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Author

Hobbs, G. Craig

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In Situ Δ ~ *The Embodied Search*: Creating Zones of Indetermination

G. Craig Hobbs
Digital Arts and New Media
University of California at Santa Cruz
Santa Cruz, CA 95064
ghobbs@ucsc.edu

ABSTRACT

A strange form of sustenance can be derived from the profusion of networked social interactions and operations, yet the resulting condition also reveals a certain poverty in our relationship to nature, our bodies, and to other bodies. In this milieu, digitally mediated systems are simultaneously enabling and disabling in regards to the human body. The contours, exchanges, and outcomes of this reciprocity are as complex as the mitigating technologies which impact and alter the physiological and psychological dimensions of our contemporary existence.

At the same time, emergent and organic multiplicities of beings proliferate within a very real material system composed of silicon, plastic, metals, energy, and ideas. In the given example, *In Situ* Δ ~ *The Embodied Search*, the viewer searches through nature by way of their proximity to a given milieu. Instead of the disembodied intellect being the agent of the search, the body is the agent of the search. By transposing the body onto the place of the intellect, the author explores embodied influence as a form of *ontological polymorphism*, and as a means to address intensities of bodies, space, time, and materiality through the creation of *zones of indetermination* and *fields of affective influence*.

General Terms

Algorithms, Performance, Design, Experimentation, Theory

Keywords

Affective Computing, Embodiment, OpenGL, Video Processing

1. INTRODUCTION

Art is where life most readily transforms itself, the zone of indetermination through which all becomings must pass. In this sense art is not the antithesis of politics, but politics continued by other means. [3]

In Situ Δ ~ *The Embodied Search*¹ functions as an ontological search, an inquiry into the nature of being, and an epistemological search, a search for ways of knowing. Yet it is also a search for the body in both figurative and processual form as an agent of movement, change, and influence. The project encompasses

¹ Henceforth, *In Situ* Δ . The “ Δ ” reads as delta, and denotes change.

digital arts research, programming, and creative praxis situated around networked bodies and their search for meaning.

In Situ Δ originates from the disembodied form of *the search* as a means to explore embodiment in a technologically mediated milieu. In the installation, the viewer activates the visual presence and sonic intensity of eight natural “worlds”. Although *In Situ* Δ sets the parameters of this engagement, the viewer modulates its form. The body is connected to what it is searching through vis-à-vis infrared tracking and computer vision algorithms.

As process, program, and artifact, *In Situ* Δ opens a discourse on matters of the body in a technological age to shed light on our current computational fascination with, and fetishization of, the human body in its search for sustenance, meaning, and recognition. Although a wide array of means exist for such an exploration, the focus of this inquiry is a material construct, an artwork, offering a series of explorations of nature and culture, image and technology.

In a hybrid mode of philosophy and technics, this paper addresses key aspects of the digital arts research encompassed by *In Situ* Δ including the theoretical origins of the project, its algorithmic ambitions and outcomes, and its current material form. I address problems solved by *In Situ* Δ in the areas of interaction design, video processing, and infrared viewer tracking with particular attention focused on processes of embodied viewer interaction through presence, proximity, and influence. By eschewing precise coordinate tracking in favor of proximity and influence, the solutions proposed herein reconsider the binary relation of subject to object in the area of interaction design. Our focus is on tracking as a proximal art, with specific attention paid to bodies as fields of affective influence rather than fixed subjectivities (both materially and philosophically). Similarly, the viewers, considered as mobilized subjectivities are tracked in relation to fixed objects, fixed materialities by which movements in and through the installation further define and reinforce that space. This relational understanding of subjects to objects, and subjects to subjects - what I term a thirdspace of *subject/ object/ image* relations - address the liminality opened by the viewer, a space, its objects, and the emergent technologies of interaction design.

2. ORIGINS

Philosophically, *In Situ* Δ originates in concept and form from the French philosopher Henri Bergson writing in *Matter and Memory*, and Gilles Deleuze writing on Bergson in his *Bergsonism*. [1, 2]

By recognizing the vast influence Bergson has had on new media art and digital culture, our locus in a Bergsonian movement of time and space provides a theoretical basis for considering embodiment and its synthesis in interactive environments.

Bergson's concept of embodiment in *Matter and Memory* is original in its approach to embodied human perception. Bergson posits the affective state as the source from which all potential action is situated in delicate tension between mind and body, matter and memory. He writes, "the brain appears to us to be an instrument of analysis in regard to the movement received and an instrument of selection in regard to the movement executed." For Bergson, the brain in recursion with the body form a perceptual engine - our nervous system - whose function is to prepare representations, "to receive stimulation, to provide motor apparatus, and to present the largest possible number of these apparatuses to a given stimulus." [1]

Bergson's model of perception exists in perfect correlation with the body, directed as much towards movement as it is towards our perceptions of the world. Bergson's perceptual system of affective representation exists in the mind (within) through a duration which is *precisely simultaneous* to the body (without). The body and mind intertwined in a temporal flux of perceptual being composed of matter and memory in symbiotic coexistence.

"And, if this be so, is not the growing richness of this perception likely to symbolize the wider range of indetermination left to the choice of the living being in its conduct with regards to things?" For Bergson, our perception, situated in a material world, provides dynamic reciprocity between that world and our being within it. Our bodies exist as ontological fields, Bergson's *zone of indetermination*, wherein, "the real action passes through, the virtual action remains." [1]

Bergson posits an embodied philosophy in which our movement *in* the world plays out as the ontological parallel to our perception *of* the world. This mind/ body reciprocity poses a challenge to Descartes dictum *Cogito ergo sum*, and extrudes the Platonic worldview by altering the temporal nature of human experience. But most importantly, Bergson's world is radically pluralistic, positing time as a continuum of coexistent multiplicities of being.

In both philosophical and computational terms, *In Situ Δ* embarks from the idea that Bergson's *zone of indetermination* is a trackable region - a zone - which manifests individually as figural form and collectively as proximal *fields of affective influence*. As such, the project traces the influence of the viewer on the presence and intensity of images, objects, and other bodies through a synthesis of presence and movement. *In Situ Δ* explores the notion that our bodies and their accompanying milieus are multiplicities of complex relations between subject and object, space and time.

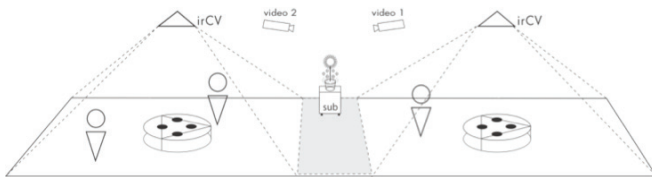


Figure 1. Space diagram of *In Situ Δ* at the Santa Cruz Museum of Art and History, Santa Cruz, CA.

3. *kwpe/ In Situ Δ*

In Situ Δ is the first iteration of the *kwpe/* research group², and the interactive installation of new media artist G. Craig Hobbs. The group is developing applications and prototypes in the areas of user interaction, performance metadata, and real-time video processing. As *kwpe/*'s first interactive installation environment, *In Situ Δ* utilizes high-definition video, audio, and infrared viewer tracking to explore embodied processes of viewer presence, proximity, and influence.

The software written to run *In Situ Δ* is a networked 4-channel XGA video mixer utilizing OpenGL slabs in Max/MSP/Jitter. The software leverages top-down infrared tracking and a fuzzy logic angle panner in its approach to multichannel video processing.³

As a result of the structural limits of the museum space (Figure 1), and as a byproduct of the constraints of infrared viewer tracking, the installation employs an original approach to tracking bodies. Bodies are tracked in terms of their distance and angle from a central point of the tracking area, and as points and angles relative to other bodies in that area. Bodies exist as both points of movement and as fields of influence on other bodies in the installation environment. This approach to viewer tracking is achieved through conversion of Cartesian coordinate data to polar coordinate data to determine viewer location and movement around a central axis of influence.

Although circular models exist in surround sound mix paradigms, the introduction of circular panning in the video realm provides an alternate model for considering video playback outside traditional polygonal implementations of 3d space, and leads toward the possibility of transiting that influence to bodies themselves as discreet fields of influence moving throughout the installation environment. The resulting algorithm solves practical problems in the implementation of *In Situ Δ*, but also addresses theoretical ambitions of the project including the affective influence of bodies in space, and subject/ object/ image relations.

Below, I provide descriptive detail of the installation environment along with detailed specifics of its viewer tracking methodology.

I also trace the projects material and algorithmic deployment to interweave the relationships of theory, aesthetics, and technics as markers and modulators of meaning embedded within the piece.

4. INSTALLATION

In Situ Δ consists of images, objects, and interactions. By images, I refer to video and sound, the digital mediums which are the perceptual substrate and content of the work. By objects, I refer to the icons and material structures situated therein. And by interactions, I refer to relationships of interactivity forming a circuit of meaning between the technologies deployed in the installation and the viewer who navigates its space.

² *kwpe/* (kyū'pē), or Keyword Processing Environment is an open-source tagging tool and real-time performance environment being developed at the UC Santa Cruz Digital Arts and New Media program by G. Craig Hobbs in collaboration with Ian Pye of the UC Santa Cruz Computer Science department.

³ Written by G. Craig Hobbs with the support of Peter Elsea of the UC Santa Cruz Electronic Music Studios.

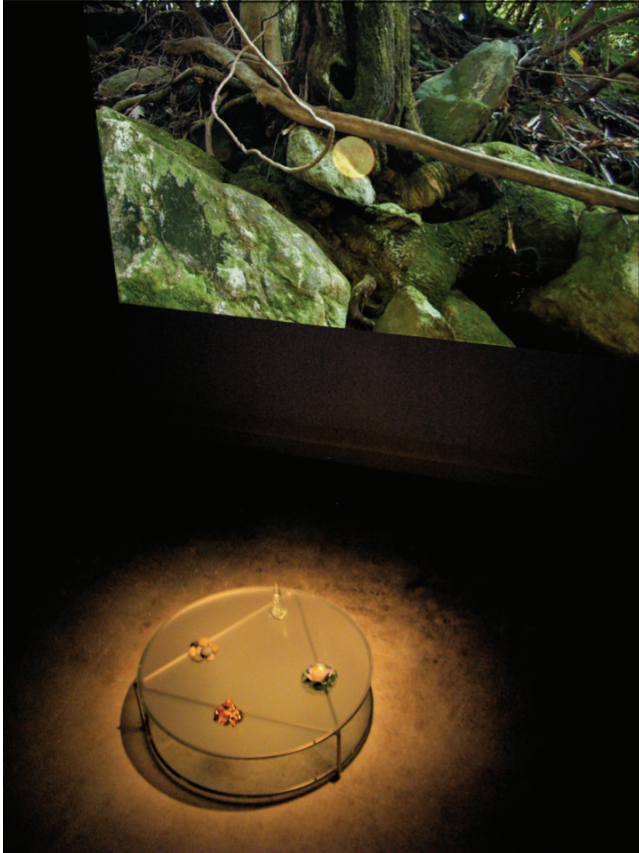


Figure 2. *In Situ Δ* ~ *The Embodied Search* at the Santa Cruz Museum of Art and History, Santa Cruz, CA, June 2009.

4.1 Images

In Situ Δ consists of eight natural milieus in transition, flow, movement, or flux. These milieus exclude mammalian presence, opting for simpler living forms; insects and sea creatures, birds and trees. They illustrate structural forms - mountains and boulders, water and ice. Places under the influence of time - a waterfall cascading from a cliff face, a desert landscape at dusk, morphing clouds at dawn. Each milieu is rendered through extended time-based video studies of nature in transformation. Field recordings were captured during explorations of environments where attention is focused on sites of imminent change and transitional affection. These sites reveal a broad range of temporality, from the immediate (water), to the cyclical (ice), to the imperceptible (rock), and the vaporous (clouds).

Accompanying these visual milieus are natural soundscapes - singing birds, cacophonous insects, flowing water, an owl, and wind. Captured at their source to reflect relationships of site and sound, the recordings are juxtaposed in the museum space with low-frequency oscillations, the resulting synesthesia a hybrid of natural and subsonic form. Site and sound blend into space and place, rendered through the movement of a circumambulating viewer. Sounds establish the *being in* the work, immersing the viewer in sonic signification and opening up a circuit between nature and synthesis at play within the space itself.

Circularity links the viewer to the interface in *In Situ Δ* in terms of images, objects, and their relationship to the body. Here the body

moves in relationship to a center which can not be occupied. In this diagram of movement, the image is in relationship to a viewer who circumnavigates a form: a glass table. Its shape - round - encouraging circularity in viewer movement. Its material - glass - implying a certain fragility and impermanence. These glass sheets supported by metal shapes, circles bisected by triangles, forming what appears to be large transport icons. The tables are lit from above, illuminated with museum grade quartz light. Visually demarcated so as not to be tripped upon, laying low so as to defer its importance away from the hands, and towards the feet.

In the installation, images are linked to objects, as objects are linked to movement. Object placement defines image placement and relationships of interactivity. In the material formation of *In Situ Δ*, subject/ object/ image relationships correlate with a theoretical and philosophical exploration into the nature of space, time, and being.

4.2 Objects

Two tables, eight auspicious symbols. A translation of Buddhist iconography into material form. The objects used in the creation of *In Situ Δ* emerge from the process of its maker. The images of nature I discovered in a search for spaces of temporal flux reveal a nexus to buddhist iconography, philosophy, and visual form.

I translate Buddhism's eight auspicious objects as the buddha, a stupa, a lotus flower, moss, rocks, sea shells, crystals, and a tree. Each symbol is imbued with emotive affect, selected for the image(s) near which it appears. Each area of appearance being measured as $\pi/4$ (90°). That circle mapped to a body in space, its radian measured from the center of the circle as theta, Θ .⁴ Within *In Situ Δ* theta functions as the device for measuring viewer presence in the interactivity of the work. A viewer circumambulates theta as a means to observe the four objects on each side of a room. Two circumambulations complete the form of a loop, a figure eight, or infinity (∞). The body generates circularity in the course of viewing eight objects of imminent change.

The viewer encircles the objects. And in doing so, their bodies emit a field of influence, what I call affect. But quite literally a *field of affective influence* measured in the work as presence. The presence of viewers as subjects of the work, and the object of its iterations, opens up the possibility of a more direct perceptual engagement with the viewer as a seer, a listener, and a body of movement, change, flux and flow. Bodies generate movement through their presence in the interactive space, and bodies in movement gain perceptual correlation with their proprioceptive⁵ sense of being present in and modulating a field of influence in the processual flow of sound and image, space and time.

4.3 Interactions

The body which moves through space emits a field of influence originating in the right hand as theta, a point (the blue dot), and

⁴ In its archaic form, theta Θ was written as a cross within a circle, and later, as a line or point within a circle. The Egyptians used the symbol of a point within a circle to represent the sun.

⁵ Here referring to the denotative sense of "one's own" perception instantiated by a bodily existence whose modality provides feedback on the various parts of the body in relation to each other.

amplitude, a blue circle surrounding the subject; and in the left hand as theta, a point (the red dot), and its amplitude, a red circle also surrounding its body of origin (Figure 3). These opposing points form a line that is bisected by a 3rd, a green dot located at the center of origin as the body moves through space in the installation environment, a green circle defining its innermost field of influence. The center of affective influence of the body in space, through time, and on other bodies therein. I will call this place in space a *zone of indetermination*, or, the *subject/ object/ image space of being*.

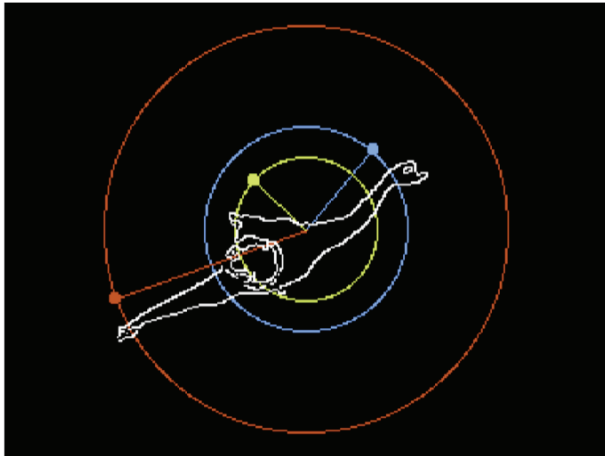


Figure 3. *In Situ Δ* jit.lcd screen shot of body and affective fields of influence in red, blue, and green.

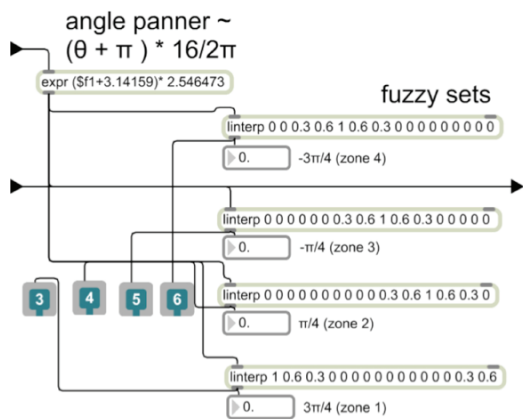


Figure 4. Max/MSP source code of angle panner and fuzzy logic sets to process affective influence data.

The body, its heads floating as the center of gravity of its presence in the installation space is tracked by computer vision algorithms designed to see movement and position in space. The eight objects driving that movement, serving as its site of conceptual correlation between subject and object, image and form, presence and movement situated within the work.

The interactions established within *In Situ Δ* are as follows: the body as a field of influence revolving around a center which can not be occupied. That point, a zone of indetermination around a glass table begets circumambulation. The body deploying degrees

of presence of the eight milieus represented in the system. Eight worlds, eight objects, two forms (circles): the circumambulation of their centers defining the interactive relations of viewer to object.

To arrive at theta in radians, and amplitude, or distance from the center, we complete the conversion in Figure 4. The conversion of cartesian coordinate data (x, y) to polar coordinate data (theta and amplitude) to locate zones of influences of the viewer to object, or *fields of affective influence*. Their distance from the center, and other subjects, a force of amplitude in the interactive relations of viewer to the object(s) thus defining one approach for interactive analysis and reactivity to embodied presence and movement.

By working within the constraints of the installation environment (its milieu), the algorithmic outcome of *In Situ Δ* is determined as much by the projects conceptual ambitions as it is by the space in which it is deployed. Herein, bodies, in the form of infrared tracking data, emerge as the primary influence on the placement and position of objects, and lead the artist toward a mathematical exploration of embodiment and affect.

The use of tracking algorithms reveals what can be more easily understood intuitively. That is, our bodies, in the Bergsonian sense of our perception, exist as zones of indetermination concurrent with our physical presence and movement within space, and as affective fields of influence upon objects and other bodies within that space. As such, *In Situ Δ* represents an original approach to viewer tracking based on circularity and influence derived as much from mathematics and philosophy as it is from aesthetics and Buddhist iconography. The resulting algorithm is an aesthetic and technical approach to the problem of interaction design which engages theoretical ambitions along with research, praxis, and experimental outcomes.

4.4 Infrared and visible light LED's

A final point of interest in *In Situ Δ*'s exploration of embodiment is the activation of infrared (IR) and visible light LED forms. Infrared appears as an approach to sousveillance, or inverse surveillance, by taking the tools of its trade and plying them toward less nefarious means. Quite literally, this entails the use of surveillance technology in the deployment of interactivity within the museum space.

The use of surveillance grade infrared illuminators (Figure 5) for tracking interactivity is as much a byproduct of thrift and experimentation as it is a conscious decision to exploit the infrared spectrum in the areas of movement and being. Whereas the function of surveillance as a means of social control must know the identity and location of the subject under observation,

In Situ Δ, as a function of interactivity must only know the presence and movement of bodies in space.

Although the appearance and functionality of IR is predominantly invisible to the viewer, technically inclined and curious viewers will recognize the use of infrared illuminators as an adaptation of surveillance tools to interaction. This function is not explicit, and for many viewers it will go unseen. Rather, it poses the situation of the visible and the invisible as being coexistent in perception.

Through the use of surveillance technologies, I seek to recover some of the power we have lost to perceptual regimes and their dominance in our contemporary cultural milieu. Through infrared light, I seek to enable the viewer as an agent of change in an

experience of perception, discovery, and nature within the representational space of an embodied artwork. As such, this interactive space - while possessing its own mechanisms of observation and control - never remembers what it has seen.

Whereas infrared light serves a critical role, visible light LED serves a heliocentric role by illuminating the objects on the tables. These visual attractors are sublimated into the work aesthetically. In practical terms, lithium ion batteries activate the luminosity of the objects for the duration of their charge. Visible LED thereby represents an activation of intent and a foil to the observational capabilities of infrared LED.

5. SUMMARY

It may be Bergson's legacy that his primary influence would emerge a century after the publication of *Matter and Memory* in the artwork and theories of a computational culture which had created mechanisms capable of manifesting his ideas through algorithms of spatiotemporal engagement. Bergson's philosophy provides a rich tapestry and functional models for considering multiplicities of time made possible by the advent of non-linear digital technologies in the realm of audio, video, and interactive programming. Matter being the situated, plastic, representational mechanism of digital art in the form of sonic and visual content, and memory being the programmatic logics which deploy, propel, and activate relations of movement, temporality, and interaction within, through, and by the agent(s) of that content.



Figure 5. Infrared dome illuminator LIR-CA60. Infrared light can be seen by specially equipped video cameras commonly used in surveillance and military applications. Infrared cameras can “see in the dark” images otherwise invisible to the human eye.

In Situ Δ seeks to create an ontological space of becoming, and an epistemological space of knowing originating from the idea that we must construct these spaces ourselves instead of relying on others to construct them for us. Humans - as self-organizing, affective influences - search for domains of influence. Through this search, domain control and reification becomes the primary modulations of technology and of suffering. Yet by the same means - belief, mobility, and intensification - creativity may be wielded as a foil to death, as a bifurcation of the liminal space of life, of liminal beings and their sounds, visions, interactions, spaces, times, and places.

Our search for liberation through technology is recursive to the fact that it enslaves us both physically and temporally, isolating us from our bodies and from nature. In my work, the body replaces the disembodied intellect as the agent of the search. By transposing the body into the place of the intellect, I offer a locus of embodiment back to the viewer. I also offer a play of cosmological forces - chaos and the indeterminacy of nature - as generators of art and affect. Through this engagement, I seek to make the viewer aware of the essential nature of being in a body. Of a knowing which can not be extracted from its being.

6. ACKNOWLEDGMENTS

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