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Publication Date

2009-12-12

Peer reviewed

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ABSTRACT

This paper outlines a research agenda that addresses the question of how contemporary interactive arts practice can evolve new strategies or ways of facilitating the development of subjective experiences that elicit an embodied, felt sense and awareness of our co-evolution with intelligent systems and digital technologies. Drawing upon and extending a phenomenological model of intentionality, we introduce the concept of the “symbiogenic experience” in relation to interactive or technologically-mediated artworks and discuss early research explorations that exemplify it.

1. INTRODUCTION: SYMBIOSIS EVERYWHERE

In the opening chapter of her book *Symbiotic Planet: A New Look at Evolution* [25], 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” [25:5]. 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 [24,23,26]. 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” [26:15]. 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. In the area of human-technology relations, both utopian techno-fantasies and dystopian visions of human-machine mergers have been popular themes in Hollywood films, television shows and science fiction novels for many years. 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. This kind of thinking even seeps into mainstream scientific research [39].

The theme of human-machine coupling is also a popular one in contemporary arts. Influenced and inspired both by technological achievements and popular culture, contemporary artists — interactive or “new media” artists in particular — often advance or examine notions of connectivity and control, both physical and virtual. Within this field, we believe, are a range of artworks and aesthetic experiences that examine, bear witness to, and engage with the observation that humans are increasingly cooperating and merging with their technological artifacts and environments. These interactions are often seen as leading to a sharing of consciousness, but can be more generally characterized as the ways in which humans and machines influence or trigger structural changes in one another [1]. Artists such as Stelarc [15:22,34] and David Rokeby [42:731-732] have spoken of their work in these terms. What we propose here, however, is that interactive art can go further and provoke or enable a bodily, felt sense of this dynamic, and thus bring into greater consciousness the cooperative and co-evolutionary nature of our relationship with technology. Following this line of thinking, and given the cultural dynamics just described, this paper outlines a research agenda that seeks to address the question of how contemporary, interactive arts practice can evolve new strategies or ways of facilitating the development of subjective experiences that elicit or induce this embodied felt sense of our co-evolution with intelligent systems and digital technologies. We believe that these experiences can reach the level of awareness, however fleetingly. Furthermore, we assert that while these experiences can be identified, they lack a cohesive theoretical framework from which to study and analyze them. To help address this question, the term *symbiogenic* has been created as a shorthand term to better discuss these types of experiences and the issues they inaugurate.

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 critical and phenomenological study and assumes the form of artistic, conceptual and first-person explorations. We begin here by providing a brief overview of critical, theoretical and philosophical concepts relevant to human-machine cooperation and co-evolution. Preliminary research strategies are also discussed. We then discuss a current research work, which features experiences where system and participant co-develop their interaction experience. As the aim of this research is to work toward developing a theory of symbiogenic

experiences — as well as introducing a different kind of techno-conceptual art practice — artistic explorations are necessary components of inquiry. Theory and practice continually inform and transform each other. Artworks are created mostly as experiments, but also function as critical points to be made that can enact or embody a textual argument. Theory and practice function not just side-by-side, but as part of the same continual, hermeneutic and reflexive process.

2. CONTEXT AND PRECEDENTS

Ideas of human-technology co-evolution are certainly nothing new. Many have questioned the ontological divide that supposedly exists between humans and the technological systems they create, as well as assumptions of technological autonomy and technological determinism. Bernard Stiegler, for example, argues that technics are at the core of what makes us human [36]. We exist not only in constant relation to technology, but realize ourselves through it. Stiegler argues that the long philosophical tradition of separating *ēpistēmē* from *tekhne* (where technical knowledge is devalued) can no longer be maintained. Drawing upon Heidegger, Marx and others, he argues that human memory — indeed all relation to time — is technologically rooted [36:135ff.] and describes a phenomenon where technics seem to move “faster than time” [36:15]. For Stiegler, understanding the dynamics of how humans and technology interact is crucial for understanding both the future of technology and the future of the human.

Historian Bruce Mazlish notes how humanity has been struggling to come to terms with its relationship to machines for quite some time [30]. Starting from as far back as the early Renaissance, Mazlish offers a rich historical context in which to understand these relations and argues that similar to the way Copernicus, Darwin and Freud forced us to rethink our relationship to the universe, nature and our own minds respectively, so too must the nature of our relationship to technology be rethought. “[W]e are now coming to realize that humans and the machines they create are continuous,” he says, and describes humans as “continuous with the tools and machines they construct” [30:4-5]. According to Mazlish, this illusion (or “discontinuity” to use his words) that we are separate from our technological creations is beginning to break down; he adds 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” [30:6].

Perhaps more than any other philosopher or historian of science and technology, Katherine Hayles [19] 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” [19:25] 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”

[19:3]. 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 notes the capacity of technology for extending human agency and cognition. Most importantly however, her critique of disembodied information — which as she states, reduces intelligence to a “property of the formal manipulation of symbols rather than enactment in the human lifeworld” [19:xi] — could be seen as a clarion call for both new media artists and theorists alike who believe that embodiment still matters in the digital age.

Many more authors have made similar arguments to those of Stiegler, Hayles and Mazlish [10,17,18,20,37], some of which are discussed later in this paper. All argue in one form or another that we have always been intertwined with our technologies in varying degrees. Thus, the belief in a deep ontological divide between human and machine, though certainly still with us, seems weakened nevertheless.

2.1 The Interactive Arts Context

This work is a study of this capacity of technology to trigger the structural changes in the human that Hayles and others describe. More specifically, it looks at how interactive artworks that offer a “structural coupling” [28,29] between human and technological structures can produce transformations in the other. The research is not merely discursive, as it focuses on how these transformations and co-minglings might be *felt* by humans — however faintly — through their constitutive embodiment. 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 [1]. 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” [1:281].

The “systems approach to creation” was analyzed in 1968 by art theorist Jack Burnham in his seminal paper, “Systems Esthetics” [7]. More specific to the discussion here, however, is Burnham’s analysis of the human-machine communication loop in the then emerging field of interactive or “cybernetic” arts [8]. The crucial insight offered by Burnham is his realization that this emerging expansion of the art experience “encourages the recognition of man [sic] as an integral part of his environment” [8:100]. 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” [8:108]. Particularly incisive, as it resonates well with 2nd wave cybernetics and autopoietic theory [28,29], 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” [8:103]. Burnham envisioned possibilities for a

reconfiguration of the aesthetic experience in Western art; one where “symbiotic intelligence” was its ultimate outcome and one’s own “bodily activities” — rather than contemplation of an object — were at its foundation [8:108].¹

2.2 Phenomenological Perspectives

Using Burnham’s approach as a point of departure, we can begin to sketch out what comprise the operative principles of a symbiogenic art experience. This is an experience that seeks to achieve a heightened awareness of an already operating social-technical milieu that situates our very being within the midst of countless omnipresent technologies that shape and color the rhythms and cadences of life. While it does have some resonances with conventional characterizations of the posthuman (e.g. cyborgs), the symbiogenic experience is not founded on the idea of a “brute force” hybridization of human and machine; one that literally fuses flesh and circuitry. Rather, it is more like an embodied integration or incorporation of shared, distributed *processes* that act as triggers for, or influences on, each entity’s operability within a domain of structural coupling. Furthermore, from a somatic perspective, this may (as in symbiogenesis) result in a blurring of the autopoietic boundaries of each system — human or machine [28:88]. This blurring is accomplished through recurrent, performative interactions of a technological nature. These interactions, as philosopher Mark Hansen notes, have always been *potentially* technical and “can increasingly be actualized only with the explicit aid of technics” [17:39].

Thus, as the view of the body as somehow subject to erasure by the informational and technological gives way to a view wherein embodiment is realized “only in conjunction with technics” [17:20], a new set of theoretical questions emerge. Most importantly for our discussion here is Hansen’s assertion that new media art reveals and catalyzes the technical dimensions of embodiment at play in the current stage of “human technogenesis” [16,17]. We must ask how these technical dimensions of embodiment — which are ostensibly unconscious (or more accurately preconscious as we will show in a moment) — can be leveraged to bring into some form of conscious awareness, this newly theorized form of human-technology co-evolution. In other words, how may this co-evolution be felt and understood?

What is proposed here is a framework for identifying and analyzing these felt experiences. At its foundation is a phenomenological model of intentionality, expanded to include its alteration by or adaptation to the varied dynamics of human-machine coupling. This is a framework that can be enacted in concrete, embodied experiments created by interactive artists and designers.

3. DISPERSING THE INTENTIONAL DOMAIN

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. Maurice Merleau-Ponty includes embodied and preconscious aspects in his model of intentionality, which he refers to as “motor intentionality” [32:127].

With regard to human-technology relations, Don Ihde [20] draws on Merleau-Ponty’s work to provide us with an analysis that helps to clarify some of the ways in which technology impacts the intentional domain. He identifies four different relationships and describes their structural features. First are “embodiment relations,” where the technics of a particular action or sense activity are located within the intentionality of that activity. It is a way of perceiving through a technology. This is a relation defined by incorporation. One sees for example, through the pair of glasses, which then become more or less transparent. In this relation, the technics of a particular action are “actively embodied.” Ihde describes technics in this context as “the symbiosis of artifact and user within a human action” [20:73]. Next are “hermeneutic relations,” wherein technologies provide textual representations of reality that must be “read,” resulting in a sort of mimicking of sensory perception. An example is the reading of a thermometer that allows one to “know” the temperature without having to feel it. A third relation is where the technology is cast as “other.” Humans interact with it directly, almost as if it were another sentient, living entity. In this “alterity relation,” the world remains as context and background, while the technology emerges as the focus or terminal point of experience. An example of this relation could be a robot or a personal computer. The fourth relation is the background relation, which refers to functioning technologies that are not directly experienced but which themselves provide context for perception and experience. Examples include refrigerators or heating and cooling systems in buildings.

Peter-Paul Verbeek [40] stresses the importance of approaching the analysis of human-technology relations with an even stronger emphasis on intentionality in order for his “radicalizations” to become visible. Verbeek extends Ihde’s analysis by distinguishing among three types of “cyborg intentionalities.” Here, Ihde’s set of relations are categorized as a subset of cyborg intentionality, referred to as “mediated intentionality.” This is where the experience of the world is achieved through some kind of mediating technological device. Verbeek states that these devices either create a context for human experience or establish “new ways of accessing reality” [40:389], and thus amount to a type of cyborg intentionality, as the intentionality “is partly constituted by technology” [40:390].

Seeking to go beyond mediation, Verbeek discerns two more types of cyborg intentionality: “hybrid” and “composite.” Hybrid intentionality refers to the intentionality of human-machine hybrids. Here, the standard or “classic” conceptualization of the cyborg is offered as an example of an entity that is physically altered so as to become a new entity with ostensibly a new intentionality. The associated mediation that is provided the human by the technology no longer exists, as it has been subsumed or incorporated into the new entity. Pacemakers and implanted microchips for improving vision or hearing are given as examples. Composite intentionality refers to a “doubling” of the intentional domain. Here, “technological intentionalities” — that is, where technological artifacts themselves have a form of

¹It should be noted that Burnham would later temper significantly his enthusiasm for technology-based art. See Burnham (1986) [9].

intentionality — cooperate with human intentionalities in directing action toward the world. As an example of this type of intentionality, Verbeek describes the photographic work of Wouter Hooijmans, who makes landscape photographs using shutter speeds of several hours in length. Verbeek describes this as an “extreme mechanical makeover of the intentionality of the human vision” [sic] [40:394].

Notwithstanding, both the problematic notion of technological intentionality and the somewhat limiting definition of the cyborg, Verbeek’s model of cyborg intentionality serves as a useful starting point for describing what is at the foundation of the symbiogenic experience: the notion of *distributed intentionality*. This refers to a single intentionality, not locatable within a single entity at any single point in time, but one that exists in a blurry intentional zone. It may consist of any number of systems (human and machine), each either ceding or co-constructing portions of their intentionalities as a result of their interactions. This ambiguous and mercurial form of intentionality exhibits a metastability that continually coalesces and disperses as a result of fluctuations in the interactional dynamics.

It is important to note that this intentionality need not necessarily occur in full conscious awareness and also rests on the idea, advanced by Shaun Gallagher, that certain preconscious factors of the body act as constraints on perception and experience [14]. Gallagher explores these preconscious or “pre-noetic” factors, and in particular notes how the “body schema” can shape the body’s attunement to its environment and “limit and define the possibilities of intentional consciousness” [14:239]. In contrast to “body image” — which Gallagher defines as having an intentional (and often conscious) status that involves representations or beliefs about the body — the body schema involves an “extraintentional operation” that exists outside of or prior to conscious experience but still affects it various ways [14:228].

Gallagher is careful to note the continuity between the body image and body schema, emphasizing their operation as a continuous system, while at the same time delineating the important distinctions between the two. Whereas the body image may involve partial representations of specific body parts that one is consciously aware of at any particular moment in time, the body schema functions as a holistic, interconnected system of motor and postural activities and potentials. And most importantly with regard to the discussion here, the body image exercises control over body movements, since through it the body is experienced as an “owned body,” one that belongs to the subject who is having the experience. The body schema, however, is not owned; it is anonymous and “subpersonal.” Thus, control over movement, even though it is for the most part a conscious and willful activity, is still subject to postural or other adjustments that are not under conscious control — for example, those adjustments necessary to maintain balance. Part of the argument presented here is that this control is subject to “outside” influence and that technics is the vehicle for that influence.

Gallagher’s theory extends Merleau-Ponty’s ideas relating to the body schema, which the French philosopher describes as “an experience of my body-in-the-world” [32:163-164]. Merleau-Ponty stresses how the body schema modifies our impressions of incoming sensory impulses, to the point where some impulses may not even be perceived if the sensory organ is not attuned to them [32:86]. Following Merleau-Ponty, Gallagher also stresses the body schema’s role in relating the organism’s sense

experience to the environment, noting that the workings of the body schema are not possible “without reference to the environment” [13:156-157]. Thus, just as embodied organism-environment coupling is central to Burnham’s vision of a re-imagined aesthetic experience, so too is it central to Gallagher’s and Merleau-Ponty’s view of a human being’s overall sense experience and world construction.

3.1 Harnessing Ambiguities

In order to elicit an “embodied, felt sense,” as artists who create a symbiogenic experience would hope or claim to do, it is necessary to reconcile the inherently preconscious function of distributed intentionality with the idea of a feeling body that is aware of the co-evolutionary processes in question. Perhaps it is useful to discuss what Brian Massumi calls the “incorporeal” dimensions of the body [27:5ff.]. Massumi describes the body as having a “charge of indeterminacy” which is not itself part of the physical body, yet is somehow still “material” [27:5]. Comparing this dynamic to that of matter and energy, both of which exist as “mutually convertible modes of the same reality,” Massumi describes the incorporeal as something akin to a “phase shift of the body,” a temporally indistinct “unfolding” [27:5]. This may have some relation to what Gallagher calls the “absently available” and “experientially unowned” dimensions of the lived body [13:153ff.,147]. Gallagher notes how the lived body (as opposed to the physiological or objective body), while partly a consciously felt body is nevertheless influenced by processes that are not consciously felt but may still influence the contours of experience. Similarly, Drew Leder discusses how physiological and environmental factors necessarily need to remain in the background of consciousness in order for the body to attend to the task(s) at hand [22]. Furthermore, as Merleau-Ponty states, things are not simply given to us in perception but instead are “internally taken up... reconstituted and experienced... in so far as [they are] bound up with a world” [32:380-381]. Thus, a symbiogenic experience and its location within a zone of distributed intentionality would necessarily leverage the inherent ambiguity and fluidity of this dynamic, perturbing one’s extraintentional operations. This is a phenomenon which is brought forth from a diffuse and mercurial set of operations, located neither completely with the human or with the machine — outside of immediate phenomenological reflection yet somehow still capable of being apprehended (if only for a moment) by tending to the shape it carves out in space and time.

3.2 The “Problem” of Intelligence

Hansen’s technogenesis mentioned above implies a two-way street. With regard to a symbiogenic experience, we must ask what the machine side of this cybernetic equation is. How do intelligent systems co-evolve with us? How does one account for machine “agency?” To answer these questions, we must first state that our operating assumption is that intelligence can only emerge from situated, “real world” interactions between complex systems (such as humans and machines) and their environment. Intelligence is not an innate property, rather it emerges from the autopoietic processes of a particular system. Thus, any “definition” must take into account this notion of intelligence as relative and contingent. These were once radical assertions in the artificial intelligence community, but are now more commonly accepted [5,3,11].

Just as importantly however, we must recognize that any intelligent system or intelligent agent is culturally situated. As artist Simon Penny notes, “it is a fallacy to assume that the characteristics of an agent are in the code and are limited to what is explicitly described in the code. In fact, the opposite is much closer to the truth” [33:105]. There is no culturally neutral technology. Intelligent systems are cultural products that affect our perceptions. An example from this essay is Ihde’s “alterity relations,” mentioned above. Is this not an inherently cultural relation — or at least one with a significant cultural component (e.g., anthropomorphism)? Merleau-Ponty himself notes the influence of culture on perception when he says that “there is an informing of perception by culture” [31:212]. Machines do not have body images or schemas and thus cannot be said to have intentionality as such. Yet they still 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. Most also possess means for directing action toward their environment. From an art context then, “real” intelligence or intentionality is not necessary, as people who interact with an interactive art piece will naturally bring their own cultural history and ascribe their own sets of understandings to their interactions. The system will trigger different associations in each person.

Additionally, while no universally accepted definition of intelligence currently exists, from a practical standpoint an intelligent system need only be understood as having some sort of ability to sense its environment and “know” when its internal states have changed in response to said environment. It should also be capable of some sort of autonomous action. That is, its behavior should be determined to a certain extent, by its own experience in the world (rather than being based completely on built-in rules or knowledge). Ambiguities or inconsistencies need not be a problem, and in fact in an art context are often an asset. Art will do what it always does — exploit the shifting and sometimes contested nature of culture (particularly with regard to technology) to take one out of their customary zone of expectations.

4. EMBODIED THEORY

This section briefly discusses *Protocol*, an interactive art project currently in the early stages of development. Since the questions raised in this research are ultimately ontological in nature, we feel it is necessary to go beyond the limits of purely discursive activity, particularly when dealing with questions that involve the body. This is why an art approach is necessary to embody and enact the ideas presented here. The construction of this system is not merely inspired by our ideas, but is manifestly a part of them; something that can only be fully theorized through making or action. It is a tangible actualization of our theoretical framework. We hope the reader will excuse the inherently contradictory nature of attempting to explain textually that which can only be fully understood tangibly and phenomenologically.

Protocol is an interactive art installation through which we attempt to realize a new form of human-machine symbiosis that we 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 entities. These entities “sense” and “communicate” with humans via sound, rhythmic patterns and electrical stimulation of the human participant’s skin. Through

interactions and communication that recur longitudinally, the entities and the human attempt to develop a human-machinic “understanding” or “equilibrium.” The system is inspired and utilizes some of the tactile communication and sensory substitution techniques developed by Paul Bach-Y-Rita and others [2,34], as well as embodied approaches to artificial intelligence such as reinforcement learning [38] and Rodney Brooks’ subsumption architecture [4,5]. Through *Protocol*, we seek to examine how a human and a physically situated, autonomous technological system can intertwine, interrelate and co-develop their world.

The entities in *Protocol* are conceptualized as quasi-intelligent beings that exist in electronic space (with the electronic here considered a property of matter or the environment). They are programmed to exhibit the ability to extend themselves via the human, and invite the human to reciprocate through them. While the entities are inherently corporeal and embodied beings, they are also electronic and digital in nature and thus require special interfacing in order to socially interact and communicate with humans.

The installation consists of a group of drums, one per entity, as well as a set of wearable electronic components that the participant puts on prior to entering the installation space. These include accelerometers that sense arm motion, and 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 entities. The drums respond to touch, agitation and concussive striking, and serve as the primary method by which the human communicates with the entities. Each entity/drum is also networked and thus is capable of sensing when another entity/drum is struck.

The entities 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 entities to “touch” and manipulate the participant’s body. 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. We believe this motor-tactile protocol, while not always immediately discernible in its fullest sense, can nonetheless be incorporated into the subpersonal aspects of the body schema and thus 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, or cause a “phase-shift” of bodily state. This may constitute a subtle yet important distribution of the intentional domain among the human-entity network, as the human is directing action toward the entities; yet the entities 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, we believe it to be one that simply cannot emerge from human or machine alone.

Building upon prior work, a prototype of *Protocol* is currently being developed with a standard drum set. In this context, the participant can be seen as a drummer and the system as one that intertwines drums with drummer. However, it is important to note that *Protocol* is not an intelligent rhythm generation system (see for example, Arne Eigenfeldt's Kinetic Engine [12] or Andrew Brown's experiments with cellular automata and rhythm [6]). It is not intended as a means of creating or inducing "musically interesting" rhythms. In fact, the system is not "interested" in creating any rhythm at all as it has no concept of such things. It is merely a system that, depending on the situation, interprets being struck, and communicates these interpretations to the human participant. Any machine intelligence that may or may not exist emerges from these corporeal interactions. The sounds, patterns and responses between human and machine could eventually blend, however chaotically and fleetingly, into a single, co-evolving state.

5. CONCLUSION

It is quite apparent that at this stage, the questions raised by a provisional theoretical explication of what comprises a symbiogenic experience are more plentiful than the answers. Can or should a symbiogenic experience be codified in some way? What qualifies as a "felt experience?" When do symbiogenic experiences come into conscious awareness? Are there a clearly identifiable set of conditions that need be satisfied in order for an experience to qualify as symbiogenic? What is perhaps most important to note however is that in a world where all reality is mixed reality and all computing seems ubiquitous, further explication of this theoretical framework necessitates that one look for distinctions among the temporal, longitudinal and overall gradational aspects of an experience that arises from mind, body and world in specific and concrete contexts. Such an approach may reveal aspects of — and relations among — different levels of perception, sensation and affect.

Finally, because the symbiogenic experience is enacted through the reflexive nature of artistic-theoretical inquiry already discussed, it necessarily requires that well-established positions on both the nature of art and technology be reexamined. Ultimately, we believe that new models of analysis appropriate for the study of complex, dynamic systems need to be developed when we speak of art, for art is no longer merely expression and technology is not merely technical. Thus, the artist-researcher's role should necessarily be partly theoretical and wholly, indeed radically, experimental and enactive.

As the increasing scale and scope of our technologically textured world continues to influence both techno-scientific research and artistic practice — particularly for those involved in networks and intelligent systems — deeply held notions of authorship and interpretation are breaking down. Much as Margulis argues — that the differences between species are not as vast as they once appeared — so too must the distinctions between human and technics, body and environment, and art and science be questioned. Yet, even small distinctions are important, for they give the arts its distinguished (though not privileged) role within the cultural landscape.

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