). The crucial insight offered by Burnham is his realization that this emerging expansion of the art experience “encourages the recognition of man as an integral part of his environment” (p. 100). Burnham was among the first in the art world to recognize the potential of the computer beyond its common usage as a ultra-fast data processor. He realized that an interactive art experience was fundamentally different from that which came before it, primarily in its ability to better attune us to the technological environment, “sensitiz[ing] us to information that would otherwise be ignored” (p. 108). Particularly incisive, as it resonates well with 2nd wave cybernetics and autopoietic theory (Maturana & Varela, 1980, 1992), is his perspective on the significance of technology for the “classical view of art and reality.” Burnham states that interactive art is forcing us to dismiss the view “which insists that man stand outside of reality in order to observe it” (p. 103). Burnham envisioned possibilities for a reconfiguration of aesthetic

experience in Western art; one where “symbiotic intelligence” was its ultimate outcome and one’s own “bodily activities” — rather than object contemplation — were at its foundation.

Many of the artworks I draw from, as well as those I am creating, are inspired by this drive for “symbiotic intelligence” between humans and their increasingly technologized environments. Some are based upon various AI, A-life or cybernetic approaches and techniques. Examples include reinforcement learning (Kaelbling et al., 1996), Rodney Brooks’s subsumption architecture (Brooks, 1986, 1991) and the work of cyberneticists such as Gordon Pask (Pask, 1971; Pickering, 2007, 2010). Simon Penny and Ken Rinaldo have used these kinds of techniques and approaches in their work (Penny, 1997; Penny & Schulte, 1995; Rinaldo, 1998). Rinaldo’s robotic piece *The Flock* (1994), features many of the characteristics and ideas I am pursuing in my own work (e.g., autonomy, emergence and human-technology co-evolution). This project consists of a group of interactive sound sculptures that exhibit collective autonomous behavior similar to that of flocking birds. The piece is an assemblage of robotic arms constructed primarily from grapevines with an array of various electronics including infrared sensors, motors and audio speakers. The agents or “creatures” communicate with one another via audible telephone tones which they use to alert each other of their relative arm position as well as the presence and location of participants. According to Rinaldo, his desire was to echo the forms and interactions of living systems and states that “by seamlessly integrating electronic and organic elements I am asserting the confluence and co-evolution of organic and technological cultures” (Rinaldo, 1998, p. 406).

Other artworks are based upon physiological monitoring techniques and/or some form of direct contact with the body (Stelarc, 1996; Stenslie, 1994), while others use video-based motion tracking (Rokeby, 1986). Some works, like Stelarc's *Ear on Arm* (Stelarc, 2006), even realize the cyborg fantasy of surgically embedding technology directly into the body. *Ear on Arm* features an ear grown from the artist's own cultured cartilage cells and surgically attached to the artist's arm. Requiring a series of surgeries, the ear is "enhanced" in several ways, not the least of which is its ability to transmit — via a speaker, and in the future, (according to Stelarc), wireless Internet and bluetooth connections — the sound that it hears (via an embedded microphone). Stelarc describes this project as a way to enable the body to become an "extended operational system," extending its awareness beyond normal boundaries and becoming an "Internet organ" of the body.

My own projects (discussed in Section 3) utilize techniques similar to the ones described above. *Protocol*, is inspired by the sensory substitution techniques pioneered by Paul Bach-Y-Rita (Paul Bach-y-Rita, 1972), particularly those that involve human-machine interfaces (Paul Bach-y-Rita & Kercel, 2003). A technique I am specifically drawing from in *Protocol* was developed by Saunders and involves information transmission across the skin (F. A. Saunders, 1983; F. Saunders, Hill, & Franklin, 1981), combined with reinforcement learning. This project investigates possibilities and alternatives for how a human and a physically situated, autonomous technological system can communicate and interrelate. *Biopoiesis* is based on the electrochemical experiments of Gordon Pask (Cariani, 1993; Pask, 1960) and investigates relationships between

structure, matter, and self-organization as well as possibilities for natural, emergent processes (e.g., chemical reactions) to serve as methods for generating interesting and unexpected media forms. While I am not covering entire fields of intelligent systems or physiological and biomedical research, my projects feature some of the most important technological aspects that are relevant to my own research.

Though wildly diverse, what all of these projects share are interactive techniques and approaches that give an intuitive sense of connection or enmeshment with some sort of emergent technological system, what Andrew Pickering might call an open-ended, emergent “becoming” or a temporal “dance of agency” (Pickering, 2008). Pickering uses these words to describe the work of Gordon Pask, particularly his interactive artwork *Musicolour* (1953), but also to more generally describe the ontology of cybernetics. Much the same could be said for all of the works discussed here. They all thematize reciprocal interplay of human and machine over representation and purely mental processes (where each is cast as separate from the other). Another discerning feature of all these works is that they are (at least in part) situated in the real world, occupying and interacting in physical space. The embodied nature of these works gives them a palpable presence, offering rich and complex experiences. They also, as Ascott alluded to above, have a resonance with autopoietic theory and enactive cognition (discussed in greater detail below) as well as my own phenomenological approach since they all hold to the view that mind, body and world are linked, with each playing a role in the development of the other. This is useful in helping me develop my own phenomenologically-based artistic methodology. Thus, whatever the specific technique or approach used to couple

human and technological processes, all these artworks advance varied themes of human-technology coupling and co-evolution and in doing so, provide a foundation for analysis and theoretical explication of interactive art experiences that I am calling symbiogenic.

## **2.2 Philosophical and Theoretical Perspectives**

Many thinkers have introduced ideas related to human-technology co-evolution that have come to inform many of the important philosophical components of my theoretical framework and influenced my overall thinking and artistic process. Ideas of human-technology co-evolution are of course nothing new. Within the humanities, many have questioned the ontological divide that supposedly exists between humans and the technological systems they create, as well as assumptions of technological determinism (the belief that a society's technology shapes and conditions social and cultural development), arguing instead that social and cultural forces have significant influences on technological development (Feenberg, 1991).<sup>1</sup> Bernard Stiegler, for example, argues that technics are at the core of what makes us human (Stiegler, 1998). We exist not only in constant relation to technology, but realize ourselves through it. Historian Bruce Mazlish notes how humanity has been struggling to come to terms with its relationship to machines for quite some time (Mazlish, 1995). He argues that the nature of our

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<sup>1</sup> My operating assumption is that cultural contexts shape our perceptions, and thus our technologies, which in turn shape our perceptions. While technologies cannot be seen as culturally neutral, as Andrew Pickering and the British cyberneticians have shown us (Pickering, 2010), they nevertheless tend to destabilize, distort and behave in unpredictable ways at times. For although there are social-cultural forces that no doubt influence or guide technological development, the unstable tendencies of technological behavior virtually ensures us of a dynamic characterized not by a Heideggerian extreme of "enframing" or domination (Heidegger, 1993) but one where there are continuous upheavals and reconfigurations; where technology can never fall completely under human control or vice versa. Thus, a more nuanced approach is necessary when considering the relationship between technology and society. A simplistic cause-and-effect formula must give way to analyses which consider the various "intertwinings" between humans and technology.

relationship to technology needs to be rethought, adding that we can now see that our evolution is “inextricably interwoven with [our] use and development of tools, of which the modern machine is only the furthest extrapolation” (p. 6).

New media theorist Mark Hansen argues that there is an “inescapable correlation” between human embodiment and technology. Specifically within an interactive arts context, he investigates how human agency can be expanded through the co-functioning (or co-evolution) of human and machine, while the autonomy of each is preserved (Hansen, 2005). In *Bodies in Code* (Hansen, 2006), Hansen offers a contrast to most previous technoculture theories wherein media, technologies and bodies are understood as primarily discursive. His phenomenological analysis of new media insist on bodily relations to digital technologies and environments. Hansen speaks of human “technogenesis” which he specifically defines as “coevolution of the human with technics” (p. ix). He notes how our interactions in the world and our sense of embodiment have always been potentially technical and that increasingly, this embodiment “can only be realized in conjunction with technics” (p. 20). Similarly, phenomenologist Don Ihde (Ihde, 1990) questions romantic notions of humans living some innocent and pure existence without technology and notes how humans have always had technology as an integral part of their lives.

Katherine Hayles (Hayles, 1999) has examined the ways in which human embodiment was systematically removed from consideration in the earliest days of the computer age. As she notes, the construction of information as “conceptually distinct from the markers that embody it” (p. 25) would give life to a new construction of the

human and along with it, a myriad of techno-fantasies or dystopias (take your pick) of human-machine mergers, making them seem all the more plausible. Hayles details the ways that the traditional construction of the human is giving way to a new construction, the posthuman. The posthuman is seen as amenable to the effects of its relation to information-processing technologies, to the point of being dependent or reliant on them. This vision effectively shatters the Western idea of a coherent and independent being to pieces. The human is now reconfigured “so that it can be seamlessly articulated with intelligent machines” (p. 3). Although Hayles argues formidably against the rhetoric of bodily erasure and the idea that information and materiality are distinct — a concept that, as she demonstrates, is evident throughout the history of cybernetics, informatics and cultural theory — she also notes the capacity of technology for extending human agency and cognition.

More recently, Hayles has described our coupling with digital technology as a “cultural co-evolution” (Hayles, 2007). She outlines a generational shift from deep attention to hyper attention. Deep attention is the cognitive style traditionally associated with the humanities and is characterized by concentration on a single object or task for long periods of time (e.g. reading a book). Meanwhile hyper attention entails a rapid switch in focus among several tasks. The preference here is for multiple streams of information that provide high levels of stimulation (e.g. playing a video game). Citing various studies of how media stimulation affects the brain, Hayles claims that “the brain's synaptic connections are coevolving with an environment in which media consumption is a dominant factor” (p. 192).

A different type of co-evolution and posthumanism from that of Hayles is posited by Cary Wolfe (2009). Drawing upon systems theory, animal studies and the poststructuralist philosophy of Jacques Derrida, Wolfe outlines a vision of the posthuman that extricates it from the traditional humanist narratives in which it is based and from which he claims Hayles's conception of it is firmly situated in. Wolfe attempts to redefine posthumanism not simply as a state of "triumphant disembodiment" that de-centers the humanist liberal subject but rather one where the human is seen as part of a complex biological and technological environment; an environment it is in constant dynamic interplay and co-evolution with.

With regard to human-technology relations from a phenomenological perspective, Don Ihde (1990) draws on Merleau-Ponty's work to provide us with an analysis that helps to clarify some of the ways in which technology impacts intentionality.<sup>2</sup> Peter-Paul Verbeek (2008) extends Ihde's analysis by distinguishing among three types of "cyborg intentionalities." He notes how the image of the cyborg has been important to understanding what it means to be a human being in a technological culture and uses it as a way to "reconceptualize a specific phenomenon which has long been considered to be exclusively human: the phenomenon of intentionality" (p. 388). For Verbeek, technology provides "new ways of accessing reality" (p. 389), and thus amount to a type of cyborg intentionality, as the intentionality "is partly constituted by technology" (p. 390).

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<sup>2</sup> A central concept in the phenomenological tradition, intentionality refers to the notion that human consciousness is always directed towards things in the world. To see is always to see something. To feel is always to feel something. This intentional structure of consciousness is vital to human experience. We are always directed toward the objects and phenomena that make up our world, and thus we cannot be understood in isolation from it. Merleau-Ponty includes embodied and preconscious aspects in his model of intentionality, which he refers to as "motor intentionality" (Merleau-Ponty, 2002, p. 127).

Many more philosophers have made similar arguments to those already mentioned (Clark, 2003; Haraway, 1991). All argue in one form or another that we have always been intertwined with our technologies to varying degrees. Thus, the belief in a deep ontological divide between human and machine, though certainly still with us, seems weakened nevertheless.

Theories and concepts in the humanities are sometimes influenced by those of the sciences (and vice versa). Likewise, in addition to the specific types of artworks and philosophical ideas I outlined above, I also draw from scientific theories and concepts that I argue, situate human-machine co-evolution as a “natural” phenomenon that is part of larger circular, environmental phenomena. These empirical, scientific and theoretical references demonstrate the fundamental circularity and collectivity of what we usually consider individuality and autonomy, as well advancing ideas of embeddedness and co-evolution with a complex environment. A good example is Thompson and Varela’s work on “radical embodiment” (E. Thompson & Varela, 2001). Drawing on the enactive view in cognitive science (Varela, E. T. Thompson, & Rosch, 1992), they propose utilizing the tools of dynamical systems theory for understanding transient brain patterns (rather than the study of particular classes of neurons). They argue that brain-body-world divisions are in essence nonexistent with regard to consciousness and thus cannot be understood as only occurring in the brain. Because of this deep enmeshment (or “intertwining” to use Merleau-Ponty’s words) they argue that conceptions of brain, body and environment should be viewed as “mutually embedded systems rather than as internally and externally located with respect to one another” (p. 423-424). The establishment of links between

direct subjective experience (phenomenology) and dynamical systems that Thompson and Varela offer (or at least hint at), suggests a rich set of theoretical tools from which to explicate the operative principles of experiences that enable a sense of the “enmeshment” of humans and intelligent technological systems. My concern of course lies in establishing links with regard to artistic experience.

Thompson and Varela’s radical embodiment and much of enactive paradigm of cognitive science, can trace their origins to the concept of autopoiesis (Maturana & Varela, 1980) (as well as philosophical inspiration from Merleau-Ponty). This biological theory of life and cognition offers a definition of living systems as self-contained, self-referencing and self-realizing autonomous entities that arise out of certain circular and reflexive processes. An aspect of the theory that is relevant to my research is the extent to which a living system and its environment are “structurally coupled”, meaning that they are not separate and in essence influence and are implicated in one another’s development. More specifically, coupling with an environment is not seen as a series of input/output relations (as digital computation suggest) but rather as an ongoing (re)organization of the system in response to environmental perturbations, which circle back and perturb aspects of the environment, which in turn cause new perturbations to the system, and so on.

Félix Guattari presents another posthumanist co-evolutionary view that draws from autopoietic theory (Guattari, 2001). Through a rethinking of autopoiesis — specifically what constitutes a topological boundary and how the notion can be understood — Guattari describes possible ways that cognitive functions are shared

between humans and machines. Echoing Francisco Varela's decoupling of closure from autopoiesis (Varela, 1981), Guattari argues not for a vitalist conception of machine autonomy (e.g., relating it to that of biological organisms) but one where we consider their "specific enunciative consistency" (Guattari, 2001, p. 39).<sup>3</sup> For Guattari this necessitates a rethinking of autopoiesis to a conception where boundaries and closure are less stable and are instead dynamic and evolutive. Guattari argues for autopoiesis to be rethought of in terms of a collective autonomy and agency arising from interactions with humans and other machines. Mark Hansen (Hansen, 2009) extends Guattari's analysis and asserts that the technical sophistication and intensity of our environment has evolved to such a degree that we must pay closer attention to the agency wielded by it (through increasingly technical means). This agency, calls for a more provisional, dynamic and ultimately less stable notion of autopoietic closure, wherein the environment itself can cross blurred boundaries and effect change in the organism.

Like those of AI, cybernetics and posthumanism, the views of these thinkers resonate with the phenomenological view that holds mind, body and world to be linked, with each playing a role in the development of the other. These theories serve as a basis for establishing the symbiogenic experience as an experience that achieves a heightened awareness of an already operating social-technical milieu where shared distributed processes act as triggers for, or influences on, each entity's (human and machine's) operability within a domain of structural coupling. In essence, I am concerned with the subjective experience of being structurally coupled to a technically sophisticated

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<sup>3</sup> From a phenomenological perspective we can interpret this as meaning that intelligent machines have capacities for "knowing" in some sense that is specific to their particular constitution — which is borne of symbolic processing, not human-like being in the world.

environment that increasingly wields greater agency, and how interactive art can provide a heightened sense of this dynamic.

### **3. Method and Research Plan**

#### **3.1 Phenomenology**

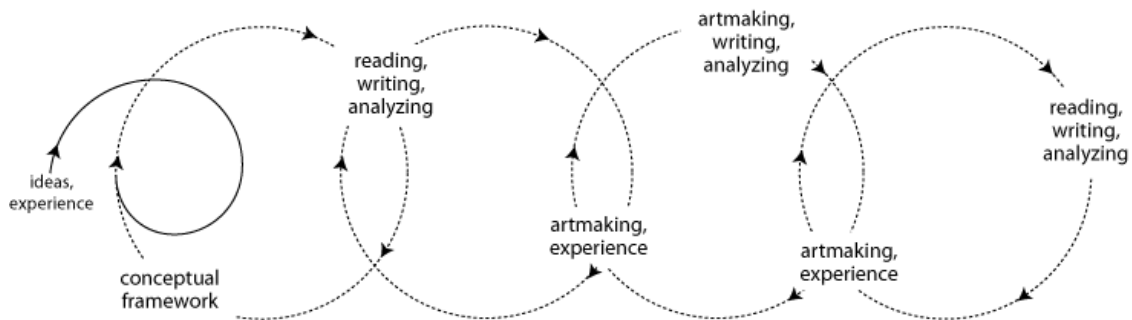
Art is first and foremost about experience (Dewey, 1958). I believe this to be particularly true of interactive art, which requires active participation for its realization. Artists think about the world and make things as a way of thinking or as a means of expression. Thus, artistic practice and reflection are inextricably linked. Furthermore, as a symbiogenic experience is a highly subjective phenomenon, analyzing it necessitates a methodology that takes experience — particularly mind/body experience — seriously. This is why I have chosen the existentialist phenomenology of Maurice Merleau-Ponty as my core methodological approach. Every philosophical tradition has a “method” or a way of seeing the world, and “doing” philosophy. Phenomenology is a method of philosophical analysis, a rigorous and systematic method of analyzing experience. It studies the structures of consciousness and the phenomena which appear to it from a subjective, first-person perspective. In Merleau-Ponty’s interpretation of it, phenomenology is a philosophical view rather than a distinct system of philosophy. Its goal is to lead us back to the world as we directly experience it in pre-reflective perception. To do this, we must set aside our “natural attitude” which consists of any preconceived ideas or assumptions we normally make about ourselves and the world for scientific and practical purposes. This setting aside of theoretical preconceptions is known as epoché or bracketing, a method of phenomenological reduction. While

Merleau-Ponty accepts the idea of reduction, he argues that it is not a complete withdrawal from all engagement with the world but rather entails a loosening of the “intentional threads” which bind us to the practical world (Merleau-Ponty, 2002, p. xv, 83), thus letting the sheer strangeness and ambiguity of the world and our existence in it become more apparent (Matthews, 2006, p. 17). By describing experiences just as we find them in our direct embodied experience and analyzing them and relating them to relevant contingent features, we may begin to change the way we see the world. It may begin to appear less comfortable and defined and appear more indeterminate, as if in the process of continuously becoming.

### **3.2 Phenomenology as a Method for Interactive Arts Research**

My inquiry assumes the form of artistic and first-person explorations in addition to traditional scholarly writing (e.g. theoretical arguments). As its aim is to lay the groundwork toward developing a coherent theory of symbiogenic experiences in the interactive arts, artistic explorations are necessary components of inquiry. Furthermore, since the questions raised in this research are ultimately ontological in nature, I feel it is necessary to go beyond the limits of purely discursive activity, particularly when dealing with questions that involve the body. Thus, a material and experiential instantiation — that is, the creation and exhibition of an artwork along with a phenomenological description and analysis of one’s experience with it — is a vital aspect of this research. Theory and practice continually inform one another and function not just side-by-side, but as part of the same continual, hermeneutic and reflexive process (Figure 2). This

intertwinement of artwork and scholarly writing will contribute to a rigorous and systematic theoretically-based artistic practice (Elkins, 2009; Sullivan, 2005).



**Figure 2.** Art Research Process

With the possible exception of Hansen (2006), there has not been to my knowledge, a consideration of co-evolutionary experiences in the interactive arts done from a phenomenological perspective. My research will use a phenomenological method that combines accounts of direct experience, philosophical analysis and reflection, with relevant aspects from cybernetics and autopoietic theory in an artistic-theoretical inquiry into the nature of our relationship with intelligent systems and technologies. As discussed above, the method employed in this research is derived from the existentialist phenomenology of Maurice Merleau-Ponty. Merleau-Ponty's phenomenological method is valuable and meaningful for this research precisely because it accounts for subjective or first-person experience, particularly mind-body experience. More specifically, this ambiguity of existence mentioned above, of simultaneously being part of the world but

able to stand back from it, from being both subject and object, is crucial to Merleau-Ponty's ontology and serves as a basis for accounting for first-hand, creative experience and for an understanding of the symbiogenic experience. Furthermore, Merleau-Ponty's focus on the material body as the locus point of knowledge and experience, of how the body is led by the particular situation (outside of purely mental/cognitive processes) to get into equilibrium with its environment in an active, dynamic process (H. L. Dreyfus & S. E. Dreyfus, 1999), aids my analysis of how the body and perception may be extended and how interactive art can influence the body's attunement.

Until very recently, there has been little research relating interactive art with phenomenological methods. Diane Gromala used a phenomenological method based upon the writings of Merleau-Ponty for her doctoral thesis in interactive arts (Gromala, 2007). The methodological approaches in her thesis were contextualized to particular interactive pieces. *The Meditation Chamber*, for example, was a collaboration with scientists and focused on descriptive analysis combined with questionnaires and physiological data analysis. Meanwhile, *The Meatbook* was an interactive book made of meat and focused primarily on philosophical analysis and phenomenological reflection. Susan Kozel also draws significantly from Merleau-Ponty in her book *Closer: Performance, Technologies, Phenomenology* (Kozel, 2007) which combines first-person reflection with descriptive and philosophical analysis. Unlike Gromala, Kozel's method is more or less established a priori and applied to several pieces rather than being contextualized to a specific piece.

My approach will be similar to those of Gromala and Kozel. I will conduct phenomenological research on symbiogenic experience by combining first-person accounts of lived experience with philosophical analysis and theoretical argumentation.

### **3.3 Research Plan**

This section will summarize my research plan. To reiterate, this dissertation will be part of the emerging and diverse art research field and in many ways parallels a philosophic dissertation. Along the lines of new media philosophers such as Mark Hansen, I will explore co-evolutionary experiences in interactive art, with existentialist phenomenology (a la Merleau-Ponty, Ihde, Gallagher) serving as the core method of philosophical analysis and with interactive art projects serving a crucial role as reservoirs of experience that inform and function alongside scholarly writing and argumentation.

Using methods of phenomenological description and analysis along with critical analysis I will explicate a theory of symbiogenic experiences by undertaking inquiry in six specific areas:

- (1) I will identify and summarize the key aspects of posthumanist theories and philosophies related to the co-evolution of humans and technology. More specifically, I will navigate various theories of ontology to demonstrate how these the supposed ontological divide that supposedly exists between humans and the technologies they create is breaking down.
- (2) Extending the analysis of (Castellanos & Gromala, 2009), I will identify preconscious factors of intentionality (as outlined by Merleau-Ponty and Shaun

Gallagher) and then examine how interactive arts can harness them to create a dynamic where intentionality is simultaneously located both in humans and in intelligent machines.

- (3) I will identify and examine notions and theories of emergence, autonomy and self-organization, analyze them phenomenologically and argue for their relevance to the concept of human co-evolution with intelligent systems. I will relate them to Merleau-Ponty's ontology of becoming by establishing connections with second-order cybernetics and systems theory (Gordon Pask in particular) and then argue for consideration of Merleau-Ponty's embodied phenomenology as a distinctive method uniquely suited for analyzing these concepts from within an interactive arts context and for its consideration as a philosophical foundation for investigating how certain interactive art works offer aesthetic experiences that I am calling symbiogenic.
- (4) I will examine notions of machine intelligence. Here, I am essentially trying to answer the question of how intelligent systems co-evolve with us. This will entail a phenomenological critique of AI and A-life (a la Hubert Dreyfus), as well as a critique of its cultural context. By analyzing and comparing various views on the embodied and situated nature of intelligence such as those of Francisco Varela, Rodney Brooks and second-order cybernetics, as well as the social and cultural forces that have shaped it (Adam, 1998; Sengers, 1996), I will account for the agency of intelligent systems as well how cultural histories affect our perceptions of agency and intelligence.

(5) I will analyze a specific range of artworks that (as mentioned earlier) thematize reciprocal interplay (and even co-evolution) of humans and machines and give an intuitive sense of connection or enmeshment with intelligent technological systems. I will develop a taxonomy of artists and art projects that contain aspects — such as particular technologies, techniques or general themes — that I consider relevant to human-machine co-evolution and symbiogenic experience in the interactive arts.

(6) I will develop my own interactive projects (*Biopoiesis* and *Protocol*) and describe and analyze my process phenomenologically. This will help enact and embody my textual arguments. The procedure for accessing the phenomenal domain and describing my lived experience will occur in two distinct but overlapping phases:

- i. the construction of the projects and testing of prototypes
- ii. the exhibition and interaction with completed projects (or completed distinct iterations of them)

Also, for each phase I will detail my phenomenal experience in three general time periods:

- i. immediate direct experience and reflection
- ii. reflection that occurs shortly after the experience
- iii. reflection and revisitation that occurs long after the experience

This is summarized in Table 3.1. The procedure for each phase will be as follows:

- I will record my ideas and bodily sensations via notes and audio recordings. This will occur “in the middle of” working on and experiencing the projects.
- I will draw from this immediate experience and record more ideas over time (minutes/hours/days). This analysis will be done primarily via notes and perhaps audio recordings and will consist of developing general themes and categories that relate to my subjective experiences. Here, I will be looking for deeper conceptual and theoretical relevance. For example, I may find connections between Mark Hansen’s notion of provisional and contingent notions of autopoietic closure or Gordon Pask’s notion of what constitutes a self-organizing system and Merleau-Ponty’s description of the interplay between humans and the world as “a certain kind of symbiosis, certain ways the outside has of invading us and certain ways we have of meeting this invasion” (Merleau-Ponty, 2002, p. 370). This may help me solidify (or reconsider) my theoretical arguments related to human-machine co-evolutionary experience. Thus, there will be an interplay between concrete description of phenomenal sense experience and exposition of theoretical abstractions. I will decide the voice (e.g. first-person, third-person) and tone of this document (e.g. critical, analytical, Deleuzian) and continually revisit and revise it as I continue my art-making and scholarly writing.

- After longer reflection (weeks/months), I will revisit these notes and all of the ideas and documentation and begin to write deeper analyses and more concretely form my theoretical arguments. Revising the document (which will ultimately be my dissertation), my artistic process and my phenomenological process will continue throughout.

<b>Construction/Testing</b>	<b>Completion/Exhibition</b>
Immediate experience	Immediate experience during exhibition
Reflection shortly after (minutes/hours/days)	Reflection shortly after (minutes/hours/days)
Reflection long after (weeks/months)	Reflection long after (weeks/months)

**Table 3.1. Two distinct phases for accessing phenomenal domain, each with three distinct time periods.**

Other forms of documentation of the art-making process will also be used, determined by their appropriateness to each phase of the respective project. For example, photographs, video, system diagrams and source code will be kept and serve a supportive role in the dissertation. It is also important to note that this is not and will not be a linear process. Some aspects happen concurrently while others overlap. Thus, refinement of theoretical ideas and introductions of new ones will happen throughout. I may for example read or re-read something and see an aspect of it that I had not noticed until after I completed or exhibited a project. As mentioned earlier the theoretical ideas and the artistic practice continually inform one another and function not just side-by-side, but as part of the same continual, hermeneutic and reflexive process.

### **3.4 Interactive Artworks**

I will use two interactive artworks in my research: *Biopoiesis* and *Protocol*. Each piece will allow me to explore particular aspects of what I am calling the symbiogenic experience.

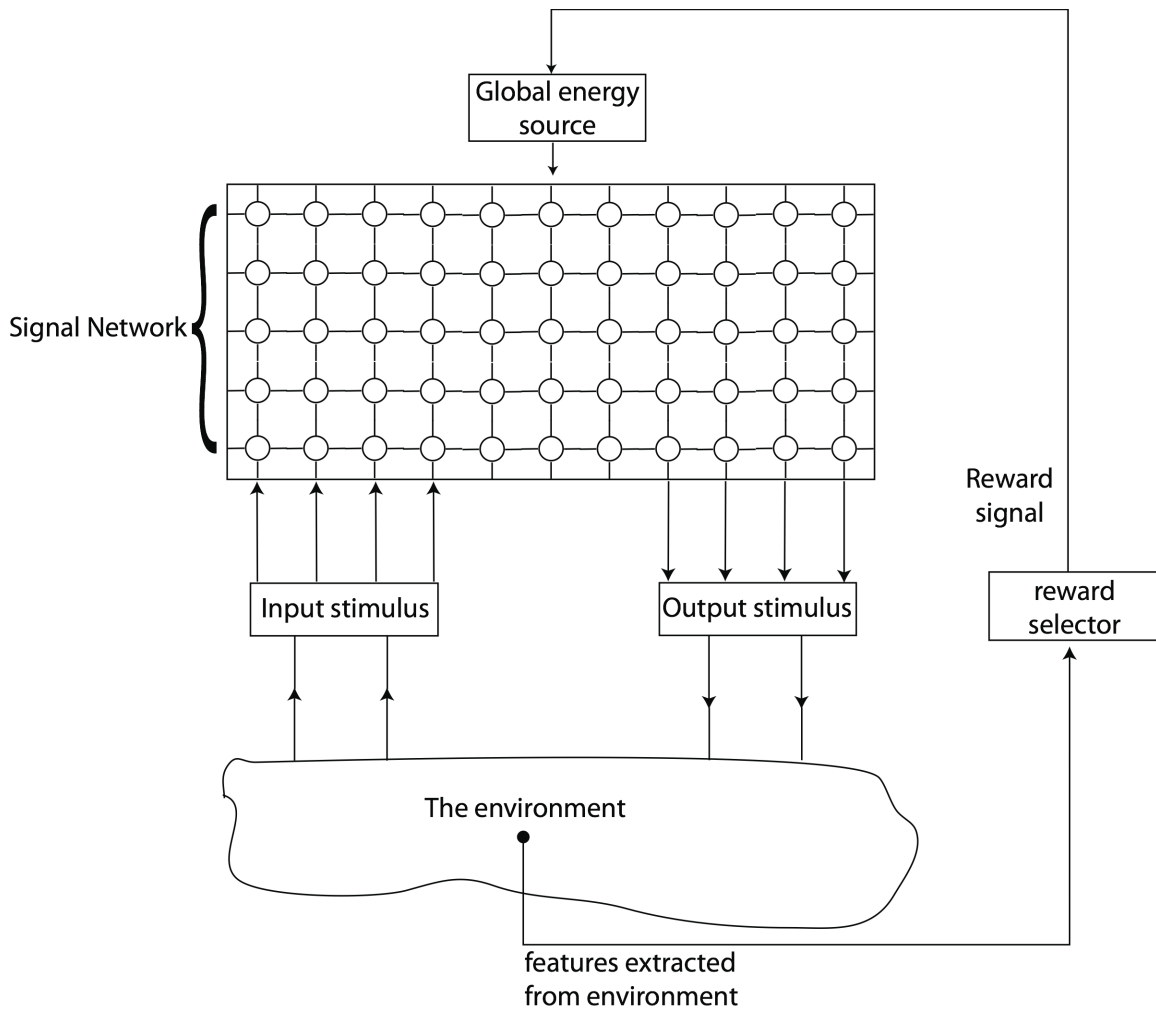
#### **3.4.1 *Biopoiesis***

This project explores the relationships between structure, matter, and self-organization. A major goal is the development of an autonomous computational and control system from what might be called a primordial computational soup. The piece builds on the work of cyberneticist Gordon Pask; specifically, his research into electrochemical control systems that could construct their own sensors (Pask, 1959, 1960). The *Biopoiesis* project explores the artistic potential of Paskian-like systems, where the components and their connectivity are “ill-defined” (Cariani, 1993). A key aspect of the project relevant to my research is exploration of subjective experiences related to self-organization and emergence through non-digital computational means. More broadly, it is an arts-based exploration of methods for creating complexity that do not rely on digital means (as standard AI and machine learning approaches tend to do) but rather incorporate and make use of the inherent complexity of natural processes.

The project features the construction of several simple computational devices that harness electrochemical reactions. Information (an electrical signal) is passed through electrodes to a tank filled with a metallic salt (e.g., stannous chloride) solution. The resultant electrochemical reaction grows into dendritic metallic threads, ultimately leading to the formation of a continuously shifting signal network (not unlike a neuronal

cell assembly). These dendrites are fluid and unstable, bifurcating and dissipating in unpredictable ways, leading to resistance changes that modify the flow of information through the network. If a subset of electrodes in the electrochemical solution receives input from an environmental sensor, and the electrochemical output can affect that sensor, then the network will move towards a dynamic equilibrium with its environment. Moreover, the dendritic network 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. Furthermore, the system can be trained by “rewarding” (e.g., by simply applying more current) certain conductance changes produced in response to a particular environmental perturbation.

A basic system (Figure 3) consists of one or more input electrodes carrying electrical signals from an environmental sensor (e.g., from a microphone or heart rate sensor) into the electrochemical solution. The effect on the electrochemical dendrites may then be captured with a microcontroller, and turned into an output capable of altering the environment (and thus the sensor) in some way; the result of which is fed back to the solution to stimulate new growth.



**Figure 3.** *Biopoiesis*: System diagram

Although a formal exhibition is also planned, *Biopoiesis* is intended as a collaborative interactive project. One of the unique aspects of the project is its “patchable” nature. Thus, for this research I will organize a series of workshops or “open jam sessions” where invited participants have the opportunity to simultaneously patch into the electrochemical network by transforming sound, video, computer graphics, or any other information source into electrical current. In addition, as the project can be

employed in countless ways and with many different media, another other goal of these ongoing workshops will be the development of several electrochemical systems of varying configurations. By establishing simple protocols for contribution and experimentation, several prototypes can be built and exhibited throughout the course of the workshops. I expect that between 3-5 prototypes will be built, depending on the number of participants and overall length of the workshops.

For this research, video and photographic documentation of the exhibition and workshop processes will be undertaken and used observational tools. Most importantly will be the recording of the growth of the electrochemical threads. The process will be as follows:

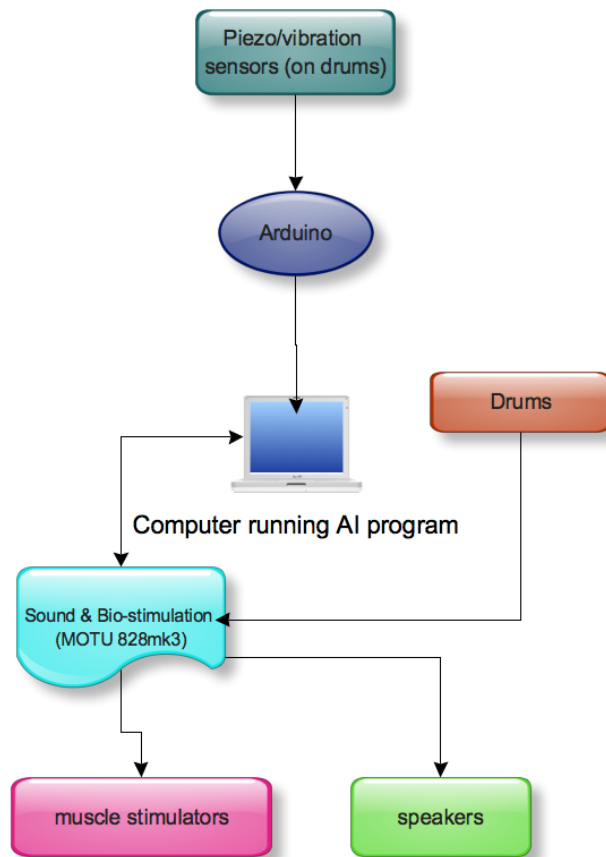
- Several sessions of video recording of the dendritic threads will be undertaken. These will consist of one hour or more of recording the threads as they grow. The growth patterns will then be categorized across two dimensions (tentatively termed “growth agencies” and “path attributes”).
- Several sessions of video recording of the dendritic threads as they grow and move through a “maze” over a period of one hour or more. This maze will consist of several barriers built into the housing of the electrochemical solution. The growth of the threads as they attempt to grow around the barriers will then be compared with a search algorithm (such as A\* (Russell & Norvig, 2003, pp. 97-104)). These growth patterns will then be categorized across two dimensions (also tentatively termed “growth agencies” and “path attributes”) and in relation to the results of the pathfinding algorithm’s simulated path through the same maze.

### ***3.4.2 Protocol***

*Protocol* is an interactive art installation through which I attempt to realize a new form of human-machine symbiosis that I have termed the symbiogenic experience. It features a multi-modal interface and non-verbal communication system that networks and integrates the human with a group of material, intelligent digital agents. These agents “sense” and “communicate” with humans via sound, rhythmic patterns and electrical stimulation of the human participant’s skin. Through their interactions, the agents and the human attempt to develop a human-machinic “understanding” or “equilibrium.” As mentioned earlier, the system is inspired and utilizes some of the tactile communication and sensory substitution techniques developed by Paul Bach-Y-Rita and others (Paul Bach-y-Rita & Kercel, 2003; Kaczmarek, Webster, P. Bach-y-Rita, & Tompkins, 1991; F. A. Saunders, 1983; F. Saunders et al., 1981), as well as embodied approaches to artificial intelligence such as reinforcement learning (Kaelbling et al., 1996) and Rodney Brooks’ subsumption architecture (Brooks, 1986, 1991). Through *Protocol*, I seek to examine how a human and a physically situated, autonomous technological system can intertwine, interrelate and co-develop their world.

The piece consists of a group of drums, one per agent, and a belt equipped with electro-tactile stimulators that send electrical pulses to the participant’s skin. These elements, in addition to spatialized sound, serve as the two-way communication interface between the human participant and the agents. The drums respond to touch, agitation and concussive striking, and serve as the primary method of communication. Each agent/drum is also networked and thus is capable of sensing when another agent/drum is

struck. The agents respond not only by processing the live, acoustic signals of the drums, but also by electrically triggering muscle stimulation patterns in the participant. These patterns serve as a means for the agents to “touch” and manipulate the participant’s body. A basic system diagram is shown in Figure 4.



**Figure 4.** *Protocol:* System Diagram

In addition, the electrical stimulation patterns, along with the rhythmic patterns generated by the participant, constitute a sort of informal protocol that both human and machine co-develop and that each must learn and adapt to. I believe this motor-tactile protocol, while not always immediately discernible may influence the participant's pre-conscious movement, gesture and affective states, resulting in an alteration of the rhythmic communication patterns. Subtle changes in patterns that the participant may not be consciously aware of may serve to alter their body's attunement. This may constitute a subtle yet important distribution of the intentional domain among the human-agent network, as the human is directing action toward the agents; yet the agents themselves may be engendering some sort of non-conscious effect on that very action (of which the participant may not be fully aware). This altering of the participant's and the machine's specific corporeal articulations could result in a shaping of the sonic, rhythmic and overall communicative dynamics that would not be possible in a non-symbiogenic state. Thus, while this is doubtless a highly subjective experience, filled with tension, struggle and ambiguity, I believe it to be one that simply cannot emerge from human or machine alone.

As in *Biopoiesis*, video and photographic documentation of the exhibition and development processes of *Protocol* will be undertaken and used as an observational tool. The process will be as follows

- Audio and video recordings of mine and participants interactions with the piece, with particular attention paid to the rhythmic patterns.

- Data recording of the reinforcement learning algorithm's output over the course of an experience with the piece. This will be done both for myself and for several participant's.
- Data recording of number and velocity of hits over the course of an experience with the piece. This will be done both for myself and for several participants.

### **3.5 Validation**

Validation is a term that has a specific meaning and criteria for evaluation in quantitative research. However, in qualitative research, this concept has proven to be problematic and has even been called into question (Creswell, 2007, p. 201ff.). Harry Wolcott for example, notes how validity acquired its formidable status primarily through its association with testing and measurement rather than observation, description and interpretation. He states that validation often distracts him from his goal of understanding what is going on (Wolcott, 1990). In my research, the overall goals and subjective nature of the accounts require a form of validation that is somewhat different from those of fields where objective third-person methods and testing and measurement are central. What I am primarily drawing from is the phenomenological tradition of “descriptive invariants” (Varela & Shear, 1999). This refers to rigorous phenomenal descriptions that provide credibility and constraints on empirical correlates as well as better understandings of subjective experience. It is also important to note that subjective accounts are not purely personal but are open to intersubjective validation from a community of observers who have familiarity with the concepts and procedures used (Varela & Shear, 1999). As my goal (like Wolcott's) is to better understand rather than

verify, I conceptualize validation as more akin to an *understanding* of a particular phenomenon or phenomena derived from description and analysis of direct experience that communicates a certain *relevance* to my “community of observers”. In essence the question of “how will I know” will be primarily answered (as it has traditionally in the humanities) through the coherence, persuasiveness and “validity” of my theoretical arguments (as determined by my community of observers). In addition however, I will also employ straightforward validation strategies such as peer review and rich, thick phenomenological descriptions throughout the research process (Creswell, 2007, p. 201ff.).

## **4. Provisional Chapter Outline of Dissertation**

The proposed outline of my dissertation is as follows:

### **Chapter 1:**

This chapter will introduce and summarize the overall research agenda. It will provide an overview of themes of human-machine coupling in the interactive arts and introduce the concept of symbiogenic experience, as well as the central research question.

### **Chapter 2:**

This chapter will consist of the literature review and explication of the conceptual framework that has helped guide my inquiry into symbiogenic experiences. I will outline the principal theoretical perspectives and relevant technological aspects informing my inquiry and analyze their relationships to one another. This will include perspectives on human-machine co-evolution from the philosophy, cultural studies and interactive arts. I will argue that what these varied perspectives all have in common is a de-centering of the human subject and a blurring of ontological divide that supposedly exists between humans and the technologies they create.

### **Chapter 3:**

This chapter will outline key interactive art practices that have informed my inquiry and which I consider relevant to human-machine co-evolution and symbiogenic experience in the interactive arts. This chapter will also include a taxonomy of artists and art projects

that contain the aspects such as particular technologies, techniques or general themes that I consider relevant to human-machine co-evolution and symbiogenic experiences.

#### **Chapter 4:**

This chapter will serve as the core chapter where I begin to sketch out what comprise the operative principles of a symbiogenic art experience. It will be devoted to a close analysis of Merleau-Ponty's phenomenology and its relevance to intelligent systems and interactive arts. This is where I will expand on the concept of distributed intentionality and establish connections between Merleau-Ponty's ontology and those of cybernetics and systems theory. I will also examine notions and theories of emergence, autonomy and self-organization, analyze them phenomenologically and argue for their relevance to the concept of human co-evolution with intelligent systems. The overall goal for this chapter will be to investigate how the pre-conscious technical dimensions of embodiment can be leveraged to bring into some form of conscious awareness, this newly theorized form of human-technology co-evolution. In essence, this chapter will attempt to answer the question this co-evolution be felt and understood in an interactive arts context.

#### **Chapter 5:**

This chapter will address what can be called "the problem of intelligence". Here I will examine notions of machine intelligence. I am essentially trying to answer the question of how intelligent systems co-evolve with us. This will entail a phenomenological critique of AI and A-life (a la Hubert Dreyfus), as well as a critique of its cultural context. By analyzing and comparing various views on the embodied and situated nature of intelligence such as those of Varela, Rodney Brooks and second-order cybernetics, as well as the social and cultural forces that have shaped it (Adam, 1998; Sengers, 1996), I

will account for the agency of intelligent systems as well how how cultural histories affect our perceptions of agency and intelligence.

**Chapter 6:**

This chapter will detail the development of the two interactive artworks that comprise the tangible/practical component of my dissertation. I will describe the development of the conceptual, aesthetic and technical structures that have informed each work. I will include phenomenological descriptions and analyses of my own experiences with the works and analyze the deeper conceptual connections to my evolving theory of symbiogenic experiences.

**Chapter 7:**

This chapter will provide a summary of the developments that have taken place during the development and exhibition of the artworks as well a consideration of key findings relating to the works to the theory of symbiogenic experiences.

**Chapter 8:**

This chapter includes conclusions and possible future directions.

## **5. Research Timeline**

The implementation of this Ph.D. research is broken down to the steps outlined below. A tentative timeline towards the completion of the dissertation is also provided (Table 5.1). Most of these steps will not be completed in a direct linear fashion but (as Table 5.1 demonstrates) will often occur concurrently and may be entered into again and again throughout the research process.

### **Step 1: Literature Review**

The research has begun by reviewing literature and prior art related to the concepts of human-machine co-evolution and techniques and approaches for the development of my own interactive art projects. This goal has been partially attained by the completion of my annotated bibliography. Integration into my Ph.D. Dissertation is currently under way.

### **Steps 2 & 3: Artwork Creation & Phenomenological Documentation**

Two art projects are included in this research: *Biopoiesis* and *Protocol*. Both are currently in progress (though *Protocol* is in a more advanced stage). These projects will be completed and exhibited by February 2012. The projects will be shown to the committee at preliminary stage in October 2011 (Step 2) and a more advanced stage (perhaps a formal exhibition) in January/February 2012 (Step 3). During development of these projects, I have and will continue to document their construction and describe my

phenomenal experience as outlined in Section 3. Documentation of the artistic process will also be performed throughout and shown to the committee at regular intervals.

**Step 4: Philosophical Analysis and Reflection**

While not technically a distinct step, philosophical analysis and reflection with regard to human-machine co-evolution is something that I have been doing for some time prior to the commencement of this research. As it naturally informs my art-making and theoretical arguments, it will continue throughout.

**Step 5: Discussion/Dissertation**

The dissertation will be written between June 2012 and January 2013. Defense is planned for February 2013.

	2010	2011 Jan-Sep	2011 Oct	2011 Nov	2011 Dec	2012 Jan	2012 Feb	2012 Mar	2012 Apr	2012 May	2012-13 Jun-Jan	2013 Feb
Step 1: Literature Review												
Step 2: Art Creation (prototype stage)												
Step 3: Art Creation (advanced stage)												
Step 4: Philosophical Analysis & Reflection												
Step 5: Discussion/Dissertation												
Defense												

**Table 5.1. Ph.D. Research Timeline**

## 6. Conclusion

This research seeks to address the question of human-technology co-evolution from within an artistic and phenomenological context. Though many artists and thinkers have questioned the ontological divide that exists between humans and technology and have also claimed that humans are co-evolving in one sense or another with their technologies, the question of how this co-evolution may actually be *felt*, through one's constitutive embodiment, has not been seriously considered. Therefore, this research explores how human-technology co-evolutionary experience may be felt and understood in certain forms of interactive art. I have coined the term "sybiogenic experience" as an umbrella term from which to study the various aspects of such experiences. By undertaking the research outlined in this proposal, which centers around the construction of interactive art systems and analysis of my experience with them, as well as scholarly philosophical argumentation in the tradition of the humanities, I hope to adequately address, from an interactive arts perspective, this question of how human-technology co-evolution may actually be felt and understood. The goal of this research is not to provide a technical framework for something like interactive co-evolutionary systems, nor is it concerned with outlining specific methods or techniques for changing one's art practice (at least not directly). Rather, it is concerned with meanings of co-evolution of humans and technology and how they may be constructed through the subjective experience of developing and interacting with interactive art systems. My research will result in a

model of symbiogenic experience that combines theoretical and experiential models of inquiry and begins to fill a gap between themes and concepts of co-evolution that are either solely discursive (as in the humanities) or objective (as in the sciences) and *experiences* of co-evolution in an interactive arts context. The ultimate goal lies in providing new perspectives from which to approach interactive art practice as well as offering new theoretical and practical approaches from which to study and analyze it.

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