EXTRA:MUROS:INTRA
Into the Heart of Quantum Matter

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Abstract

Extra:Muros:Intra: Into the Heart of Quantum Matter

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Extra:Muros:Intra: Into the Heart of Quantum Matter is a phenomenological investigation in design processes between digital and physical space. As the physical landscape changes with the hybridization of digital communications, classical concepts of Cartesian and Newtonian space are disrupted in non-classical, quantum indeterminacies. The research involves an interdisciplinary study of quantum physics and contemporary architecture in two phases: the first phase is a comparative analysis of spatial theory in modern architecture and quantum physics starting from the 20th century, and the second phase entails a research-creation prototype in the form of an experiential display, installed in a site-specific public location for 9 days. An analysis of quantum space theory is evaluated in the literature and materialized in the display through a variety of methods: a comparative literature study, observation and documentation, a sample study interviewing participants, and a reflective practice, through which the design process is assessed.

Keywords

Quantum physics, Design, Agential, Materiality, Affect, Embodiment, Affordance, Surface, Digital, Presence, Transmaterial, Architecture, Phenomena, Entanglement, Apparatus, Posthuman

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Dear Ingrid, you are my Absolute.

Dear Chloe, you are my Quantum everything.

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PHASE I

00 **Set-up**

00.10 Introduction: Bohr, Barad, Ebeling

> In everything is preserved the potential space of play that would make it possible to become a site of new, unforeseen constellations. The definitive, the characteristic are avoided. No situation appears just as it is, intended as such forever; no form asserts its own 'just so, and not otherwise'
> (Benjamin, 2008, p. 7)

In the age of quantum revelations, in physical, digital, and philosophical pursuit, the development of modern science in the 20th century has emerged as an ontological point of interest in a socio-historical context, producing a question of moral consequence we continue to unravel to this day. This specialized scientific field of concern has manifested in the humanities for over a century, evidence of which has been found to be embedded in the material and spatial practices, influencing the very concept of space we inhabit. Perhaps this is because the search for foundations in physical matter was so closely tied to the dominance of territory leading into the Second World War; science was inextricably linked to political agenda, geographic identity, social morality and technological supremacy as quantum physicists who were at the forefront of discoveries were also enlisted in the race for atomic armament[1]. One of the three leading protagonists who will be explored in this project, theoretical physicist Karen Barad, replays the ultimate question of a physicist's moral character extracted from the manuscripts of Germany's leading physicist during this time, Werner Heisenberg: "Does one as a physicist have the moral right to work on the practical exploitation of atomic energy?" (Heisenberg cited in Barad, 2007,

[1] Consider the events leading to the mysterious meetings between Niels Bohr and Werner Heisenberg and their letters of correspondence during the second World War – Karen Barad differentiates the moral dilemmas with ethical concerns to frame her departure from centrist patriarchal physics (Barad, 2007, ch.1).

p.7). Another plausible interpretation of this statement: what role does a physicist play in the life (and death) of humankind?

The exploration of quantum physics therefore not only ratified conceptual space, but it altered the production of space in material and social practice, too. Boundaries were rendered indeterminate, and a new discursive practice of spatial design initiated a re-evaluation of the architectural discipline previously built on the classical Vitruvian principles, starting and ending with the limits of the human body. The resulting discoveries of unquantifiable phenomena has inspired this project to conduct a phenomenological inquiry of space and the body. Quantum physics has tangible effects; it moves us with equal measure to our presence inhabiting its multi-dimensions. At the core, in its infinitesimal level, quantum theory has seeped into the undoing of spatial territory, blurring the nodal points that define everyday conceptions of spatial operations: position, movement, event, effect. The results of a quantum application to space have rendered classical boundaries indeterminate, as we will review during Phase II in the research-creation project, *Extra:Muros:Intra.*

In the quantum age, there are no fixed dimensions or centralized points of origin in a dynamic field of elements, rendering Newtonian concepts (absolute time independent from space, for instance) to be obsolete. It is for this reason I open my current project from not one, but three positions. The first position consists of a philosophical manifesto published in 1947 by an architectural theorist from the Bauhaus, Siegfried Ebeling who lays out a foundation for a structure-less architecture based on cosmological relationships; the second, a scientific paper introduced by theoretical physicist Niels Bohr in 1927 that describes unquantifiable phenomena in *complementarity*; and the third position, theoretical physicist and feminist theorist Karen Barad introduces a contemporary re-evaluation – or as Barad emphasizes the performativity of

language and identity, a re/turn – of Bohr through her theory on *agential realism*. These three points synthesize and diffract through an interactive field of insights, as I examine their perspectives from an interdisciplinary method of practice and reflection. The varying positions of research intersect trajectories of architectural theory, public and private space, and research-creation methodology. The position and momentum of the research process moving collectively and asynchronously is intrinsic to the framework of the thesis question and argument at hand, to address the nonlinearity of a decentralized quantum condition carrying forth in *posthuman* terms of critical theory, which will be analyzed in section 02.20 in a comparative analysis of literature.

I have focused on the work of Ebeling, Bohr, and Barad, because they have challenged the ontological landscape in their respective disciplines, disrupting the structures of classical concepts in practice. They have subverted the higher strata of incontrovertible objectivity traditionally upheld in their fields, embracing the subjective nature of inquiry. They have also acknowledged to varying degrees of definition a *wholeness* beyond the limits of what can be discerned, a force of phenomena that is limitless beyond our capacity of knowing. Furthermore, they have acknowledged the phenomena of space-time as having no specific means of measure or territorial boundaries. This is a turning point in the epistemology of disciplines wherein emerging fields result not in the uncertainty of knowledge, but rather constitute a transformation of discourse from classical concepts into heterogeneous research methods. My intent for this project is inspired by their examples: to consider alternate practices in design, expanding the concept of the spatial field for spatial plurality. In section 02.20 to come, we will compare the following practices: Ebeling's *naturphilosophisch*[2] design (Ebeling, 1947, p. 1); Bohr's expansion of an approach to philosophy-physics (Barad, 2003, p. 813) (Plotnitsky, 2010, p.

[2] *Naturphilosophisch* is the term ascribed by Ebeling in the introduction to his last text, *Extra Muros: Einleitung in die theorie des freien hauses* to describe his approach to structural dynamics found in nature and its comprehensive ecological context.

39)[3]; and Barad's agential realism[4] (Barad, 2007, p. 56). I am particularly interested in the ways one establishes a meaningful dialogue with an unfamiliar environment, by connecting to a kind of felt presence beyond the physical measures. Can we get to the heart of matter in its becoming, in transformation? This investigation is an alloyed approach to research methods in an interdisciplinary[5] practice, with practice at its core.

00.20 Practice and Discourse

If science enables us to observe the nature of matter in ways unforeseen, architecture enables the expression of matter's nature through space. Until the beginning of the 20th century, art and science held to classical views of Newtonian principles, demonstrating a soundness in its resolute structure of definitive design. In a way, matter was absolute, and its mysteries needed only an instrument to define its nature. However, nearly a century ago a simultaneous rupture of disciplines in both science and architecture occurred, wherein critical theorists-as-practitioners examined the ontological infrastructure of a seemingly sound classical foundation during the 1920s and began to reveal an uncertainty in the genetic makeup of quantifiable methods. In its wake, a post-positivist field of inquiry (through ethnography, environmental psychology, feminist studies, practice-based research) has precipitated into an interdisciplinary practice between the arts and sciences. A multiplicity of research models employed less of the traditional affirmations

[3] Barad contends Bohr's philosophy approach to physics is inseparable; Heisenberg once suggested Bohr to be more of a philosopher than scientist.

[4] "Experimenting and theorizing are dynamic practices that play a constitutive role in the production of objects and subjects and matter and meaning. ()…(T)heorizing and experimenting are not about *intervening* (from outside), but about *intra-acting* from within, and as part of, the phenomena produced." –p56, Meeting the Universe Halfway 2007

[5] Trans/ inter/ intra/ intersectional/ multi/ un/ cross/ disciplinary methods. While I do identify with the variations of disciplinary practice, the word trans-disciplinary is probably more apt, used to exemplify a seamless integration of two or more fields of knowledge without a hierarchic relationship. However, the fluid dynamics of hierarchy in relational disciplines calls for the concept of ***intradiscipline,*** based on theoretical physicist Karen Barad's mutually entangled term, *intra-actions*. For more context, see Meeting the Universe Halfway, 2007 p33

seeking a universal point of origin, and more of a visionary pluralism to project beyond the plausible, classical models of constructive applications.

Using the critical theory derived from quantum physics, and employing a rigor of quantum phenomena inquiry in a spatial design prototype, the aim of Extra:Muros:Intra is to examine how the integration of the various fields will operate, and what new insights could meaningfully be generated in an interdisciplinary methodology, that which a single discipline could not produce. It is also important to stress the outcome is not based on the quantitative measure of validation, given the nature of architecture and physics disciplines are predicated on defining embodied knowledge through the lens of practice standards measuring material in relation to bodies in space. In other words, the world is a construct made to the measure of our presence in it, yet quantum physics has disrupted the measure of all things: I will be exploring alternate means of measure beyond the definition of a body, outside classical standards of precision, and towards the interiority of the experience.

00.30 Why is this important?

> Apparatuses [through which we use to measure] are material (re)configurings/discursive practices that produce material phenomena in their discursively differentiated becoming. (Barad, 2003, p. 820)

Why is this project of quantum relations of importance to the field of spatial design? Perhaps because, in a climate of automation processes, binary linguistics, and pre-determined relations (the predetermination of a minority if not a part of the majority), quantum events reveal the inexplicable character of occurring phenomena generated in spatial constructs that can't be defined in its entirety, yet is specific in relative conditions. What this means is, the classic bounds of architecture that pre-determine spatial relations of the outside and inside have a deeper

complexity than the observable surface. The program of space has the potential to be many things, as much as it can be designed to preclude, by intent or default. There are other instruments to explore in the design process. As a multidisciplinary practitioner of spatial design of no fixed discipline, and as a citizen who's values of individual identity, privacy, autonomy and universal access are ever-present in a spatial field less secure, and less autonomous in the material and dematerialized constructs in the public sphere, I have come to reflect on my own work asking what role could a designer have in creating a space to serve in the interests of others. In a similar crisis of conscience Heisenberg once asked of himself about the role a physicist had in the field of science, I asked to what end does design intent have, in the interests of designing a space of agency? In this age of uncertainty, is there a mode of practice that can navigate the many fractured states of divisible disciplines? What processes could help guide us toward the creation of a place of inclusivity? If a universally accessible design means it can be all things to all people, is it at risk of being nothing of substance to anyone or anything?

00.31 Landscape

An exploration of digital and physical environments guide the process of inquiry. In disciplines of user interface interaction design, industrial design, interior design, architecture, urban landscape and planning, a practice is often in or adjacent to boundaries of the next, at times sharing interstitial moments when social, political, and cultural underpinnings of space intercede tradition and scale. The integration of digital space in its various forms of ubiquitous data – virtual, augmented, telepresence, GPS, mobile communications – disrupt tradition and scale simultaneously. While technology is not a discipline of its own, its effects interpenetrate the boundaries of environmental processes, and requires a re-examination of classical models. For instance, the interior design field is a practice negotiating a cohesive synthesis between the

human body within the context of a pre-existing envelope of architecture, and further, within the embedded culture of the larger physical, social territory. Today, however, the classical meaning of architectural space is surpassed by new structures of material and cultural value, collapsing public and private space (Mitchell,2003, 8). Exterior and interior space is no longer mutually exclusive, and classical thresholds are compromised. Binary modalities of outside and inside are dismantled from classic prescriptions of form and function, and the question of interiority begins: where does space start, and the body end? As objects and surfaces afford new interfaces of digital information, how will it change the ways we navigate through a layered space topology? And what of our presence – how will we interact and engage in yet to be negotiated ways, inventing protocols for an ethical approach to design processes? The landscape of an interior discipline is at stake. Without the pre-determining boundaries of an architecture, an interiority requires a reformation of measuring systems, enfolding apparatus to be accountable for the experience of phenomena, as varied and multiplicitous as the possibilities of interaction.

One significant aspect to the research is the emergence of real-time interactions and unforeseen fluctuations that change or influence the process of the project. The investigation into the landscape of the digital and physical space in Phase II of the installation Extra:Muros:Intra generated a disruptive effect of light and sound, an effect which is later referred to as *BlackField*. The BlackField condition emerged through experimentation with the unique aspects of the site, the program interface, and the individual participants. The condition can be described as a distortion of audio feedback, and the name of the condition is a reference made to the digital processing visuals creating an expanding field of a black screen, which occurs unpredictably from unknown causes, however is a product of all the elements in the physical and digital field combined collectively. In section 04.40 this emergent concept will be expanded upon in detail.

00.32 Process

Specific to this research is a focus on the increasing hybridization of analog/physical and digital systems emerging with the promise and threat of an orderly and freer future, wherein new forms of communication, places, identities, and relationships are changing the parameters of the once familiar Cartesian landscape into new interconnected territories. What is ultimately at risk is the *concept* of a space for people or persons to operate and engage in without fear of retribution or cost, free from mediated constraints, free from invisible forces of intended and unintended means of control, free from regulated points of access devised for the interests of other bodies of consumer and policy regulators. Mediated forms of communication are interpenetrating the physical space outside classical concepts of time independent from space. In other words, the demarcating boundaries of private and public space are shifting and dissolving with new developments of technology impacting the social structures overlaid on the pre-built physical constraints. Thus, an *entanglement*[6] of forces, namely the physical, psychic, and social factors between people, objects and environments are in constant motion, generating an actionable field connected and simultaneously discrete, charged with the potential of self-governed interactions. Interdisciplinary methods of practice have the means to engage, mobilize and fluidly react to non-classical challenges by responding in kind with hybrid actions informed by various and specific fields of knowledge. The interdisciplinary approach to this project of quantum physics, architecture and spatial design intersects the following research trajectories by

1. Creating models of potentiality in architectural theory
2. Critically analyzing engendered and inherited classical structures in public and private space
3. Exploring the concepts of an inclusive heterogeneous public space through research-creation methodology.

[6] Karen Barad defines entanglements as a condition of existence, connected in multiplicity – Meeting the Universe Halfway p.ix

If we return to the practice of spatial disciplines at stake, we must consider how theory and practice of social and physical parameters are integrated at the outset, and consider whether the outcome will either welcome or disenfranchise the public in a designed space for plurality. If the spectrum of interdisciplinary is expanded to include non-binary conditions outside absolute parameters in classical models of tradition, then the multiplicity of potential actions, or what Barad identifies as *agential cuts*, have a real tangible role in the interdisciplinary democratization of space:

> It is through specific agential intra-actions that the boundaries and properties of the "components" of phenomena become determinate and that particular embodied concepts become meaningful. A specific intra-action (involving a specific material configuration of the "apparatus of observation") enacts an agential cut (in contrast to the Cartesian cut—an inherent distinction—between subject and object) effecting a separation between "subject" and "object." (Barad, 2003, p. 815)

The agential cut intersects across the dichotomy of subject-object relations, implicating the observer as an active participant in the formulation of generative relationships in the environment. Action of consequence are equal as hierarchy between, say, a person and an object co-opt the relationship and the unique positioning in the space. In this way, design has new potential for agential practices. We will look at the ways Ebeling, Bohr and Barad have cut polemic paths toward a critical, ethical practice, an interdisciplinary practice, to break from classical homogeneous methods in their field, which have informed the design development of this study.

00.40 Research question (what if)

My research question starts with the ontology of spatial design practice*: In what ways can we devise methods of design towards a comprehensive, critical engagement of spatial practice? And what might that practice look like?* If we start at the practice, we then begin to address the framework that defines boundaries, and the subjectivity of spatial experiences that are immeasurable. A new typology of space might entail an evaluation of physical, psychological, digital, and virtual presence in hybrid landscapes. It might also negotiate the boundaries of space through these evaluative operations, offering insights to the meaning of inhabitation in multiple *presencing* ways. By asking questions on what constitutes space in various methods, we may find insights toward a different relation that redefines space as an enabler to our being within, or a barrier of limitations, from the outside. Boundaries may be reimagined in different threshold experiences, changing the dynamics of classical states of exteriority and interiority.

But if, for a moment, we consider different methods of inquiry, how could the process of the research transform itself from a fixed construct of a definitive hypothesis, to an open-ended exploration, generative in iteration, unbound from prescription? Absent of a predicated hypothesis in the constructive *if…then* statement, we begin the research with an open-ended question, removing the conclusive binary statement proving or disproving a theory. What if, for a moment, we could imagine a design beyond a finite, formal dimension? The measured value in research, beyond quantifiable and reproducible proof could supersede the Brief (i.e. the set-up of a predetermined challenge within a specific context provided by the client) exploring what may come as a result of parameters unbound: a new territory of *unboundaries*.

In such an indeterminacy of “outside” parameters, the exploration of interiority becomes, as Karen Barad offers, an “apparatus of open-ended practice”:

> This indeterminacy of the "outside" boundary represents the impossibility of closure—the ongoing intra-activity in the iterative recon-figuring of the apparatus of bodily production. Apparatuses are open-ended practices. (Barad, 2003, p. 816)

The question – "What if" – is an extension of what she calls *an impossibility of closure*, in constant formation. In the cartography of the dynamic unboundary, the classic systems of "the measure of man" have no jurisdiction. New instruments are required.

00.50 Theoretical Framework

Three points of theoretical trajectories – intersecting *entanglements* – are analyzed in theory and design experimentation, exploring the trajectories of architectural theory, public and private space, and research-creation methodology. The first point takes on the position of Niels Bohr's account of complementarity, which entails a two-pronged approach of scientific research: a methodology encompassing a theory of science and philosophy, and a practice embracing the immeasurable totality of phenomena based on the human limitations of human-centric apparatus. The second position is an *agential realist* account of phenomena, in which Barad extends Bohr's complementarity into a posthuman consideration of interactive relations that are dynamic and essential to agential transformations of space outside of a structural human-centric order. The third position is Siegfried Ebeling's concept of the pre-conditional *freien Raum* (free space) extending beyond the walls of social and architectural structure, dynamically informed by the working actions conducted in the *Wirkungsbereich* (active field, field of action), a term which Ebeling interchangeably refers to as a *kraftfeld* (field of force).

The three positions of the argument work toward the concept of a design practice that considers a heterogeneous approach in method and theory inclusive of differential programs of space. This proposal of a new practice also cautions us about the limiting effects of inherent structures

assumed in the production of environments that have evolved without a critical evaluation on classical hierarchies in their respective design fields. Fields which have traditionally been individuated and formally applied in categorical procedures share a common thread in a post-quantum landscape: space is charged with forces seen and unseen, defining the relationships and actions to our surroundings, which in turn define our agency and identity. Designers cannot be complacent in the singular disciplinary structure they traditionally operate within, if they are to consider a greater field of potentiality in non-classical conditions we live in. The research-creation development of Extra:Muros:Intra is a demonstration of an interdisciplinary methodology connecting Barad's agential realist account of phenomena, Bohr's complementarity of physics, and Ebeling's concept of the *freien Raum*. For this reason, we will review the terminology at a glance and contextualize its relevance to the practice before proceeding to the methods and literature analysis.

Karen Barad's posthuman account of agential realism is an affectual engagement of matter distinct from its representation, critically examining the relational phenomena and matter in and around us. What separates agential realism from the production of meaningful symbolic representation is the ability to engage in the theory and practice of the material constructs that create its conditions. The disruption of practices through experimentation from within – and external to – conditions, defining subjective relations and hierarchies, enables

> …a realism toward phenomena and the entangled material practices of knowing and becoming. Phenomena, according to my agential realist account, are neither individual entities nor mental impressions, but entangled material agencies…*experimenting and theorizing are dynamic practices that play a constitutive role in the production of objects and subjects and matter and meaning***.** As I will explain, theorizing and experimenting are not about *intervening* (from outside) but about *intra-acting* from within, and as part of, the phenomena produced. (Barad, 2007, p. 56) (author's original italicized emphasis)

Barad calls for a critical engagement in the theoretical pre-concepts of the practice to change the position of a dominant theory, wherein objective idealism reigns supreme. A re-consideration of positionality supplants the human-centric presence, and opens a space for a discursive engagement of phenomena, respectful of its multiple non-human states. The *Intra-actions* that ensue are unique encounters between entities within phenomena in the field, in a state of becoming. Unlike interactions predicating a state in which entities already possess an established status prior to an event, Barad distinguishes intra-actions as non-hierarchical and dynamic. The practice of Barad's agential realism is a performative instantiation of dynamic theoretical matter, having material effects in the exchange of intra-actions observed and partaking inside the events within the field. In relation to the project, the field is the spatial prototype from which observers will become active participants. The spatial prototype will examine what agential capacity can be determined within a public space, and how phenomena of space-time is revealed in its variant modalities, actively engaged in agential becomings that have tangible results in individual states – the private space.

Niels Bohr's principle of complementarity is an inseparable approach to a philosophy-science, an inclusive philosophy of difference. Neither rejecting nor negating variance, Bohr's framework encompasses a greater network of possibilities outside systemic practices valuated in the ability to perform experiments with reproducible results. In fact, complementarity considers the differentiation of quantum actions to be a part of a rigorous process, accounting for the variant characteristics phenomena demonstrates through different lenses of apparatus. Bohr's elucidation of complementarity was developed in response to his colleague's theory of indeterminacies, informally referred to as the Uncertainty principle. Werner Heisenberg introduced the Uncertainty Principle in Copenhagen, describing the variation of results when measuring the effects of light in two experiments: observing light as (photon) particles, and light

as waves. This thought experiment was later expanded upon by Bohr, known as the “double-slit experiment”, demonstrating the irreconcilable nature of light which was dependent upon the apparatus used to construct and observe the events. (Plotnitsky, 2010, p. 49) (Barad, 2007, pp. 266-267) The results were clear: two states of an observed event cannot be reconciled or measured in accordance to the same event, as “the more precisely the position (momentum) of a particle is given, the less precisely can one say what its momentum (position) is.” (Faye, 2008) If science was predicated upon absolute measures of defined entities, it failed to determine the constitution of matter in its atomic, indivisible scale, and therefore questioned the veracity of any determined value assigned to the material world. Yet Bohr did not think this was a finite resolution, nor a flawed state intrinsic to the scientific field. In philosophic terms, Bohr questions the nature of indeterminacies, suggesting, rather, a complementarity of quanta offers a greater understanding of the object observed. If the position and momentum of a photon (light) cannot be measured simultaneously, perhaps there is more than one value that can be ascribed to phenomena, and this value is entangled in the apparatus of the observer. From this theory of observation, Bohr reconsiders how the constructs of knowledge are affected, if not pre-determined by the position of the observer intrinsically tied to the events in action.

The complementarity principle operates within the structure of the apparatus, eschewing objectivist idealism, or absolute properties independent from contextual relations, for it is inescapable to remove the observer from the experiment. In the same way, the observer as designer develops research to the measure of the human scale of knowing. With this in mind, in the practice of *design complementarity*, the methods undertaken to explore conditions of phenomena cannot be assumed to be definitive and finite in form, but can be leveraged to offer variants of a space field for the potential of agency. Agency is determined by a co-development of relationships between subjects and objects, and is an interdependent intra-active exchange,

building upon an agential realist practice of accepting matter as an equalizing medium, human and non-human alike. Methods of complementarity research may offer insights beyond the scope of a finite research question (thus a *what if…* question ensues), and invites an interdisciplinary process to cross-examine spatial designs in the rigor of the particle-wave double-slit analysis.

I am using the term design complementarity as a mode of practice. As a foundation, it could be derived from a practice of epistemological plurality (Miller, Baird, Littlefield, Kofinas, Chapin, Redman, 2008). For the purposes of this research, design complementarity is a continuous open-ended practice engaging different programs outside of a binary identity, of the intent to diffract absolute conditions of spatial ideals, and to consider the phenomena of space-time as a material agent of manifold states in architectural theory.

In a 16-page manuscript, entitled *Extra Muros: Einleitung in die Theorie des freien Hauses* (Extra Muros: an Introduction to the Theory of the Free House), Siegfried Ebeling introduces the *freien Raum* (free space), a pre-condition to architecture free from predicated form, shaped by active forces present within each body and building, relational and conditional to the *Kraftfeld* (field of force) we encounter:

> *„*(Es gibt keinen) dogmatischen Maßstab dafür, was als Architektur anzusehen ist und was außerhalb ihrer Linie liegt. Entscheidend allein ist – es klingt paradox – das Maß des Nichtmeßbaren, das aus einem Menschen oder einem Bau auf uns zukommt und dessen inneres Gesetz wir anerkennen müssen....*"* (Ebeling, 1947, p. 2)

> (There is no) …dogmatic benchmark for, what is to be considered as architecture and what lies outside its line. What only matters – it sounds paradoxical – is the measure of the immeasurable, which approaches us coming out of a human or a building, and its intrinsic principle is what we have to acknowledge….(my interpretation of the translated passage)

In this passage, Ebeling conflates the uncertainty of architectural practice and boundaries of space, stating there is no dogmatic benchmark (*dogmatischen Maßstab*) to delineate a line from which it operates within, and what lies beyond. "What only matters is…" (Entscheidend allein ist…) the paradox of the immeasurable (*Nichtmeßbaren*), the unquantifiable elements generating the relationship within the field of actions, the *Kraftfeld*. It is here we give pause to consider the next line in this passage, where Ebeling engenders objects and subjects in equivalence, from whence the immeasurable attributes originate and develop. Whether it is a human body or structural building, each and every particle of matter has an intrinsic quality of autonomy surpassing difference into ontological parity: the building "approaches us" [7] (*zukommt*) in the same manner we approach it. Ebeling's architecture is not exclusive to constructed inanimate things: the fabric we share with the inanimate suggests the corporeal world does not end with the body, therefore architecture as a discipline of structure is incomplete, if solely divided by exterior program and form. Interacting entities acknowledge and bring forth their prior state of being, predisposed to a positionality in the causal event relationship, precluding new trajectories that might develop outside of mutual binary definition. If for example an event brings together a building and a body, the building is measured as a static entity; it is therefore a foregone conclusion the body in motion is moving toward it, if observed from a human body-centric lens. Ebeling however considers the probability of cosmological and atomic connections a building possesses – radiation, light photons, atomic material effects yet to be observed. The building is

[7] *the object in the text is not passive, rather active. A fundamental shift in assigning autonomy away from the human experience, agency is linguistically engendered to things, objects, buildings and space outside of anthropocentric reality. In other words, objects can be subjects in Ebeling's original German text, and can possess active qualities: *we arrive at the building* becomes *the building welcomes us.* In contemporary theories of new materialism and agential realism (Barad), actor-network theory (Latour), and affordances in environmental psychology (Gibson), non-human subjects and objects equally have the capacity to actively engage in the field of action we are embedded within. Objects exist with intrinsic characteristics upon our perceiving them, uniquely dynamic in each relational encounter.

part of the *Kraftfeld*, in constant motion, projecting itself toward the body as it "approaches us" in pre-cognitive packets of information and matter. Therefore, Ebeling's concept suggests the building is an autonomous entity with forces of its own within the *freien Raum* coming to greet a body even before cognitive processes acknowledge its status. The intra-action of energy between the building and the body have properties exchanging affect and residual effect: the dividing substrate of space between, is transformed into a uniquely direct interface of experiential space.

The concept of *freien Raum* is of significance to the spatial condition in architecture, for it considers space as a quantum field wherein all entities have a presence, in agential potentiality. The *freien Raum* inverts the modernist ideal of anthropometric design made to the measure of human dominance, and Ebeling all but names the discoveries of quantum theory in *Extra Muros* having influenced his *naturphilosophisch* approach: he describes an awakening of scientific discoveries in the 20th century having changed the comprehension of physical relations in the *freien Raum* field and the world. (Ebeling, 1947, p. 2). Thus, in the purview of the research, the *freien Raum* is a proto-performative concept applied to the making of a spatial prototype that can explore the field of space as an active condition. The project will explore research-creation methods offering an intra-active exchange between humans and objects in space: a continuity and connection of matter recurring in the *kraftfeld*. Bohr's entanglement of subject and object is invoked, whereby the nature of objects observed are reciprocally affected by the observer. The observers in the design will be the participants in a feedback loop of intra-actions. Actions are discrete *and* connected, enabling intra-active forms of relations in space to develop in kind.

In summary, each assumed position of the theorists at hand help to inform the field of research, and provides a foundation from which a spatial apparatus can be used to observe unique relations in development (Barad calls this *relata* - to be expanded in section 02.20), in turn

creating a phenomenological inquiry into the experiential dimension of space-time. Parallel concepts between the architectural field and quantum physics draws from the shared point of spatial relationships entangled in quantum observation practices. Ebeling's publications suggest he was highly attuned to the contemporary practices of theoretical physics, and sought to reconcile material application with quantum discoveries.[8] There is no evidence to suggest Ebeling had a direct relationship to Bohr's complementarity principle, however there are similarities in the way both theorists challenge the epistemological structure of their respective fields at a time when architecture and science were dramatically undergoing a change from classic foundations on spatial origin and practice. Ebeling displaces the architect as the central nucleus of design: "we should not make architecture more important than it actually is. We should not affix to it a seal of eternity", (Ebeling, 1926, p. 18) contrary to the climate of modern manifestos in the spirit of Le Corbusier's 1923 *Vers Une Architecture* (LeCorbusier, 2007), subordinating architectural materiality, supplanted by immeasurable relational phenomena as the primary design element, as early as 1926 (Ebeling, 1926). Bohr replaces uncertainty with the complementarity principle in 1927 (Plotnitsky, 2010), altering the objectivity of scientific reason as an entangled field influenced by human intervention, suggesting the full comprehension of phenomena is outside the spectrum of the human scope. Barad expands on Bohr's entanglements in a philosophical return to the indeterminacy relations, illustrating the diffractive and heterogeneous potential such relations may contain outside of the human condition. Barad presents matter as having real consequences in the linguistic and social genetics of meaning-making, offering an overhaul of classic methods of inquiry through agential realist practices to demonstrate how multiple realities, simultaneous and discrete, can coexist in complementarity. In terms of an architectural

[8] Ebeling proposed an autonomous house made of steel utilizing environmental processes as a means of generating a sustainable environment with cosmic quantum energy – the "all-metal circular house". Many comparisons were made to Buckminster Fuller's Dymaxion house presented a few years earlier. *Membrane and Ecological Architecture – Scheiffele, p.VIII*

intervention, each agential cut produced by every observer / inhabitant of space is a development of discursive practices untethered from a singular architectural vision. The program of a space therefore has the potential to be developed through the site conditions and the inhabitants, relative to the time-space connections brought forth by each entity in the design apparatus.

00.60 Parameters

The theoretical premise of this project explores quantum spatial relations, often referring to classical theories that may be defined as a Newtonian principle of an absolute time independent from space. The quantum indeterminacy relation of position and momentum is also a contrast to a Cartesian stratification, prevalent in architectural constructs. The quantum theories put forth are intended to intersect both classic physics and traditional architectural foundations, as a means to contextualize the research-creation components in theory and practice. The project owes much to Newtonian and Cartesian thinking, but will focus on the scope of non-classical theory from the 20th century onward.

An interview process is included as a small sampling of first-person accounts during the implementation of a design prototype, or proof of concept. The intent of the research and the interview questions have been approved by an ethics review board facilitated by the academic institution prior to the set-up of the prototype. Accounts of eight interviews in this paper will be limited, but will be used to gain insights and to highlight experiential affects. Quantitative analysis would be ideal for future extensions.

A text written by Siegfried Ebeling in 1947 is currently being translated from German to English for this study. Some of the passages and references made are interpretations of preliminary translations. The translation process is on-going at the time of writing.

01 Methodology

01.10 Methodology: Creative Practice – Practice-based Research

In 2007, design scholars Michael A.R. Biggs and Daniela Büchler addressed the perilous state of practice-based research by confronting issues of studio practice positioned as a subset category when applied to the accepted rigors of scholarly research (Biggs+Büchler, 2007). The argument revealed challenges to the systems of qualification regarding the deficit of design research through funded agencies, suggesting qualified research is generally accepted if and when it is supported by scholastic traditions of rigor (Wood, 2000). The authors concluded design as a process is inherently rigorous, deserving of its own taxonomy of research untethered from formal fields of research externally applied to design practice, and not as a subset of a traditional field (e.g. scientific practice). This is not to suggest design is independent from critical analysis or peer review, but an emphasis on the methods used in the process is given precedence:

> If we apply this [testing the structure and appropriate use of method] to practice-based research, we would contend that, while rigorous practical competencies are important, they are not the most important aspect to be judged. What the practitioner has to demonstrate is the validity of a particular method to deliver the research solution. The peers must judge the merit of this solution, not as a creative contribution but as an answer to a question. (Biggs+Büchler, 2007, p. 68)

(Practice-based) research, then, *is* a valid practice, instantiated by a qualitative assessment of the methods used to derive at a design resolution. No singular formula or method will procure design plurality. Unique methods are developed and aligned for the design process to assess qualities of

variable and subjective affect, experience, perception, cognition, awareness of presence, social inclusion, and culture: spatial experiences more elusive to quantify than evaluations deployed in the academic studio, and less so in the marketplace, e.g. function, efficiency, cost effectiveness, through-put, circulation, health, safety and welfare. These latter evaluative measures are arguably the parameters of success for the client, an industry standard that comes in the form of a brief. Instead, this design practice involves the conceptualization of imagined worlds proposed through projected contexts of social, environmental, and temporal conditions of *what might be,* sometimes requiring methods of inquiry that do not lead toward a concept of incontrovertible proof. Elements are situated in an experimental proposal outside of the brief, seeking insights in the realm of discovery exterior to a navigable territory, informed by an interiority of sensations and experience. An element of rigor in design practice is to critically reflect on the process through documentation to extend into the *exterior* unknown. As a practice, then, Phase I of the research will be a critical analysis of external studies applied in a comparative manner. Phase II will focus primarily on insights[9] developed from methods of design experimentation, observation, and qualitative analysis of a sample study cross-examining subjective experiences through the design prototype apparatus. The designer-as-observer is intrinsically tied to the experiment, affecting the inquiry process as it develops, entangled in the performative space.

01.11 Methodology: Quantifiable practice: Principle vs Constructive

The goal of incorporating quantum space in the process of design is to investigate iterative and discursive practices in the development of new spatial constructs that no longer adhere to binary states of interiority and exteriority. To paraphrase Barad, the design process is an open-ended

[9] Biggs Büchler considers insights to be, in certain conditions, a "subject-dependent internal insight rather than an external, evidence-based assessment", but qualifies the method in (design) practice as a rigorous process, resulting in a qualitative and legitimized category of research (68).

apparatus, an impossibility of closure in its inquiry of boundary and meaning. Thus, the research seeks to assemble a question suitable for its intra-active development. It seeks to ask such an open-ended question, initiated from an internal view of the process, like the observer as the active participant. The format of the research question is revisited: What if?

The normative approach to a thesis proposal is in keeping with a constructive theory founded in a question: *If* a quantum time-space is combined with architecture, *then* the classical orders of interior and exterior space will require new methods of a practice to determine the spatial language of quantum design. Or, *if* digital environments could connect to a user's biorhythmic feedback in realtime, *then* environments could be beneficial to the health and welfare of its inhabitants. If…then… seeks to affirm the hypothesis structure based on assertions of a pre-existing foundation. A constructive theory attempts to build the mechanics behind the outcome of an event to qualify the resultant nature of phenomena. Albert Einstein reflected upon this approach, suggesting that a *principle* theory approach to quantum physics could be considered a more philosophical and intrinsically sound method of investigation, limited to a narrower set of conditions:

> We can distinguish various kinds of theories in physics. Most of them are constructive. They attempt to build up a picture of the more complex phenomena out of the materials of a relatively simple formal scheme from which they start out[…].
>
> Along with this most important class of theories there exists a second, which I will call 'principle-theories.' These employ the analytic, not synthetic, method. The elements which form their basis and starting-point are not hypothetically constructed but empirically discovered ones, general characteristics of natural processes, principles that give rise to mathematically formulated criteria which the separate processes or the theoretical representations of them have to satisfy. (Einstein, 1954, 1982 reprint, p. 228)

Einstein is reflecting on a philosophy-science that constructs laws upon itself in the making. This is what he refers to as an empirically derived principle, from which the discovery develops from an intrinsic character or value and expands, in what he refers to as natural processes. It is not synthetic, nor hypothetical: the principle derives from an interiority, from which a research question can be informed. In this way, the hypothesis method of applying specific parameters (if, then) to the investigation constitutes an external constructive theory substantiated by quantifiable proof. As we have already elaborated, quantifiable proof is an elusive paradox in quantum physics. In fact, it would be a contestable objective in the design research, negating other possibilities of spatial agency and plurality, in its impossibility of closure. A further analysis of a principle theory demonstrates that its generative nature is "…to build up the theory from such (empirical) principles. That is, one aims to show how these empirical principles provide sufficient conditions for the introduction of further theoretical concepts and structure." (Hilgevoord, 2014, p. 2.4) This last point is of utmost importance, for it considers the larger ecology of inquiry beyond the singular event.

We then return to the research question inverted to an open-ended process of *what if*:

> **What if** architecture were no longer 3D or 2D, mass or surface, object or space? What if space were no longer envisioned as an abstract continuum but as a material extension of the human skin, an elastic medium uniting the body with the walls of the building instead of creating a barrier between the two? What if this epidermic space then projected beyond the edges of an individual edifice, creating a network with other spatial organisms within an urban system? And what if this network extended beyond the limits of a city or a nation, spanning across the continents to create a global membrane? (Papapetros, 2010, p. xiii)

Architectural researcher Spyros Papapetros opens the foreword to a translated reprint of Ebeling's *Raum als Membran*, a precursor to *Extra Muros*, written in 1926. Papapetros is theorizing Ebeling's premise of a spatial interface identified as a membrane, and in it can be

found the beginnings of Ebeling's theory of a cosmological space-matter. In the speculative proposition, Papapetros instigates an imagined future to be materialized without material properties, without predetermined quantitative goals fulfilling the conditions of a constructive theory foundation. In the spirit of Ebeling's passages, Papapetros calls for an exploration of a body-space that has yet to be developed, exploring phenomena within an apparatus devoid of an end goal. Ebeling considers this methodology as a philosophical means to explore phenomena outside our grasp of knowledge from an interiority of discovery, but we can only accomplish this through a principle theory approach, discovering the natural processes through the exploration:

> Seit Nietzsche wissen wir, daß man von vielem noch nicht weiß, was etwas ist, d.h. zu seinem Begriff gehört, es sei denn, man schafft ihm einen Inhalt. Und es gehört unverlierbar zum Leben, daß es dauernd schafft, unterbricht, abbricht, träge dahinfließt, ruht, um von neuem zu Kraft anzuschwellen und Neues zu setzen. Dadurch gibt es der Erde ihren Sinn. (Ebeling 1947:2)

> Since Nietzsche, we have been aware of the existence of much that we do not know, not knowing what things are until we create a content for it. It is always a part of life that it constantly creates, interrupts, cuts, slowly flows, rests, to create new strength and something new. Through this (life), it gives sense to the Earth. (my interpretation based on the translation)

In this passage, Ebeling discusses the process of design in the context of phenomena beyond our understanding. We cannot know what questions to ask until we delve into the fabric of creation, and through the creation process, can we truly offer new insights on our being within the world, as it "creates, interrupts, cuts, slowly flows, rests, to create something new" (*schafft, unterbricht, abbricht, träge dahinfließt, ruht, um von neuem zu Kraft anzuschwellen und Neues zu setzen*), an invitation to explore beyond the constructs of human perception with principle theory methods of design practice. We may observe, predict, and formulate trajectories of phenomena, but never truly understand its intrinsic nature beyond our observation in our best capacity relating to it. But we can acknowledge its potential as an active agent in the *freien Raum* (free space). Inspired

by Ebeling's *Raum als Membran*, the spatial prototype is a discursive development of mutable boundaries to be defined in the experiment, between the participant and the extents of the program both material and immaterial, to ask the questions that we could only think of once in the presence of its creation.

01.12 Methodology: Ethnography – Observations and Interviews

What is the lived experience of space? The questions inspiring this project seek to understand the nature of this embodied experience. In order to expand on the reflective method of internal insights during the design process, eight participants were asked questions about their encounters with the designed environment immediately after the experience, with little-to-no information about the design intent provided. Interviews were consensually recorded, and observations are then made from their feedback. As discussed earlier, the subjective accounts of an experience are unique, and it is not necessary to summarize the survey of experiences into a law of averages. What is of interest are the anomalies in the responses – the points at which experiences diverge and create a wider spectrum of experiential observations. The divergent points are then based on an objective of design complementarity, through which an apparatus actively seeks the variant outcomes of a relationship toward the phenomenological experience, which may be contrary to design values seeking uniformity in homogeneous experiences, such that archetypes like a cathedral would predetermine (in this case, it was important to consider a design that did not immediately become recognizable as a typology of space). Differences and dynamic hierarchies present in the active field – the *Kraftfeld* – are unique to each subject / object / environment relationship. Design complementarity, then, enables a space to be divergent, dynamic, and recombinant in relational ways. Participants as observers are uniquely cognisant of their relational dynamic within the space, as their own matter in the time-space

phenomena apparatus is entangled in the material and immaterial presence of space they intra-act within. The positionality of the ethnographer is intertwined with the intstruments of observation in the experiment, just as Bohr had accounted for in the subject-object dichotomy of the scientific apparatus in the lab.

01.20 Limitations / Scope

This is a project of qualitative analysis with a limited sample of participants, which precludes quantitative findings. A small sample of participants are asked to respond to the event-experience, limited to 10 questions. Limitations in the time of the event, quantity of the samples, variations in the design, and technological constraints are taken into consideration as parameters of the interactive design. The specificity of a hybrid digital / physical space focuses on the unique qualities the site offers, which, in principle theory, offer a framework to employ an analytic approach over a synthetic construct of quantifiable data supporting the argument. Because of the time, location, accessibility, and limited conditions of the apparatus availability, the findings in the process are not intended to be reproducible, nor conclusive. Site specificity considers the intimate details of the program and design, tailored to its novel orchestration. If the project were to be placed in another site, a different sample would potentially render new findings outside of the current report, without the stigma of undermining the intent of the project.
Complementarity, as we will discuss in section 02.20, acknowledges entities (findings of observed phenomena) to be discrete / mutually exclusive, yet interconnected; and sometimes with the appearance of demonstrating both states, simultaneously.

01.30 Contribution to the Discipline

As designers of our own environments, we are continually engaged in the process of controlling conditions outside of our own body and mind. Experiences become the interior frame of reference we differentiate from exterior conditions. Such conditions, sometimes alien and unfamiliar when one finds oneself in a new place, are at once engendered in “objective” Cartesian projections to define and fix the environment into a known coordinate, confining its position, and isolating it until relational coordinates are collected. Interior experiences are reconciled with the exterior conditions, which, over time become a part of our interior expanded catalogue in the Cartesian territorial system of knowledge. My interest in the question of space, however, lies in the phenomena of experience inside and outside, denaturalizing space from Euclidian geometry. This binding element of the experience underpinned with the absolute cartographic method of territorialization figures deep within the structure of spatial practices and perpetuates a self-generative validation of space, pushing and pulling linear, planar, and volumetric elements codified in materiality, quantified in standard systems of measurement. But these are all learned and accepted practices of quantifiable space, measured in coordinates confined to its dimensional topography. Yet this practice is a subjugation of dominance in form and in subject matter, as the former predicates the language of what we assign to its meaning. Through quantum physics – rather, through quantum *design* – space enfolds the experience of the event with dynamic processes of the body and objects, with architecture and communication, and with perceptions of phenomena and inherited systems of spatial language. The contributions this study aims to offer to the discipline are an alternate means in which design processes can be developed to offer quantifiable and qualitative methods of spatial practice, starting with an interdisciplinary approach as a point of entry toward a multiplicitous field of design. A dismantling of classical standards based on a singular disciplinary practice

enables designers to critically engage in the question of spatial programming for a diasporic society, breaking down pre-concepts, offering performative spaces both private and public to be re-conceived. Through intra-active events, space becomes alive again with the potential for agential change activated beyond the symbolic representation of architecture.

01.40 Conclusion

This thesis argues against a constructive theory approach, against a definitive conclusion. Rather, much like the on-going history that is central to the material to be discussed, decisive moments in theoretical physics resurface in current debates about the dis/positioning of our anthropocentric world-view, revealing a marked shift in the framework of a constructed reality based on Newtonian principles of absolute time and space, and in Cartesian definition. A space of unspecified territory opens up without conclusive parameters, in the quantum configurings of a space-time confounding absolute positioning and trajectories. This territory of unboundaries is threaded with non-linear connections from practice to critical theory, yet the connections are of the same space-time fabric. Perhaps the best way to describe the principle method of approaching the project is to consider the points of investigation as a dynamic field, each entity all-pervasive, interconnected, and mutually independent. The viewpoints between architecture, phenomena, quantum physics and agential materialism are discrete and simultaneously charged in a *field of action*….

02 Literature & Practice

02.10 Introduction

Architects, artists and designers are implicitly exploring the effects of *being* within a quantum state, employing non-classical methodology from which I intend to show how Barad, Bohr and Ebeling have influenced their respective fields. In Ebeling, Bohr and Barad there can be found a common form of resistance to tradition in their own field. The fixed foundations of science, art, space and design have never been more mutable, and in each of their respective disciplines is a desire for freedom from an immanent unifying theory delimiting all pursuits of an inherently diverse ecology of creative practices. These points of resistance offer a point of entry into the transformative capacity of matter in a quantum frame of reference. We will first review the position that each theorist established in respect to the climate of their field, which then leads us to consider the climate of the design field by surveying contemporary practitioners who employ interdisciplinary practices. In the Comparative analysis section 02.30, I introduce three current practitioners – Rafael Lozano-Hemmer, Ryoji Ikeda and Philippe Rahm (Décosterd + Rahm), to offer a context to my research-creation design in Phase II. The following relations of virtual and physical interactions, transformations of discrete (private) and connected (public) bodies, and spatial phenomena will be cross-examined in non-classical terms of quantum physics events, as such time may not be considered independent from space, and the space-time prototype is a subject-object dependent relationship. Free from the program of spatial function, the design of a spatial experience in this project will not be prescribed in a performance-based criteria of an archetypal function of space, nor will the materialization of architecture define exterior and interior relations. In contrast, we may explore the experience of space through different intra-actions which give architecture less prominence as a discipline of a material space-making process, and more-so as a medium of communication synthesizing on-going generative

relationships. We will then consider how the learnings from these points applied to the design prototype have affected the process / methodology, architectural practice and theory, and the importance of a site as it related to public and private realms of inhabitation.

02.20 Comparative analysis: Historical and Contemporary literature review

Ebeling / Bohr / Barad

02.21 Ebeling

The design research begins with an inquiry into the writings of an enigmatic architectural theorist and poetic philosopher who has become central to the theory and the research-creation prototype. Siegfried Ebeling, a one-time Bauhaus student, wrote a then little-known essay on the consideration of space as an organic transmitting medium, a membrane. *Raum als Membran* published in Germany 1926 is a philosophical and cosmological text (Scheiffele, 2010, p. i), invoking phenomenology, bio-architecture, and metaphysics, running counter to the pragmatism Walter Gropius inscribed in the Bauhaus school, as described by Spyros Papapetros in his foreword to the English reprint:

> …Ebeling's Space as Membrane reads as a point-by-point attack on Gropius's politics and more specifically his 'one-sided' and 'rationalistic' attitude towards design, standardisation and prefabrication in terms of mass production, the economic utilisation of space and the expansion of public housing. (Papapetros, 2010, p. xiv)

Very little of Ebeling's work was considered in his lifetime: Ebeling was not as well-known in comparison to his prolific Bauhaus alumni Johannes Itten, Paul Klee, his mentor Wassily Kandinsky, and Ludwig Mis van der Rohe, yet recent readings into the influential Bauhaus figures during the 1920s reveal Ebeling's concepts had a deeper influence in the practice of his contemporaries than his dormant archives suggest. In Fritz Neumeyer's monograph *The Artless*

Word, a look into Ludwig Mies van der Rohe's letters and manuscripts behind the work, he extensively cites Ebeling's influence on the ground-breaking open architectonics van der Rohe demonstrated with the German Pavilion in Barcelona 1929, a short time after *Raum als Membran* was published (Neumeyer, 1991, pp. 171-173).[10] The spirit of Ebeling's *freien Raum* (Free-space) had transformed van der Rohe's plans into an endless open vessel, demonstrated in the undefined volumes created by permeable fluid space. (Giedion, 2008, p. 591) Van der Rohe considered the possibilities new materials and building technology could afford, expressing architecture free and independent from a program previously dependent on infrastructure characterizing the function, coupled with the desire to dissolve the architectural membrane delineating the exterior and interior divide. A new architecture decoupled from a formal program of function, walls served as permeable glass extensions of the outside, streamlined steel columns afforded expansive interior vistas, and air systems (HVAC) enabled continuity uninterrupted by acclimatized thresholds of fluid space. In further analysis of this text, Ebeling's *Space as Membrane* could be perceived as a post-Newtonian critique on the modern architectural practice that aspired to contain space in absolute universal geometry. Rather, Ebeling proposed space as a transitive force made apparent when the relationships of external and internal conditions were formed by – and became a part of – a membrane, a living extension of the body lacking vertices, transforming energy into a sustainable ecology of resources. As membrane, environmental space became an interface, in form and in mediating content.

When the *Space as Membrane* manuscript was translated to English in 2010 for the first time since its original publication in 1926, a direct lineage of heterogeneous space theory resonated in a pluralized embodiment promoted by Ebeling: space was less prescriptive, and increasingly active in synthesizing the environment with the body. Ebeling's thesis was guided toward a

[10] Neumeyer methodically lays out evidence of Mies' annotation in reference to Ebeling's work

proto-performative space of scalable action, further developing his mutable theories that eventually surpassed the building technology into the realm of subjective and cosmological phenomena. After abandoning the prescriptive sheet metal housing prototype demonstrated in *Raum als Membran,* Ebeling focused all his efforts on a transcendental meditation unencumbered by material representation. The form-giving Membrane was eventually surpassed by an ever-present potentiality of form, ever-evolving in relations pre- and post-existence into an expanded field of actions. The result was Ebeling's 1947 publication of *Extra Muros*. Ebeling's manifestos from the beginning were in sharp contrast to the form-follows-function credo the Bauhaus school was inscribing on a global scale. The significance of Ebeling's *naturphilosophisch* (Ebeling, 1947, p. intro. 1) text lies in its remarkable currency to concepts engaged in the question of space today. From quantum mechanics in thermodynamic energy, to a Kantian inquiry of material phenomena, Ebeling's last known published text - *Extra Muros- einleitung in die Theory des Freien Hauses* offers insights to heterogeneous relations and design agency outside of the requisite physical form in the architectural discipline. Ebeling was aware of the historical -transformations that were occurring simultaneously in architecture, philosophy and in science – a collective awakening he understood to be as natural and inevitable as the *freien Raum*, from which he based an interdisciplinary call-to-action:

> Da ist es nun gar nicht so zufällig, sondern hangt mit dem Erwachen eines neuen Raumgefühls eng zusammen, daß etwa seit der Jahrhundertwende die Freiraumwissenschaft mehr und mehr die Laboratoriumswissenchaft verdrängt und das Wissen selber eine wesentliche Erweiterung gerade nach der Seite der physikalischen Beziehungen des freien Raums in sich und in Wechselwirkung Erdboden erfahren hat.
>
> There is an uprising of a new sense of space at the turn of the century (1900s) during which the Freien Raum science replaced the scientific laboratory, and the knowledge experienced an expansion towards the physical relationships of the freien Raum within its field and the world. (Ebeling, 1947, p. 2) (my interpretation of the translation)

In this passage, Ebeling is referring to an 'awakening' (Erwachen), much like an uprising of a new sense of space that occurred in the science laboratories at the turn of the twentieth century, whereupon the *freien Raums* science expanded the field of knowledge into the physical world. In this instance, I hypothesize *freien Raums* refers to the quantum physics field (initiated by Einstein's paper on the Special Theory of Relativity in 1905[11] (Bohm, 1996)).

In a constant field generating between the intimate space of interiority, to the cosmic energy of the sun and stars, *Extra Muros* ventured beyond the walls into a quantum field of interconnected matter. A prescient forecast into the field of information systems[12] that followed in the decades after *Extra Muros* was written, Ebeling's treatise forewarned of the consequences should architecture follow in the path of a scientific discipline without an ethos. He opened the text with an interdisciplinary pairing of science and *naturphilosophisch*, an alloyed methodology working toward a comprehensive architecture, two requisite forces that he claimed were necessary in society because "democracy requires both" (Ebeling, 1947, p. 1). It is evident Ebeling was concerned that architecture as a total science was one without a conscience. The *naturphilosophisch* mindset was then an applied philosophy borne from an ecocentric position with the world, beyond human constructs, in order to realign an ethical architecture practice in harmony with cosmic life-forces. In a final turn, *Extra Muros* was Ebeling's last declaration toward a method of practice, and in it he found closure in the *freien Raum* that shared similar traits to Niels Bohr's philosophy-science. He expanded on the scientific logic architecture

[11] Einstein's paper on the Special Theory of Relativity presented in 1905 was influential in the disruption of Newtonian time independent from space: "…the general attitude…()…was that there is an *absolute space*, i.e. a space which exists in itself, as if it were a substance, with basic properties and qualities that are not dependent on its relationship to anything else whatsoever (e.g., the matter that is in this space)." (Bohm 1996:6)

[12] Systems of communication – first overlaid as a new strata of urban infrastructure, such as telecommunications, fibre-optic cables, physically embedded into materials of the city – permeated boundaries in ways that Georg Simmel (Simmel, "The Metropolis and Mental Life" (1903) IN The Sociology of Georg Simmel, 1950), Orit Halpern, William J Mitchell, Marcos Novak, Marshall McLuhan and others have observed. Yet the adverse effects of connected systems, much like McLuhan's central nervous system metaphor, opens unmitigated access to and from repositories of information of the private citizen.

necessitated, equally paired with the creative need to explore a wholeness, a Gestalt of the idea that pre-existed in the *freien Raum* guided by the forces of nature; a human place within the whole is a part of, but not essential to its existence. Ebeling's *naturphilosophisch* was at odds with modern machinist aesthetics, who concerned themselves with the physical properties. He suggested that these "technicians who were concerned with the physical certainty of the Earth's landscape only engaged with measurable forces proven and measured through verifiable experiments." (Ebeling, 1947, p. 2) In essence, the measured forces only proved the technical prowess of modern technology, lacking the "unlimited extension of creative power achievable for a human being" (Ebeling, 1947, p.2) which he summarized as freedom. Ebeling presented a way of navigating through a new age of modernity that brought about exacting geometries of technical precision in the form of what Le Corbusier called *machines for living in*.[13] This led Ebeling to an informed *naturphilosophisch* model as a way of guiding the rational and creative potential of human endeavors during the rise of modernist techniques, acknowledging and accepting greater forces less quantifiable, and more qualitative. This is what Ebeling considers as he forges a natural-philosophy for architecture, incorporating the free-space of a quantum field, unleashing a new architecture built *Über Steine hinaus* – beyond stones. (Ebeling, 1947, p. 2)

02.22 Bohr

Ebeling rose to the occasion by challenging the Bauhaus technical school of form and function with an impassioned plea toward a rational and ecological respect for all matter in its whole unquantifiable form. In a similar confrontation of prevailing thought, Bohr's complementarity

[13] "A house is a machine for living in. Baths, sun, hot water, cold water, controlled temperature, food conservation, hygiene, beauty through proportion". Le Corbusier considered all things to aspire to a machinist aesthetic, in particular mass-production housing, from which efficiencies of daily living could be maximized through template architecture. *Toward an Architecture,* 1928 translation version, John Goodman trans. 2007 Getty Research Institute publishers, p.151

principle embraced an existence of irreconcilable quantities, stemming from the irreconcilable impossibility of knowing the position and momentum of light simultaneously. Niels Bohr, a colleague and mentor of the uncertainty principle physicist Werner Heisenberg, challenged the epistemological break-down Heisenberg brought to the world of the scientific inquiry. Bohr introduced a phenomenological critique on the limits of human observation, rejecting the totality of a positivist science based on objective observations. Rather, Bohr postulated that there may very well be multiple results dependent upon specific dynamics between subject and object, and the apparatus used to observe the evidence creates an intrinsic dynamic unique to its relation. In response to Heisenberg's "Indeterminacy relations" (Hilgevoord, "The Uncertainty Principle", 2006, p. 2.4), Bohr developed a Complementarity principle theory, wherein each instance of interaction observed, unique relationships of qualitative difference (and quantitative variance) are formed. Thus, the practice of an exacting field of physics cannot be applied to a quantum phenomena of variability. It follows, then, that such a precise science cannot be deterministic in nature, when the observed nature of phenomena is not quantifiable. Like Ebeling, Bohr is postulating an expansive field of quantum phenomena (Plotnitsky, 2010, p. 9) beyond what can be observed. The apparatus we use to observe the field is specific to the conditions of interaction, suggesting multiple *conditions of the possible* will occur if phenomena are observed in different ways. For the first time in the ontology of physics, the entanglements of the observed and the observer are considered as working agents intrinsically active in the extended matter of the event. In other words, by way of observation, physics is not separate from the physicist, and objective science is a reciprocal dialogue of cause-and-effect to effect-and-cause without a pre-determined hierarchy. This led Bohr (Plotnitsky, 2010, p. 194) to declare three postulates of the Complementarity principle:

(a) a mutual exclusivity of certain phenomena, entities, or conceptions

…which declares independent objects and concepts to be independent;

(b) yet the possibility of applying each one of them separately at any given point

…yet can be called upon to interact, as they may continue to be independently operational;

(c) and the necessity of using all of them at different moments for a comprehensive account of the totality of phenomena that we must consider

…and the collective sets of observations, though different and irrational from relational sets, may provide a larger conceptual understanding of the nature of phenomena, as close as we can get to an understanding of a non-human *essence*.

Bohr acknowledged the human condition to be a part of the apparatus that affected the results of an immeasurable quantity. And if the scientific method was unable to discern any sort of consistent quantity of measure with the simplest entities of the material world, Bohr did not declare the world uncertain nor indeterminate, but suggested through a philosophic approach that the classic parameters of the deterministic scientific method was insufficient. Science therefore could not be objective, and classical rationale was inverted: the subjective relations within all human systems of knowledge were equally valid in infinite variables. Indeterminate values were varying sets of information of many possible outcomes. In other words, one possibility may not have precluded all other possible becomings. Many possibilities, variations, conditions, and values could be accepted as a greater frame of context in understanding an unknowable phenomenon. Each set of information resides in accordance, in complementarity, providing a greater insight to the wholeness of phenomena that only reveals a fracture of its essence through the observable lens of the apparatus. Perhaps we cannot know the larger scope of variables outside of the human condition. While Bohr did not contemplate this epistemological frontier, contemporary physicist Karen Barad does.

02.23 Barad

Barad expands on Bohr's complementarity principle and applies the fundamental tenets of quantum physics debate to the larger field of actionable consequences in physiological-social contexts. Matter is the core of material substance, but in Barad's view, matter is not fixed and neither are their relations – they are *relata* within relations. Relata are found in the process of forming relations through specific events in the transient material matter:

> Relations do not follow relata, but the other way around. Matter is neither fixed and given nor the mere end result of different processes. Matter is produced and productive, Generated and generative. Matter is agentive, not a fixed essence or property of things. (Barad, 2007, p. 136-137)

Relata therefore are the specific exchanges that occur between entities, in development. It is a performative action, formed by the parameters each relational instance mutually defines. Relata have the ability to transform space into a meaningful contextual relation, self-governed, self-defined. If we were to reconsider the inherent properties of matter in motion, a fixed position of matter identified through a measurement is merely a representation of the object – even more-so in temporality – and less of a determined characteristic. Yet the identification of a fixed character once put into place becomes deterministic in relation to other objects and events, scaled to the linguistic and social spheres of human meaning-making. Thus, Barad considers how the relata within intra-actions can be mutually determined instead of having pre-assigned identities and hierarchy. She emphasizes how matter *does matter* even beyond the human sphere, as our world of potential agency depends on it, depends on how matter presents itself to us, and how we see / not see / feel it in its becoming.

Working alongside the body of posthuman theorists such as Donna Haraway[14], N. Katherine Hayles, and Rosi Braidotti, Barad positions the 'queering' of atomic particle phenomena outside of the Kantian phenomena / noumena binary: "…there are no determinately bounded or propertied entities existing 'behind' or as the causes of phenomena" (Barad, 2007, p. 138). The mechanics of the unknowable quanta are cast into a wider spectrum of non-classical relations beyond simple difference. This includes actions and identities of events yet to be conceived in the agential condition of *becoming* from which bodies, objects and affecting entities have an active positionality outside of our own understanding, decentralizing the human condition of knowing as a primary construct, permitting intra-actions to develop "from within, and as part of, the phenomena produced" once again (Barad, 2007, p. 56). The classical concepts originating from Protagoras' *Alētheia* wherein ''Of all things man is the measure, of the things that are that they are, and of the things that are not that they are not'' (Apfel, 2011, pp. 47-48) are obscured, if not altogether disembodied from the unit of systematized measure. And what of the environments measured to a unit without context? A new formation is required, one that reconsiders the absolute exterior / interior divide responding to multiple landscapes which they, too, are cast into the wider spectrum of non-classical relations requiring other methods of inquiry to investigate in depth, beyond surface. Barad is operating outside – yet within – the confines of a classic space expressed linguistically in absolute terms, in finite time and space, to disrupt the fundamental units of scientific measure that which the monistic structure of physics is built. It is not just unknowable quanta that is cast into the expanding non-classical spectrum, it is the heterogeneity of identities and meaningful spatial configurations working toward a condition of possible agency, a *diffraction* for all potential and as of yet unidentified quanta to

[14] Barad credits Haraway with her extension of the term Diffraction, a means of visualizing and revealing a greater spectrum of the nature of phenomena – Meeting the Universe Halfway – p29

create a place of fluid, and dynamic differentiation "...(which) does not actually entail a relation of absolute exteriority at all". (Barad, 2007, p. 93)

> Hence the diffractive methodology that I propose enables a critical rethinking of science and the social in their relationality. []…Like the diffraction patterns illuminating the indefinite nature of boundaries – displaying shadows in "light" regions and bright spots in "dark" regions – the relation of the social and the scientific is a relation of "exteriority within." (Barad, 2007, p. 93)

Barad continues: "This is not a static relationality but a doing—the en-actment of boundaries—that always entails constitutive exclusions and therefore requisite questions of accountability." (Barad, 2007, p. 135) Like Ebeling's prerequisite *naturphilosophisch* for a democratic society, Barad is concerned about an agential realism philosophy to navigate through material practices, having social impacts in material performativity, as material relations produce tangible effects. A diffractive differencing shows on the one hand how certain properties will come to light if the structures are revealed under certain conditions; the social implications embedded within the scientific field, integrated within the very atomic structure of matter. On the other hand, there is an array of infinite possibilities – colours, shades, tones, contrasts – that are present in the prismatic field; one's position and relation to the spectrum is subject to beholding any one or multiple sets of values, given the right circumstances for the *condition of possibility*: "Apparatuses are the conditions of possibility for determinate boundaries and properties of objects and meanings of embodied concepts within the phenomenon." (Barad, 2007, p. 143) Barad is extending beyond the representation of a democratic ideal – she is presenting evidence to demonstrate the ever-present connection of social responsibility to the real and theoretical structures of matter which in turn create indeterminate boundaries of the body and the body politic, and offers a means to denaturalize an engendered pre-concept of classical constructs. agency has the potential to develop in a dynamic hierarchy from object to subject, perhaps

because as Bohr suggests, we are indivisible from the "…close connection (that) exists between the failure of our forms of perception, which is founded on the impossibility of a strict separation of phenomena and means of observation, and the general limits of man's capacity to create concepts, which have their roots in our differentiation between subject and object." (Bohr cited in Plotnitsky, 2010, p. 230).

This approach of a social / science informs the structure of my design process to engage in the posthuman process, a process toward a performative design agency that accounts for the discrete actions within a field entangled in a synthesis of spatial becoming. Matter, material, and the processes of enacting relationships with material structures are to be conceptualized with the intent of actualizing tangible affects in the design prototype. Change is viscerally felt in the transformative nature of a spatial agency at work, which may be as simple as a relation to a reflective surface in an environment: how the surface reflects the body image, refracts light, distorts depth perception, or enacts a floor surface into an active tectonic plate – a material quality extends beyond its own presence, as our body matter becomes the space. The works by the following artists and designers demonstrate the underlying tension of agency and subjugation within environmental parameters, as they investigate new relationships revealed in non-classical design apparatus.

02.30 Comparative analysis: Practice: Hemmer / Ikeda / Rahm

02.31 Lozano-Hemmer

Delving into the apparatus of embodied digital space, Rafael Lozano-Hemmer is a multi-media arts designer who confronts the dichotomy of agency and control through digital presence. In the work *Zoom Pavilion* (Lozano-Hemmer, 2016), co-created with American Polish artist Krzysztof

Wodiczko, gallery visitors are subjected to 12 surveillance cameras transforming people into the contents of the space in projected images on the interior surface. Observers-turned participants, they are simultaneously scrutinized as objects under the control of the cameras because they are the panoptic overseer, being and seeing all at once (*figure 1.).*

figure 1. Zoom Pavilion 2016
"This piece emphasizes the temporary construction of connective space in relation to predatory technologies of detection and control." Statement from the artist's website, describing *Zoom Pavilion*, artist collaboration between Rafael Lozano Hemmer and Krzysztof Wodiczko. First showing, Mexico City, MUAC museum 2015. http://www.lozano-hemmer.com/zoom_pavilion.php Accessed November 11, 2016 Credits:Rafael Lozano-Hemmer, "Zoom Pavilion", 2016. Shown here: Art Basel Unlimited - Art Basel 47, Basel, Switzerland. Photo by: Antimodular Research

The multiple layers of observation and surveillance are inverted through a subversion of participants enacting a form of "sous-veillance" (Mann, 2013). Sous-veillance reflects the gaze of the security media as the surveilled subjects use personal mobile devices to record the actions and effects of the control system as a form of citizen journalism reclaiming the individual will through collective action. A reversal of oppressive forces is activated, whereby the individual

citizen destabilizes the hierarchy of the pervasive watchdog authority by mirroring and reporting abusive violations of power. A distribution of access to the sousveillant media re-calibrates the balance of agency, creating for the first time a mass media dialectic in the form of socially mediated network reporting. The gallery setting pre-empts the subject/object as a willing participant, but it does not undermine the intent of the media-as-interface relationship with embodied presence through the digital form, and the inhabited space. The panopticon thus is transformed into a dialogical apparatus, a typology of quantum architecture theorist Marcos Novak calls the *Pantopicon.*

> "I coin the word pantopicon, pan+topos, to describe the condition of being in all places at one time, as opposed to seeing all places from one place. The pantopicon can only be achieved through disembodiment, and so, though it too speaks of being, it is being via dis-integration, via subatomization of the consciousness, rather than by concentration or condensation" (Novak, 1999).

Novak speaks of inhabiting through disembodiment, a negation of the corporeal experience sublimated into the technological infrastructure. The fusing of mind and body with technology, an extension of posthumanist theory inspired from earlier prognostications of cyborg culture re-iterate definitions of boundary (Haraway, 1991, pp. 161-162). Further, the notion of the citizen embedded within the pantopico-presence introduces the empowerment of sousveillance ("watching from below" – Mann, 2013:19). Zoom Pavilion is an example that further abstracts the definition of design disciplines – the social affects intertwined with the science of matter – calling for a consideration of technology in mobile, media, information, geographic, and social parameters that are proliferating within the mediated forms of communication instantiated as spatial *relata* in a changing environment.

Lozano-Hemmer positions the body somewhere between the material and transmaterial communication of a disembodied presence (Whitelaw, 2012), digitized and recontextualized in

the material presence of space. For this reason, Lozano-Hemmer's exploration of the re-presented enactment of multi-dimensional time is referenced. The installation to be prototyped is an investigation of a re-presented self, asking the participant to consider what their own presence consists of, and where the boundaries of the body and space meet and end.

02.32 Ikeda

The presence of data, *ubiquitous* data is, as previously stated (00.31), an entity of material affect. Data informs our navigation systems, data quantifies perceptions through measured accounts, data reifies one's being and existence in relational measures. It asserts instinct, intuition, and sensation through absolute means of authoritative processes, sometimes perceiving invisible information, diffractive patterns of phenomena we hope will reveal knowledge about our world. Ryoji Ikeda, a data-visualization artist, works to reveal these patterns and present them as phenomena, simultaneously obscuring the meaning of the data content in trans-media format. Such formats as data projections, media screens, analog to digital morse-code machinery, surround sound acoustics and modern gallery surfaces are used to dissolve the quantitative certainty of data. The result is a complex orchestration of deconstructed binary forms in frequency and amplitude, black and white, language and semiotics, with an infinite array of patterns splayed into the spatial void and often overlaid on the body of observers. A complete immersion of recombined data is presented as audio-visual material in the environment, displacing the original authoritative content source by activating an interiority of experience in sensorial information. In Ikeda's exploration of quantum mechanics and computation, *Superposition (figure 2)* (Ikeda, 2012) transforms an audience-filled theatre into a transducer of sound and light, generated by instruments both material and immaterial (Lee, 2015). Ikeda positions the performance as an ontological study of data systems, testing the limits of human

comprehension as observers are within the apparatus of human-machine information being revealed in real time. The phrase “Information is not Knowledge” is stated in the work (Lee, 2015) and Joo Yun Lee’s critique considers the subjective nature of the quantum performance:

> Our realities consist of immense amounts of information and data, but not all of it is authorized or proven by the system of human knowledge and intelligence. Ikeda underscores that knowledge is only one way to understand our being and world, making information and data unbound by human perception and recognition "sensible." (Lee, 2015)

figure 2. Superposition, 2012. Screen capture of performance.
“Superposition is a project about the way we understand the reality of nature on an atomic scale and is inspired by the mathematical notions of quantum mechanics. Performers will appear in his piece for the first time, performing as operator/ conductor/ observer/ examiners. All the components on stage will be in a state of superposition; sound, visuals, physical phenomena, mathematical concepts, human behaviour and randomness - these will be constantly orchestrated and de-orchestrated simultaneously in a single performance piece.” – Excerpt from ryojiikeda.com Performers: Stephane Garin, Amélie Grould
http://www.ryojiikeda.com/project/superposition/

Lee considers the infinite ways of knowing outside of the *sensible* conclusions derived from human faculties. Sensing the world through human perception, then, encodes and decodes data from the source through to the interpretation, and reinforces the idea that the embodied experience of information is rendered for our constructs. Yet Lee’s interpretation also appears to

yield a reverence for data as a pure phenomenon, which deserves debate at greater length outside of this study. However, given the exacting method of executing data environments in Cartesian supremacy, Ikeda's symmetry underlies an authorization of control, limiting the audience to a role wherein random actions breaking outside of the grid aesthetic is removed to ensure data's sublime wholeness remains intact. Regardless of this point of view, knowledge is arguably greater than the sum of data represented in aesthetic form. Knowledge is transferable through media-formed matter, changing our awareness and position, and informs the momentum of future actions. Ikeda's spatial apparatus is a vehicle for data to reveal discrete sets of knowledge, and the information territorializes the program of space. The prototype design will investigate whether a reciprocal dialogue between the observer, media, environment and context of the site is achievable in entangled conceptions, or whether it disembodies and factions the body and mind.

02.33 Rahm

> There's a kind of misunderstanding of what architecture is. It's not to design solid shape and form, it's to design climate.
> -Philippe Rahm (Rajagopal, 2014)

Philippe Rahm has been prototyping physiologically responsive environments since 2002, using the vernacular of utilitarian objects and engineered systems of climatic control interfaces – HVAC (heating, ventilation, air-conditioning), UV lighting, for example – as a means to develop a bioarchitecture removed from the tectonic archetype of modern space-delineating structures. For over a decade, Rahm has been situating bioarchitecture technologies between meteorological data and physiological responses to guide his practice. Dematerialized thresholds have evolved into new forms, transforming as air currents, thermal masses, lightscapes and

pressurized atmospheres, expanding the field of architecture into an immaterial condition of climate control. The specificity of site, however, was never considered in practice: often placed within hermetic white gallery space, climatic relations were specific to non-contextual interior constraints in a deconstructive dismantling of form. In 2011, however, Rahm won a competition to develop the Jade Eco Park project in Taichung, Taiwan alongside Mosbach Paysagistes and Ricky Liu & Associates (*figure 3*). This ecological park is conceived as a "programme-to-climate or form-follows-climate or even function-follows-climate" design, developed with climatic technology built into the landscape, using the existing meteorological conditions of the environment to filter, cool, heat, light, and offer open programming (Garcia, 2014, p. 85). In this ecological sense, Rahm has been working toward a method of interdisciplinary design starting with the atmosphere as the substrate material. Analyzing engineering models of climate control which are often adapted after the design schema is complete, Rahm insisted on starting the design process with the detail, specifically with the engineering systems used to transform environmental conditions. The climate would inform the program, which in turn would result in the synthesis of the body and the environment.

> I have no image of the design at the beginning. We are trying to use the climate as an element in designing. But not in the Modernist way, determining function and place. We want to create a multiplicity and diversity of [atmospheric] qualities. Philippe Rahm (Rajagopal, 2014)

Rahm's environmental approach is nearing what Ebeling referred to as an *autarky*, a comprehensive ecological integration of architecture independent, autonomous, and harmonious with the landscape and atmosphere (Ebeling, 1947, p. 1).

figure 3. Jade Eco Park, conceptual rendering, courtesy philipperahm.com
Landscape and architectural design for a new 70-hectare park on the site of the old airport, with leisure, sport, family and tourist activities, a 3000 m2 visitor center, a maintenance center, and the urban regulation for a new museum and the Taiwan tower." – Rahm and associates

> Die energetische Autonomie eines Gebäudes oder wenn man will, seine Autarkie, d. h. die Selbstversorgung mit Energie zu seiner beabsichtigten Erwärmung, Abkühlung, Beleuchtung etc. durch Auswertung der natürlichen Strahlungsverhältnisse seines Standorts ist unabhängig von der wirtschaftlichen, politischen und kulturellen Struktur eines Landes oder Staatsgebiets.... (Ebeling, 1947, p. 1)
>
> The *Autark* building (an energetic autonomy of the building) - including the self-sufficiency of energy for heat, ventilation and light – is independent from the economic, political, and cultural structure of the country. (the *autarky* emerges from the idea and later transforms into the scientific – technique follows the idea – becoming). (My interpretation based on passage translation)

Ebeling contends the autarchic building possesses an autonomous energy (*Die energetische Autonomie*), independent from economic, political, and cultural structures (*wirtschaftlichen, politischen und kulturellen Struktur*). The freedom from precepts enables the structural relationships to develop. Autarky materializes from the idea, the technique follows, a becoming in form and intent. Rahm's functioning details follow the autarchic model, emerging from the

idea first, and not as the aesthetic form; the technical medium harnessing the environmental conditions leads the design process, from parts to the whole.

02.40 Conclusion

Design complementarity is the hybrid process of a *naturphilosophisch* science, an agential realist account, and a philosophical physics approach toward an interdisciplinary design practice. Such measures of subjective intuition, feeling, apperception, experience, memory, projection, mindfulness, awareness, and *being* are considerations to be accounted for in the next phase of the project, from which an experiential prototype is developed to explore the metaphysical entanglement of a body-space in its becoming. The essence of quantum design in principle is in its mutable state of becoming. Matter is in a constant re/positioning from not one locus, perhaps not even from many *loci*, but as a field, diffracting in patterns of charged particles from one perspective, and to waves in the next. This quantum essence is intrinsic to a critical review of the design practice, as rigorous experiments of qualitative analysis are needed to test the limitations and conditions of the possible in various materializations of relational space. Thus, intra-actions in new spatial design configurations require a new social-scientific framework to consider alternate ways of being and inhabiting, which may at times bear no relation to a classic interior/exterior binary. For instance, the sublimation of material processes within the emergence of digital presencing has destabilized the architectural landscape, requiring a negotiation of access, security, and a reconsideration of private and public spheres; the social strata of political and cultural space has diffracted into layers of material and dematerialized forms of communication, requiring an expanded scope of inclusiveness for bodies, entities and interfaces that affect the course of agential navigation; and the processes of design are no longer

exclusive to the classical material-ness of interior and exterior transitions in mutual exclusivity, requiring a shift in disciplinary thinking and production.

Classical methods of practice are hierarchically static, based on the central tenet of an absolute baseline from which all things are measured from. They cannot respond to a quantum dynamic of matter in constant momentum, continuously diffracting space and identity from which relationships continually break and re/form. And if an absolute command of space could be achieved by isolating a single particle from the continuum, the search for an indivisible entity – the atomic singularity – always enacts a desire to split and splice it in an atavistic pursuit of its beginning, to see how much further one can peer into a containment of infinite interiority. Atoms are divided, the singular point is halved in two, expanding the detectable units of measurement as best comprehended through the human discernible lens. In the long view of observation, the scales are in constant acceleration, dividing, multiplying, reframing the scope of matter. The point of origin thus is in constant transformation in multiple, divisible entities as the single unit of measure and all scales in accordance follow suit in becoming smaller. This scalar transformation demonstrates a pattern of constant space-time expansion from afar, as each generation of refined scale-sets requires a repositioning of the human relation context, which calls for a reconsideration of the absolute measure of things, when the space field around things are fundamentally changing in every direction, all the time.

From conceptual models of the infinitesimal atom to the infinite sublime explorations of cosmic relativity, discoveries about the body and its relationships with the environs has achieved a critical mass whereby the space *between* matter is inconsequential, for the *kraftfeld* is of an entanglement of matter and action, connected and continuous. Space is an active field: the conception of phenomena is entangled through observation. In other words, phenomena occurs

or reveals itself, becomes, and materializes – to paraphrase Heidegger – in the moment of vision (Heidegger, 1962, p. 388). Such conceptions exist in arrays yet to be observed/ materialized, but first, new methods and instruments of design are required to engage in non-classic methods of practice, and second, a re-calibration of 'measure' beyond the quantitative value is needed to enable forms of agency in the wake of a landscape transformed. Furthermore, an inclusive, expanded approach to de/material processes may come in the form of a design complementarity. Identities of indeterminate quanta may substantiate new becomings in social relations, and relational dynamics are always in motion from one person to the next, or in equal consideration of one object to the next, therefore quantum design defies classical fixity of measured data yet does not compromise potential futures from materializing in agential multiplicity.

PHASE II: EXTRA:MUROS:INTRA

The research-creation design phase proposes intra-active relations between the body and its environment, examining digital media as an architectural interface. The interface is a medium of light and sound in archetypes of walls and thresholds. These affordances of media as architecture offer the inhabitant a way to engage in physical and psychological parameters of space in a subjective and personalized experience, made apparent through visualization and movement. Through critical analysis and prototyping, I will frame the fields of spatial processes in theory and practice as a subjective interactive experience. A site-responsive installation will present a dichotomy of corporeal presence: what constitutes space and its boundaries, and what defines exterior and interior inhabitation. Architecture and media are interchangeable, as media becomes architecture, and a meaning-making process of matter in a body-space is explored.

03 Process

03.10 Introduction

The following phase of the project documents the studio process in the creation of an experiential space. To review, methodologies of Practice / Research (research through creation), principle theory inquiry (*what if*), ethnography (observations and interviews), and a reflective practice lead the research-creation project into an experimental form of an interdisciplinary process. The spatial prototype is developed to offer a sectional cut – an insight into the interiority of phenomenological affects of a body-space from the outside–in, working within the design apparatus of digital and physical interaction. Supporting the experiment are qualitative accounts of unique conditions and perspectives of *being* within the space. These qualities are the immeasurable accounts of an awareness of *presence* from objects to subjects, surface to skin,

biorhythmic data to visualization; and the level of action and engagement in the digital and physical spatial medium. Digital / dematerialized matter and physical material set up the parameters of the experiment within a site-specific intervention to reveal bodily actions and reactions through wearable technology, connecting and displaying content as an architectural interface. The concept of *Transmateriality* will be introduced in section 04: Analysis as a conductive meaning-making process in the active environment.

A reflective practice assessing the methods of inquiry affords an opportunity to review the epistemological edges and constraints of disciplinary territories in question. Such delineations are rendered indeterminate, as the demarcations of architecture are challenged with quantum variables expanding and contracting in temporal perception, and a dynamic interplay of content intra-acting with the structural environment is interdependent on the relationships of the co-creative content generated by the participant. The design of the archetypal elements of surfaces and formal structure independently act with the space as objects, and as extensions of the subjects, receding in the program in one moment, and actively engaged as the dominant organizing principle in the next. It is completely feasible to observe measures of one event be dissimilar to another observation, even within the same conditions. Anomalies and diffractions of pattern norms reveal insights about the indeterminacies of phenomena outside of general knowledge constraints, offering a greater picture of the *nature* of phenomena within this specific frame of inquiry, without the impossible pre-condition of explaining what the totality of phenomena is.

03.20 Design Intent: Representation and Observer // Participant

> …concepts are defined by the circumstances required for their measurement. That is, theoretical concepts are not ideational in character; they are specific physical arrangements. (Barad on Bohr 2007, 109)

The intent of the design prototype is to create an apparatus for observation and immersion, to explore digital and physical space in theory as a materialized field of actions. Observer as participant, subject as object, and environment as a threshold to interior matter, a spatial design prototype responding to specific parameters of the site and its material composition is constructed to ask questions, to ask what it is to be immersed in the *Kraftfeld*. Beyond this, there is no proof of concept required to test a hypothesis, and no 'real-world' application for it to benefit from. However, the material conditions of digital and physical space are presently explored to gain insight to the perception and connection of being and awareness in a quantum condition.

03.21 Representation

Gedanken experiments[15] in the field of quantum physics transitioned the production of laboratory demonstrations to theoretical paper constructs defined in mathematical terms at the turn of the twentieth century. The material process became abstracted into a numeric representation, yet offered unlimited possibilities of potential outcomes (Barad, 2007, p. 100). Yet neither process was any less a representation of phenomena observed / hypothesized, for Bohr insisted the instruments of observation defined the character of the phenomena sought:

[15] Barad describes Gedanken experiments as thought experiments, a turn from traditional laboratory work demonstrating a proof of concept validating the research. Gedanken experiments expanded the realm of possibilities in conceptual thinking, unbound from the physical and technological limitations, experimented through a soundness of mathematical abstraction.

(words and) material practices were equivalent in the production of rendered knowledge. Bohr made a distinction between representations of phenomena and the nature of phenomena itself, suggesting that the observation cannot be a complete analysis of phenomenal composition, as Heisenberg's indeterminacies of position and momentum illustrate. And if we were to try and compose a theory of absolute phenomena, the image of representation would betray the individual actions and anomalies that would have to be qualified in exception. Instead, we will focus on the discrete actions, anomalies and specific moments to exploit the condition of agential possibilities as they are, not as they appear. This means individual processes are considered seriously as a portent to agential action, influencing the relationship one has with material and immaterial properties in the moment. The spatial design affords a way in to understand the unique experience beyond its representation through tangible immersion, due in part to the context of the experiment activated in an existing public space and not in a gallery setting, and to its real-time recursions of data specifically generated by the participant.

03.22 Observer // Participant

The observer's role doubles as a participant, effecting variations in the composition physically and psychically. The observer is explicitly tied to the generation of events through movement and focused intent / attention, and summarizes her own experiences. The decision-making process in navigating the program is self-guided, and a recursive responsiveness is encountered through the physical constructs and displayed media. The observer is also observed and engaged for feedback, sometimes in the moment of the experience, and a dialogical exchange generates feedback in a post-positivist practice diffracting the authorship of findings into many voices.

03.30 Apparatus and Conditions

The research-creation phase is comprised of three parts during the apparatus development: The first part is material, creating a digital and physical interface through the exploration of material and immaterial design. The second part is on the condition and context of the site. The third part is on the synthesis of material and the engagement within the apparatus as an observer and participant.

03.31 Materiality

To create a body-space design – a space extending awareness from one's own sense of corporeal presence to the archetypal constructs of walls, surfaces, landscapes and objects – the sensory qualities were considerably influenced by the synthesis of details to the whole (concept). Initial phases of the design process had begun in iterative ideation of an enclosed environment, yet did not necessarily require an encapsulated insular space. Criteria for a body-space had origins in the following conditions:

1. Space must feel close – intimate, connected
2. Space must be individual, customized to a participant's actions
3. An active field must be intuitive, enabling an array of possible outcomes, relationships
4. The composition should have a degree of unfamiliarity for the participants to negotiate their own actions
5. The space should be multisensory, immersive, and have real-time feedback
6. The design must be synthesized within a physical environment, precluding complete virtuality. A site was not a part of the original concept however it became an important factor during the design development

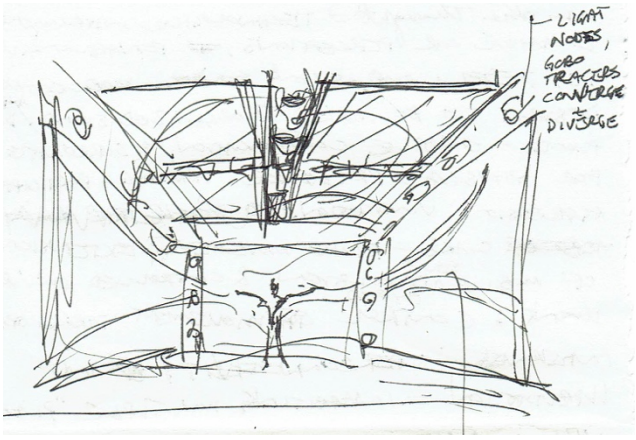

figure 4. Concept sketch 2013

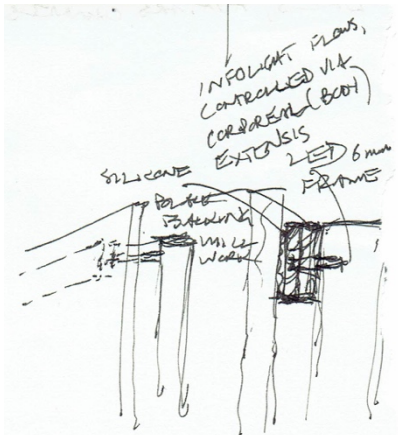

figure 5. Concept sketch Detail 2013

03.32 Body

The program of a body's own biorhythms is as intimate a proximity as can be experienced. Visceral, tangible, familiar, yet external to our own interiority, to experience another's physiological rhythms are as mysterious as they are unifying: heartbeats, eye movement, warmth. Architecture as a connective, communicative environment experienced as one's own corporeal machinations disrupts the interior / exterior membrane, externalizing the internal information. A body-space architecture invites outside bodies to become a part of the ecology of space and matter. For this expression of communication to occur, a connecting medium between the body's information and the environment was considered, and the field of biometrics offered resources to explore, specifically in the metaphysics of a kind of neuro-space – devices capturing data from electrical impulses from the brain. A device was selected on the criteria of EEG[16] readings. While such devices on the market are not to be considered equivalent to medical grade neuroscience equipment capable of correlating data to medical prognostications, the mechanics of the application are based on the same principles of body-data readings. Biorhythmic

[16] Electroencephalogram, readings from the brain's electrical impulses

information was captured via a wearable head-mounted device[17] to obtain raw EEG material, relayed to a computer. The built-in algorithmic structure of the device's proprietary data capture interpreted 8 value sets of brain waves[18] into 2 categories, loosely translated as a mind's state of activity. It is important to note that while the manufacturer of the device labels the two states as *attentive* and *meditative*, the associations of the states are arbitrary and are not universal. For the purposes of this study, the two states will be state 1 and state 2. Numeric values from 0-100 – 0 being the least engaged, 100 as the most *present* and engaged – were assigned to each state, to be translated by a digital interface program. Real-time readings of values were constant every second, and both states were evaluated simultaneously.

figure 6 wearable device capturing EEG signals.

[17] Mindwave™ by Neurosky technologies is a commercial product for entertainment purposes. The author is not affiliated with the company and does not endorse promotional material for this study.
[18] Delta, Theta, low apha, high alpha, low beta, high beta low gamma and mid gamma waves

03.33 Digital Interface

A program created in Processing, an open-source JAVA-based programming environment, converted the incoming data streams into visual colours and thresholds of sound corresponding to the data value. The program enabled real-time visualizations on any medium of output (such as a laptop or an LED billboard), and parameters of the interface apparatus were embedded. The variables of the parameters, it could be said, are arbitrary, binary decisions, wherein certain values of state 1 being greater than state 2 induce a particular effect i.e. *if* this, *then* that. This would be true in the frame of one state being external to the other. However, in the algorithmic code of the program, the statements are designed to be internally entangled whereupon the values of state 1 will produce an effect that is also codependent on the values of state 2, and the continuity of the effect will be dependent upon the refreshed data every second. In theory, 100 variables of state 1 multiplied by 100 variable possibilities of state 2, compounded by a variable of 100 colours is equal to 1,000,000 possible variations of real-time visualizations per second that are self-generated in an internal and (for all intents and purposes) infinite system. The aesthetics of the program is in its state of becoming, finding resolution in the infinite possibilities of parametric design governed by *internal relations*.[19]

[19] Philosopher Ludwig Wittgenstein theorized colour relationships as having indeterminate properties. The phenomena of one thing can be identified as having a specific property in contrast to another, but to describe the relationship or, the nature of phenomena is less arbitrary: “A language-game: Report whether a certain body is lighter or darker than another. – But now there's a related one: State the relationship between the lightness of certain shades of colour. (Compare with this: Determining the relationship between the lengths of two sticks – and the relationship between two numbers.) – The form of the propositions in both language-games is the same: "X is lighter than Y". But in the first it is an external relation and the proposition is temporal, in the second it is an internal relation and the proposition is timeless.” (Wittgenstein, 1998)

```
163     //  attention = attention+1;
164    // }
165       if (attention++ > 80) {
166           pulse = true;
167               smooth();
168         // attention+=attention+1;
169
170 //frameRate(10);
171      // background (255,200,50,0);
172  rect(0,height/2-attention/2, width, attention);
173               fill(0,0,100,meditation*8);
174 smooth();
175 //frameRate(10);
176 attention = attention++;
177 scale (4.0);
```

figure 7 Extraction from Processing code, indicating the shape (rectangle) and colour (RGB spectrum) is instantiated by the incoming stream of values within this specific instance: If state 1 sequentially increases in value and is greater than state 2, it will scale in value and fill the screen.

The Processing *sketch* was developed not to create representations of form and bodily function, but rather to act as a condition of spatial presence. It conveyed information through patterns of light and sound based on an individual body's readings, informing and inhabiting the environment in fluctuations of being. The visualization patterns were therefore conceived to be a medium un-bound to a standardized computer screen relationship, as the intended site became of importance to the conveyance of a dimensional-media synthesis. Light and sound as information were formally reduced to focus on the material dialogue within the active field of spatial matter.

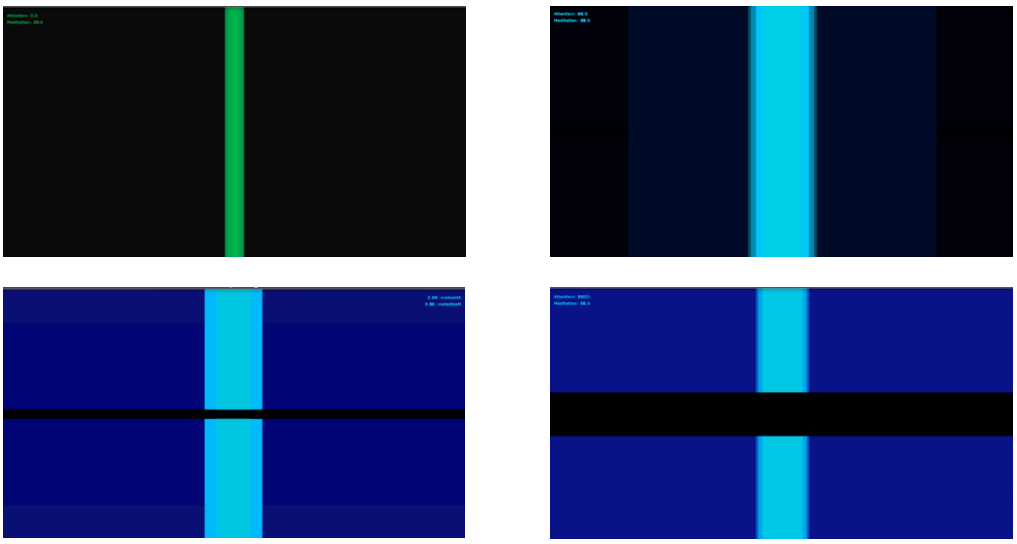

figure 8 Processing sketch testing variations of EEG data visualization

03.34 Light // Sound

In an effort to facilitate a connection of an individuals' implicit thoughts, feelings and intimate responses within the environment, the ready-made biorhythmic device used to stream data into a software interface (Processing) translated the EEG data into a customized display of sonic and visual media designed for this project. At this point, data from the body was sequenced into light and sound. The energy of data as visual information required a quantum transformation into the space. The medium of light is a form of pure information, thus a material investigation led to the deployment of LED systems. The audio/visual content was explicitly mediated through an architectural arrangement of LED panel walls and speaker systems composed in a linear promenade formation on the site of the Evergreen Brick Works of Toronto (Ontario, Canada). (The composition of the design responds to the specific dimensions and site conditions of the heritage site to be expanded upon later). Presence was mediated in digital technology employing modular LED panels, and projection. The medium of LED light was selected for its purity of light and colour – each pixel a construct of individual RGB light diodes emitting direct light without filtration of a screen or focusing lens, achieving full brightness without ambient light in the environment compromising the image. This is in contrast to the first light interaction, a projected image onto a veiled threshold, visually and tangibly softer.

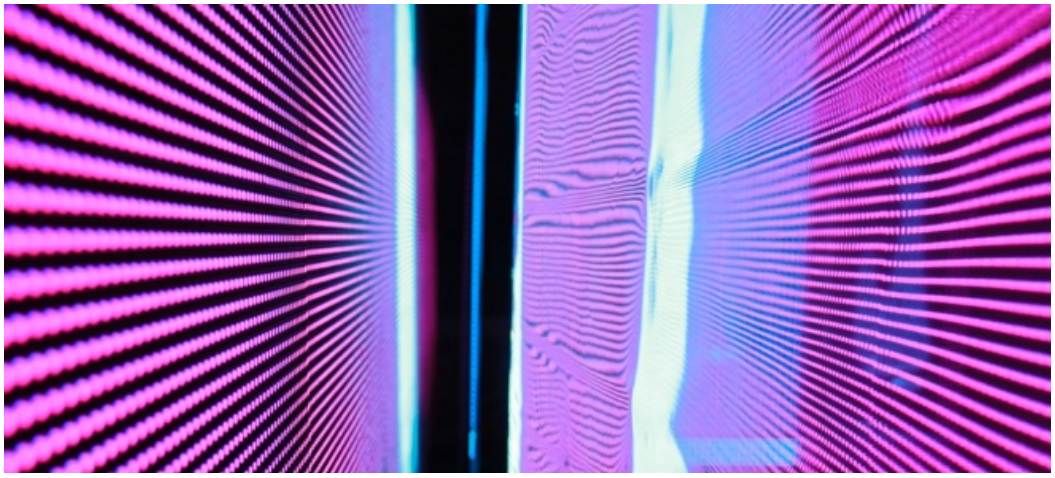

figure 9 LED light emitting diodes, 7mm resolution

figure 10 Projected image on fabric threshold

Speakers were used to create a surrounding quadraphonic field, altering the sonic landscape, discontinuous from a synchronous orchestration. Sound in the Processing sketch was embedded as a layer of two-tone bells, each tone activated by 80 percent values of engaged states. As a participant oscillated between states of being, the bells would ring (a singular gong dissipating in a reverberating echo) sometimes simultaneously, synthesizing the internal state with the external experience. Echoes in the site and beyond added a temporal complexity to the present moment, and may have had consequence to the spatial perception of time. A microphone was also placed at the outset of the installation, picking up auditory cues from other parts of the environment and feeding them in aural intimacy into the heart of the display, creating a dissonance of visual proximity with disembodied / decontextualized sounds. The purpose of the a-temporal technique was in part a practical analog solution to a digital coding element that was originally embedded within the Processing code structure: Sounds of the environment / participant / bell sounds would have been picked up by the program, echoing in delayed response, its cadence defined by the values of the EEG readings. For instance, a shortened echo

of the state 1 bell would resonate in quick staccato clips if values increased, or would elongate in slow dissipating loops if values decreased and so on. This was not to be the case, as limitations to the input and output channels would not allow for simultaneous pick-up and outputs of sound through one computer processor. The outcome of this was not incidental, however, and its agential affects will be explored later.

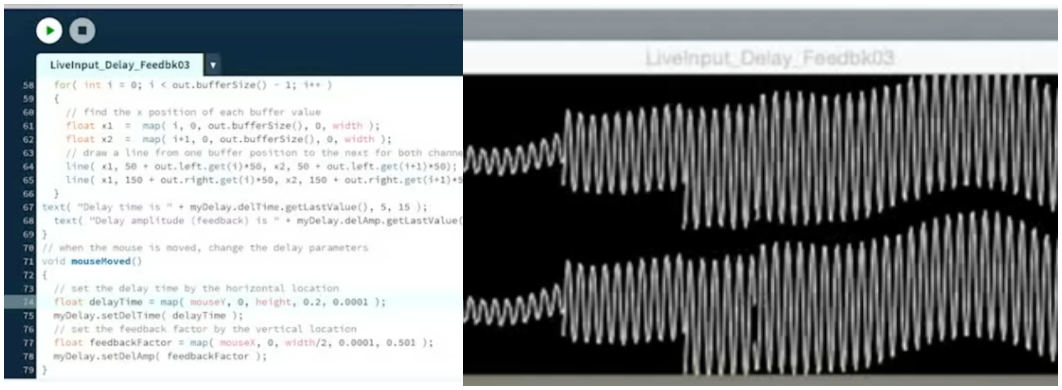

figure 11 Testing audio feedback and delay, Processing with Minim plug-in. http://code.compartmental.net/

03.35 Surface

Research was initiated in search of a malleable material with transformative capabilities. Active and reactive, reflective surfaces were intended to complement the LED light sources. In active states of LED content when a participant was engaged, reflective surfaces served to activate horizontal and vertical planes, providing depth and amplification to the active and ambient light space. The plan of the floor was divided into raised mirrored slabs, compromising circulation, or, affording elevated standing platforms of reflection. Conversely, vertical sheets of reflective film, a translucent acetate with a reflective mirror surface was overlaid on LED surfaces to amplify varying levels of surface brightness and depth, interacting as a secondary layer of visual information. The presence of the reflective film overlay was a constant negotiation of the light-

content in the space, reflecting and filtering light in dormant states of inactivity, all but voiding its own presence when rendered transparent in the full brightness of the backlit LED activity.

figure 12 Reflective material testing

figure 13 Variable material opacities

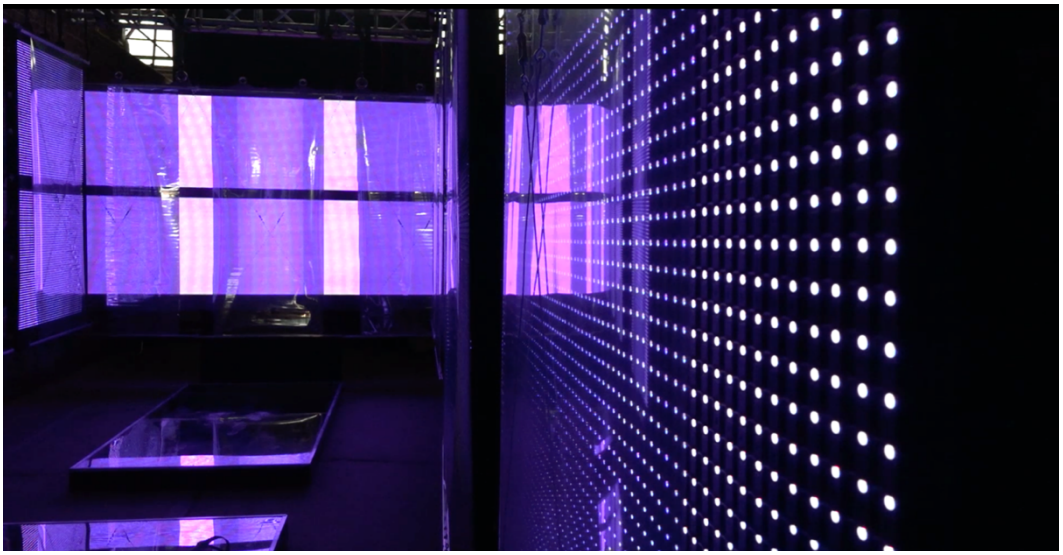

figure 14 Transparaency overlay, reflective surfaces. Reflective mirror acetate, acrylic mirror platforms. 18mm LED resolution

In a recursive theme of architectural exploration, the physiological and psychological transition separating external and internal states of the installation became a point of negotiation at the threshold of the designated site. This point of transition was then designed to be tangible and intangible – a surface of malleable fabric to separate / penetrate, and yet be a continuous portal into the possible worlds on either side of the interface.

figure 15 Entrance Threshold

Projected live feed video of the site on three suspended white scrim panel transparencies. Participant sees an overhead view of their own image approaching the threshold, translucent and continuous, with a projected horizon mapped in line to the viewer's perspective. Still from video, courtesy Umar Amunullah, 2016.

03.40 Site: studies, variation

> From the viewpoint of classical physics, the vacuum is complete emptiness: it has no matter and no energy. But the quantum principle of ontological indeterminacy calls the existence of such a zero- energy, zero- matter state into question or, rather, makes it into a question with no decidable answer. Not a settled matter or, rather, no matter. And if the energy of the vacuum is not determinately zero, it is not determinately empty. In fact, this indeterminacy not only is responsible for the void not being nothing (while not being something) but may in fact be the source of all that is, a womb that births existence. (Barad, 2015, p. 394).

The following account is the thought process and exploration that determined the selection of a site. Site was not initially a concern nor a concept in the development of the design, but was of great importance to the final outcome of the spatial prototype. It is important to discuss the

terms of a gallery space and site specificity to delineate the intent of the apparatus, and the conditions of the *kraftfeld*.

At a certain point in mathematics, geometry is required to substantiate the laws of physics. The geometry of dimensional conditions, boundaries, apparatus and windows specific to the problem characterize the physical properties in context to everything and no-thing. In turn, the conditional geometry of lab testing pre-determines certain conditions of the results, even in the assumed optimum ideal of a vacuum state, or zero-sum environment. A zero-sum environment, assumes a positivist vantage point from which observations can be made to explicate the singular nature of an event or phenomena. And perhaps this is the simplest way to logically define particles of the whole, dis-locating external aberrances and reducing randomness. In this inductive approach to a theoretical construct, the ontological premise is suggestive of a universe that is comprised of units separate from the next, quantifiable and reducible to a finite order. And should finite particles have a resoluteness, a soundness in its ordering, the whole of an infinite unified theory can therefore be reduced to its vacuous origin: zero.

A universe of zero origin, or the void-state of the beginning, is a pervasive construct in multiple fields of anthropology, physics, cosmology, computer science, theology and cultural studies. Anecdotally, it shapes our understanding of a human scale relationship in a world-historical view of the Big Bang. Yet the impact of this universal notion affects the everyday psyche of how we see the world, in pattern recognition, of cause-and-effect constructs, and of binary states of 0,1; nothing, or something. There are current theories in support of a zero origin, ones which consider "the ultimate starting point": "So, zero must be our starting point. It must also be where we finish, for nothing, as we all know, comes from nothing – n*ihil ex nihilo fit*" (Rowlands, 2007, p. 3). There have also been considerations of the universe as a computational *self-exciting*

machine in the view of information theory – each particle containing a singular element of information from the binary logic of bits, activated in symmetrical alignment to its counter particle, and in reconciliatory fashion, activates infinite possibilities in a quantum field (Lincoln, 2013). Suffice it to say this approach to a binary construct of being and non-being is prevalent in contemporary modalities of reason and practice, whereby the production of knowledge is conducted in a rational order then presented as evidence of a natural occurrence independent of human intervention. That is to say accretive knowledge of a being-state is best perceived in a landscape of non-being, generating evidence of original creation removed from human influence. Perhaps it is not just our desire, but a pre-determined destiny to return to a state of zero; thus the non-contextual modern archetype of the minimal lab space is idealized in the likeness of examining space-time concepts in its original state.

In a similar development of laboratory experimentation, art and design have gravitated toward a representation of neutral space evolving from the 19th century salons, hermetically sealed from external influences, presenting ideas in scientific regard. The non-objective gallery space had become a typology of its own, extricating objects from the entangled conditions it derived from, re-framing its relationship of hierarchical representation / observation. Revisiting the Kantian "condition of the possible" (Barad, 2007, p. 143), modern processes of technological achievements in construction enabled the aetheticization of a 20th century positivist neutrality, self-evident in geometric forms external to the natural world. A non-representation of "space, emptied of meaning" aspiring to be the void, intrinsic to the micro detail, Neumeyer's analysis of van der Rohe's philosophy on 'form-giving' reveals an intent of creating a new spatial language of zero origin: "The logic of this ascending order (of building) was simple and compelling: the corrosion of symbols by the processes of technology hostile to tradition also cleanses space of "alien suggestions" and throws man back upon himself." (Neumeyer, 1991, p. 179) The question

at hand was to determine if the application of a spatial design in a (non-)representational condition represented space as the classical void, and if so, would an absolute determinacy of zero space not be contradictory to the intent of a quantum space design? In many ways, the thought process of this project had developed considering its questionable relation to a site condition through *Ex Nihilo* iterations as representations in a gallery setting, then returned to the field in search of present entanglements, becomings, and of actualizations in a refutation of the spatial void. To apply Barad's inversion of the void from her quote at the top of this section, quantum space and all its entangled relations calls into question the root of nothingness, the single point of an absolute commencement, despite contemporary theorists' pursuits of finite order. A nullification of commencement reduces the commandment of hierarchical structure, of an order *a priori* to intra-actions. The *indeterminate* void, then, considers systems of possible variations on matter, order, and perceptions, to be found in-site, on-site, within site, and throughout, a rich exploration that I contend would be difficult to achieve off-site, in the void-absolute.

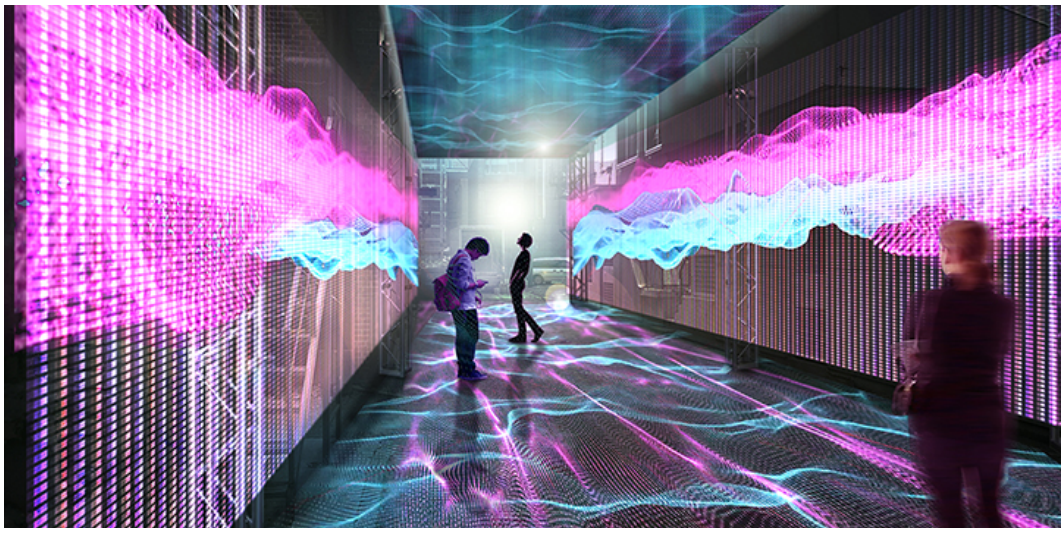

figure 16 Concept render, *Layered Space* 2014

figure 17 Concept render, inactive March 2016 *figure 18* Concept render, active March 2016

The final site, the Evergreen Brick Works of the Don Valley River, Toronto Ontario Canada, was selected for its adaptive re-use buildings that once were kilns for manufacturing bricks, now an open public heritage space. The historical prominence of the Brick Works kilns as a place of material origin for many of the city's buildings throughout the last century provided a counterpoint to the proposed digital content of the installation. In consideration of Ebeling's theory of *Raum als Membran,* and later *Extra Muros*, the Brick Works was symbolically the producer of a classical construct of spatial typologies. The wall-making function of a brick defaced individual expression of the unit into uniformity, dividing space and allocating finite external and internal programming. The design of a layered body-space, however, would intervene in the binary traditions, extending beyond the place of walls, into the *kraftfeld* of possible connections. As a new production of space, digital media would enact a dialogue with the physical parameters of the site, a dynamic action of history and temporal presence in constant negotiation. The digital and physical environment afforded a unique interface for participants to explore, prompting us to question how we connect with a place through its physical and perceived attributes.

figure 19 Evergreen Brick Works kilns, site visit June 2016

03.50 Synthesis: Design in Situ: Freien Raum

There are conditions of a place that cannot be described unless you experience it, embody its engagement, as it reveals its own presence. In the site of the Evergreen Brick Works, the fluctuating summer humidity embedded within the walls, the smoke-like must of wet concrete where waist-high floods flowed and will flow again, faint pollen and insects humming interspersed with distant vehicular traffic, and pauses of soft shoes scraping on the ground echoing against the aisles of kilns once blazing with 2000-degree fires now dormant; these are milliseconds of moments in a continuum of events un-recorded and unseen. In fact, there are perhaps multiple continuums, some of which are subject to specific ecological disciplines of study. This particular study responds to the architectural dis/continuity of time and space, a site that is in its own version of spatial-social transition.

The Kilns building is an open-air pitched structure with a steel grid, canopied in corrugated steel. Its north-south axis provides ample daylight but is limited in its reach. Aisles are formed by brick walls, varying in 8-12ft heights – some with 8ft height limitations of overhead metal work – with a break in the central section providing much of the traffic circulation coming in from the west stairs and accessible ramp. In light of this configuration, an aisle mid way was selected for its accessibility and width variances, height accommodations for overhead infrastructure, and controlled lighting (north lighting is to the left of the plan).

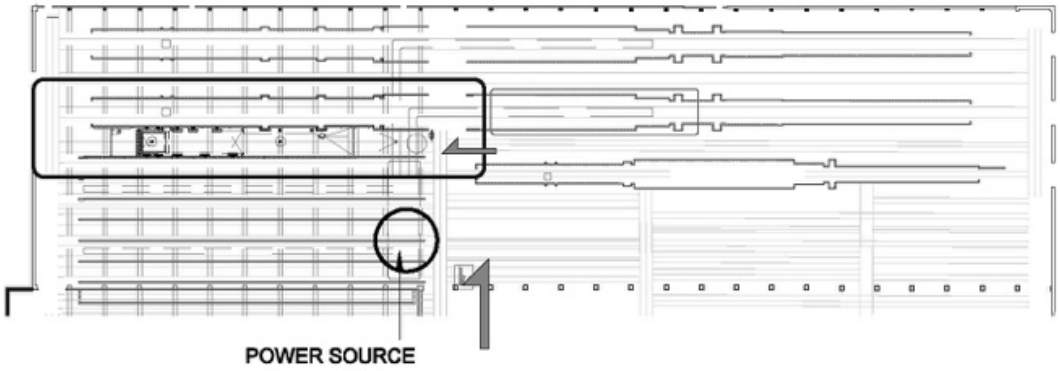

figure 20 Site plan of the design installation Kilns building north side aisle 2

figure 21 Kilns site aisle 2, north view

03.51 Synthesis: Conditions

Specific features of the kiln aisle were mapped out to determine the integration of media and media infrastructure. For instance, a threshold space was considered, one in which participants would determine how to encounter the field of space. Use of existing overhead beams, catwalks and infrastructure determined the positioning of threshold panels, slightly staggered to appear impassive yet translucent. Walls with portal openings determined sightlines of media panels seen in opposite aisles external to the experiential space. Media panels 4ft wide (to accommodate mirror acetate panel overlays 4ft in width), 8ft high were staggered in asymmetrical distance down either side of the aisle, leading toward a wall panel at the end of the aisle, 8ft high, 12ft wide. All of the media panels were aligned to a centre line of approximate standing eye level, initially designed to be built from the ground-up, then floating above the ground to the rated steel above on linear trussing, to accommodate contingency plans of a 2-3ft flood line level (all buildings within the Brick Works grounds are subject to a flood every 2 years, and are retrofitted to accommodate for the emergency occurrence).

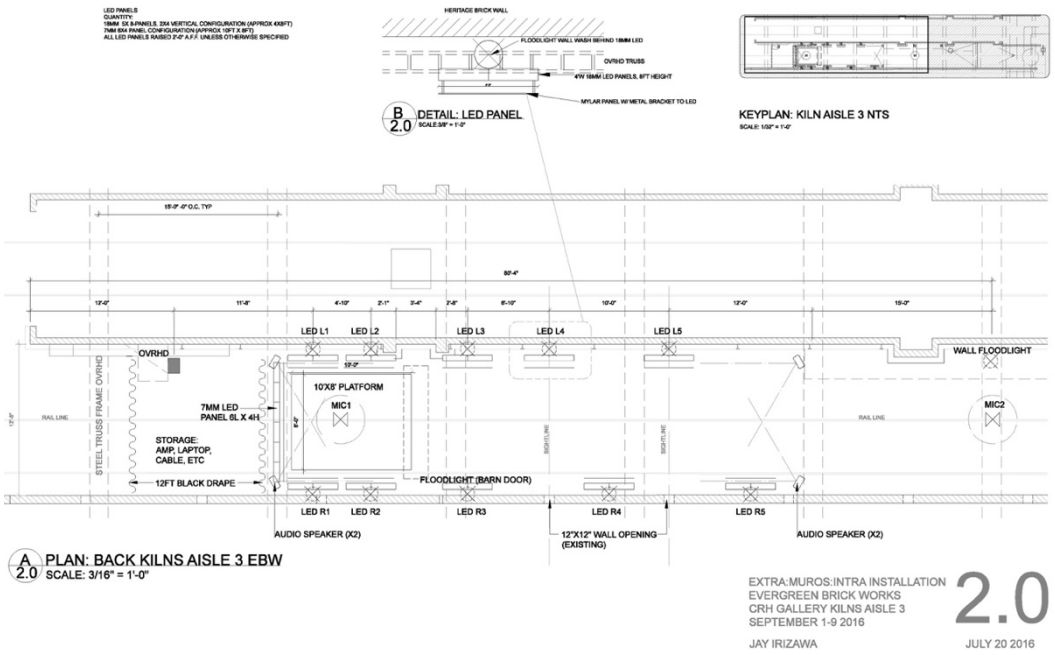

figure 22 North section plan of installation

With the media panels aligned, content was enabled to be synchronous, continuous, and immersive, spanning an overall visual footprint of 60+ft, and all cabling was sourced from above in a safe manner to enable free circulation. The initial concept was to have a rising graded platform to change the physical sightlines, and activate one's awareness of motion and position in close proximity to the media screens. This was modified to a linear formation of 4 platforms running down the centre of the aisle, aligned to the axial rail tracks embedded in the concrete once used to transport the bricks. The one-point perspective view of the mirrored platforms was a strategic inquiry to observe how participants would navigate in the limited aisle space of 12ft widths: platforms were 4ft wide 8ft in length 6 inches in height, placed 3ft apart, barely sufficient for accessible circulation; limiting in terms of comfort in public spaces. Mirrored surfaces on the ground activated the floor to a view of the structure above, and doubled the perceived height of the active media surfaces.

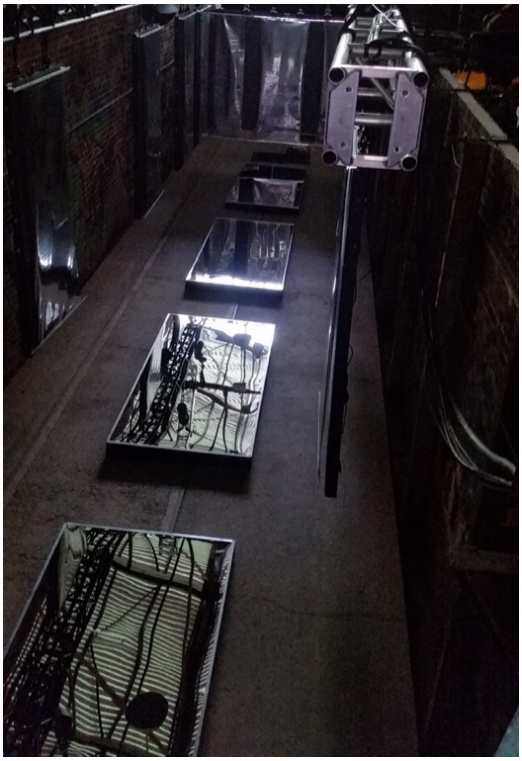

figure 23 Mirror platforms installed in axial formation. Participants negotiated the path of travel based on individual perceptions. Media screens were uniformly elevated with trussing. Graffiti and existing wall portals were highlighted between media and mirror surfaces.

figure 24 Detail. Still from video, courtesy Umar Amunullah, 2016.

03.52 Synthesis: Tension

Surface tension is generally referring to physical properties of a liquid surface offering resistance, maintaining its membranous form. In regards to the surfaces of this installation, the reflective materials presented practical considerations to account for in the design details. Specifically, edges and perimeters of tectonic surfaces are an obsession for designers to resolve, and this project is no exception. The challenge of the light sheet mirror acetate film overlaying the LED media screens required affixing points and a certain tension to articulate the planar surface without distortion. Preliminary concepts conceived of a structural tensile cable connection to stabilize the torque of the gravity-weighted panel, resolved by a crossing of 1/16” steel aircraft cables through the centre and affixed to a top and bottom angled ¾” .125 anodized aluminum channel. Zinc-coated turnbuckles providing allowances of adjustments on-site emphasized the

physical tension between the structural apparatus and the media content, ever-present in the centre of each panel. Material form and media as matter combined into a transmission of a surface tension, a tension of alterity between states, in constant negotiation between light as information and the reflection of the physical landscape made less certain.

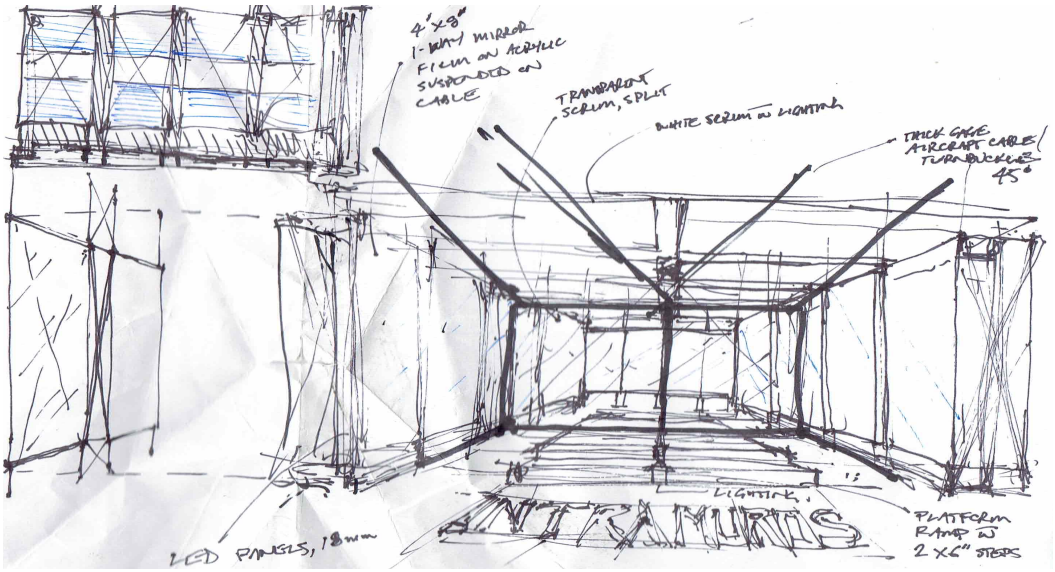

figure 25 Concept sketch: Surface tension


figure 26 Pre-installation

03.60 conclusion

A synthesis of the site and the design intent is a mutual development of environmental conditions and design details. Within the specificity of the material process in this apparatus belies a surface tension of varying depths, resulting in a quantum field of media content to structural material, ambient noise to disembodied amplifications, digitized data and corporeal presence. The psyche is externalized: impassive walls are trans-materialized into fluid body data, and the body internalizes the immersive infrastructure. It is a program – looping, transforming, receiving, responding, materializing – it "creates, interrupts, cuts, slowly flows, rests…" (Ebeling, 1947, 1) to create anew. In these terms, the project's becomings are charted *extra muros*, and simultaneously *toward an interiority.* Extra:Muros:Intra is a site-specific installation responding to the dichotomy of the site history, and its present condition of emergent revitalization.

The notion of digital fields in the urban physical environment is increasingly disruptive when applied inadvertently or with the intent to define individual liberties in the sociological sphere. In sociologist Georg Simmel's essay *The Metropolis and Mental Life*, Simmel entangles the city's will-to-being with the extents of the individual body and psyche reaching beyond the material environment: "A person does not end with the limits of his physical body or with the area to which his physical activity is immediately confined but embraces, rather, the totality of meaningful effects which emanates from him temporally and spatially. In the same way the city exists only in the totality of the effects which transcend their immediate sphere" (Simmel, 2002, p. 17). A culmination of an immanent body politic greater than the singular entities emerge, from which this project questions the methods that will shape its outcome. Extra:Muros:Intra seeks to counter this notion, to re-connect our awareness of the present moment in this specific intervention. As our own psychological state is revealed in the digital landscape in audio-visual information of biorhythmic data, presence of being is virtual and physical. The historical

"presence" of a space is as much a virtual invocation of the senses, as is its potential reality of an emergent future. As the site continues to re-invent its place within the landscape and the community, Extra:Muros:Intra returns to the place where the materiality of a wall – that which constituted and defined space as outside and inside in the last century – began, and asks us to re-imagine what space could be like, and how it might extend beyond the walls of conventional wisdom, creating meaningful, agential connections.

04 Analysis

04.10 introduction

Intra:Muros:Extra is a phenomenological investigation into the layered states of presence within a space. Participants are engaged in a voluntary basis, using an ethnographic method of inquiry, that is, with the mutual understanding they are active and integral to the discursive nature of observation-outcome. A state of being in the moment constitutes a performative engagement of the thought experiment as it unfolds around them, through the spatial medium. In this way, the thought experiment transposes representations into live sensations, wherein feelings are paramount to a body-space synthesis. Half of the participants were invited to provide feedback, whereas the other half unexpectedly came upon the work on their own. For the latter group, the qualifiers for the study required participants to enter through the projection-fabric threshold of their own volition – they were not recruited outside of the space, and they had to be of legal age of consent. The general public outside of the study was able to access the experience, and were not screened for minimum requirements (age, ability etc).

A set of 10 questions were prepared in the hopes of revealing connections between the body and the space, and what it means to be present in a hybrid space experience. What transpires in the following section is a personal account of various intra-actions occurring between the dates of September 01-09 2016.

04.20 Interviews

The following interviews were conducted during and after the experience of the design installation. Assessment of the responses are conducted in the 3 categories presented in the questionnaire: Awareness – of the body and surroundings; Perception – digital media, physical landscape, and the experience itself; and Connection – of time, and the relationship of thinking versus feeling in a space. A final reflection question was included to offer participants an opportunity to give constructive feedback.

04.21 Awareness

Joyful. Overwhelmed. Curious. Confused. Happy. Calming. The descriptors range from anxiety to elation, when asked what the participant became aware of during the experience. The primary relation people were best able to respond to was of their own body, the emotions one felt in relation to the sensations they physiologically perceived:

"I often felt like a sensation of chills or shivers run up my spine and into my head…. When I was up at the front I closed my eyes, I became more aware of the light – I sensed it peripherally – I felt like I could feel it through my eyes, but I could also just – *feel it*" (participant 6f).

Less immediate, however, was a relationship to the physical landscape of the site beyond the media components, however the history of the heritage site would figure prominently in regards to a concept of time later on in the interviews. A common recurrence the descriptions of

emotions led to was an *introspective experience* (participant 7g), where participants felt an intimacy with the site. Perhaps this was due to the nature of the personal biorhythmic content on display, regardless of the scale of architectural-scale media, brightness, volume of sound, and volumetric space of the site. The intimacy factor reported suggests that the event of actions, and the relation to the content/ experience has potential to overcome spatial volume and physical material measured to human scale axioms of comfort, even within a design of industrial construction material – brick, concrete, steel – within a volumetric envelope (overall aisle dimension 120'-0" X 12'-0" width, 8'-0" – 12'-0" wall height, within an open volume, 30'-0" peaked roof structure). In one respondent's reply, an induced introspection expanded known limits of the self and beyond:

"Conducive to introspection, making you hyper-aware what your body's doing. (The space) allows you to get in touch with your boundary and you can do more things" (6f).

'More things' suggested a progression beyond the demarcated boundary of the self, to engage and be receptive to the un/known conditions. In extension to introspection, one respondent described the experience as a form of "introception", a reflexive awareness encompassing a totality of mind and body beyond the central corporeal self. "For me it was like an introception that's something I could externally experience at the same time" (participant 5e). A reflexivity of internal awareness in conjunction with an external experience begins to dissolve the body membrane, from which classical interior and exterior categories originate.

The events of a personal body-space enmeshed with a public space were at times "confusing" (participant 3c), in the synthetic composition of intimate digital data displayed in an open physical landscape: how was one to navigate in unfamiliar territory if there wasn't a code of conduct or road map to follow?

"You don't understand how the connection between what you're seeing and hearing (in/with the design apparatus) is related to what you're thinking and feeling, so you understand there should be a connection…()… but you feel that you can't control it" (3c).

The participant further explained that it would have been beneficial to understand the intent of the design before the engagement, to know its function and maximize its potential activation. As an experiment of spatial conditions, the unfamiliar setting in this view caused confusion, leading to a feeling of a loss of control. Another participant supported this claim: "At first walking in, the space feels really controlled" (participant 8h); in other words, not in the participant's will to order. The notion of control – whether it is actualized autonomy or induced perceptions – was a critical variable in the concept of spatial agency. The perception of a harmonious space, for instance, was closely tied to the psychological embodiment of control. As a participant (7g) explained:

"That feeling like you have control but you really don't – that's the overwhelming (part). ()…If your thought patterns are having an affect on your environment, and your environment is responding to your thought patterns, then what does it say about your thought patterns when you cannot control them enough to make your environment harmonious?"

In this view, control / non-control is largely assumed to come from within, dependent upon the alignment of sensory information (*seeing, hearing*) and cognition (*thinking, feeling*). However, as one participant noted, digital assurances of behavioural patterns may be misleading: "although on the contrary it (digital media) may build certain conceptions that may or may not be true – there could be a disconnect with what your feeling / thinking" (5e).

If one were to align perceptions with cognition, a sense of control would ensue; but it also suggests something posthuman, not of our will, an environment *responding* in kind. The paradox of the immeasurable, unquantifiable elements generating the relationship within the field – an intrinsic principle equally generated from object to subject, building to person – Ebeling insisted

it must be acknowledged, and *despite its difference from ourselves, from our own inner laws, we encounter and accept differentiation outside of our own existence* (Ebeling, 1947, p. 2). To conclude this point, participants that acknowledged the inevitable outside factors beyond their control tended to respond favorably to the experience, acquiescing as a sort of overwhelming "wash-over" effect (8h). Agency, therefore, is ontologically interchangeable between material and immaterial media-matter in a reconsideration of interdisciplinary design complementarity.

04.22 Perception

> *I think it makes it more immediate – helps you to be drawn in, you are aware you are being watched, and your image is being projected.* It turns your insides out. *(*Participant 7g, on the question of digital media*)*

Perceptions of a hybrid media-matter space were described in terms of physical archetypes and psychological states of being, stratifying definition at times ontologically indistinguishable. This dissolution of boundaries circumnavigated central tenets of classic architectural theory of place-making – space and experience decoupled as plastic entities independent from, yet mutually defined with one another, shifting in non-classical space-time relations. Quantum affinities to a participant's position and momentum varied: the start and end of an experience were neither synchronous with demarcations of a physical boundary, nor consistent with time, and the subjective account of events was metered in the experiential affect. An inversion of interiority is at work – *It turns your insides out* – and physical constructs are dematerialized, or rather *synthesized in a new dynamic of body-space corporeality.* This process subjects the participant to surrender to unseen forces in the greater design ecology, activated in discrete moments defining unique body-space intra-actions. Never quite revealed in its entirety, the design whole is empowering in its undefined form.

This concept of the mutable whole was conceived as the basis for Ebeling's theory of an Autarchic architecture – an autonomous structure (*haus*) in harmony with the cosmic relations of matter as energy – described as the form-giving process of an idea coming full-circle in its process:

> Denn als architektonische Idee, die aus dem Ganzen zum Ganzen strebt und schwillt, will und wird sie nicht den Bau als Kunstform verdrängen, sondern gerade mit neuer Dynamik erfüllen. (Ebeling, 1947, p. 2)
>
> As an architectonic idea, it strives from the whole, toward a wholeness. (idea is not attainable as a whole – Faust – makes us less human) it won't reject the architecture as a form of art, rather, it fosters new dynamics. (my interpretation of the translation)

To paraphrase Ebeling's passage, an architectonic idea strives <u>from</u> the whole, <u>toward</u> a wholeness. It does not reject architecture as a form of art, rather, it fosters *new dynamics* (*neuer Dynamiker erfüllen*). He continues to alloy the logical science of the discipline with "*im Irrationalen*" (the irrational), "*In der Kunst*" (the art), "*im Erhabenen*" (the sublime), "*im Schönen*" (the beauty) from which the idea derived from. A metaphysical source of creative unfiltered energy, the place of origin is greater than any human construct, greater than any single human conception, and he advocates for the *Gestalt* of many forms, in multiplicity, that underlie its ambiguous nature. The new dynamics Ebeling considers is open to a posthuman corporeality, a directional change in the anthropocentric essentialism he pronounced in earlier texts ("What is essential is the human being: the object… is subordinate to it"). In this light, an architectural landscape of media and matter produces multiplicitous variations of inverted material relations divested from a central human point, disrupting the flow of continuous space-time. In Extra:Muros:Intra for example, a quantum differential could be summarized as the disjuncture of a material threshold and the event produced – within, without, cut off and recurring in the post-spatial experience. For some, the space commenced at the material markers – curtains, mirrors,

platforms, lights, and auditory cues of people and their movement. For others, the sight of their own presence reflected in mirror surfaces opened the space. And as one participant intimates, a deeper level within: "It started in my body. It was internal and then it became external. And then I was trying to absorb what was happening. It was a loop" (5e). Similarly, this participant felt the experience commenced once able to "connect when I felt my inner self became externalized, observing, absorbing. It started when I could externalize my inner experience (with the media space)". When describing the end of the experience distinct from the physical space, however, participant responses varied between the engagement of the event and the non-locality of time. Some experienced an abrupt, definitive end:

"I guess (the experience ended) when I took off the device. More so than the physical space, it's the act of realizing that you're disconnecting with the space in this way" (1a).

"It ended when I stopped focusing on it (content) even though I was at the end (of the display parameters) and I had to walk back; I really forgot about the state. I just walked off" (3c).

"Physically it started with the mirror platform, but psychologically, past the white screens.
It ends once I'm out of the tunnel" (4d).

The same participant (4d) also had different scale when relating to the experience: "I thought that everything was part of it (the building) – I think the real experience is right here inside, the ceiling above, looking into it" (4d). Others too, had expressed an indeterminacy of when the experience ended:

"The experience and the aura lingers after you leave, but there's a delay when you first enter. At one point the intellect gave over to feeling" (8h).

"I guess it will end when I stop thinking about it, when I'm far enough; as I leave this space I'll still be thinking about it so it'll probably still be with me…" (2b).

"Its different when you leave, because you don't want to leave, and so the space became bigger and extended after that because the feeling is still around when you are in it,…" (8h).

These insights suggest the experience of space is autonomous from its physicality as it occurs, and continues into the on-going present thereafter. Differentiated from memory, the presence of the architecture actively affects the body beyond its reach. Could it be possible then, for a space to possess an autonomous agency outside of the individual's presence? One participant rationalized this thought. "I don't think it (the installation) actually has a boundary on the entrance side…(). You realize you are already a part of the thing – it already started. That means, it doesn't start when you become aware of it, but for the installation – the sentient being – *it* would start for the individual, as soon as you move in the camera" (7g). *It* had its own active presence in the field *a priori*, yet developed an intra-active relationship upon a mutual acknowledgement of being and discovery.

The many forms of engagement, of specific *relata* dependent upon the negotiations of the physical, digital, bodily and psychological states, reveal insights about *Extra:Muros:Intra* as a consideration for a greater design ecology beyond the body-centric metric. It presages new dynamics in speculative media-matter and body-space generated in individuals, and prototypes an immersive environment of extension / inversion. The prototype has a higher goal, too: to denaturalize classical concepts of architectural space as a form of territorialisation in non-classical parameters. Fundamental to this function is a deconstruction of physical affordances and absolute time. The next part of the interview process – Connection – expands on the agential practice of affordances, and the non-localities of temporality.

04.23a Connection: Affordance

How does one navigate through territory that is unfamiliar to the senses? How do we sense the unknown, and what devices do we resort to using in an evaluation of the unmeasurable? An inquiry into the physiological and psychological states was conducted in an attempt to find just

such variances and relationships. On the question of *feeling* in the space, participants consistently reacted positively, offering descriptions of nostalgia, child-like fun, curiosity, some trepidation, and a lightness.

"I felt like taking off layers. First trepidation, after it was different. A feeling of lightness. I was expecting to feel in the grip of the technology but I felt more light than if it was just the historic shell" (1a).

On the question of *thinking*, responses were much more complex.

While most *thinking* responses did not engage in critical analysis in the moment of actions[20], thoughtful insights developed upon reflection, invoking places of precedence to consider as a comparative experience from the past. In one account, a cathedral space was used in reference to the axial linearity of a passage leading to the existing light filtration above, in the apex of the kilns building structure. "It definitely emphasizes the important lines in the structure – the verticality. This looks very ritualistic with the daylight, symmetrical (order), the corridor, kind of like an altar finish at the end, very cathedral-like" (6f).

Similarly, another response referred to the architectural composition of the promenade as a ritualistic indoctrination of body movement in the space:

"It feels like an early roman basilica in some way where you're nearing the altar, the narthex; this feeling your connecting with something or yourself in a meditative way" (1a).

These insights of a ritual embodiment were seriously considered in the design process. The implementation of a non-classical digital interaction program in a heritage site (alien to the context of biorhythmic data and sensory feedback) challenged the notion of a spatial archetype – specifically, an industrial 20th century brick factory. This challenge then, proposed a variability of interactions between the space and its inhabitants, which in turn afforded material surfaces,

[20]However, Participant 4d did critically inquire about the privacy issues concerning the biorhythm data – if it was being collected, what the artist could disseminate from the values, and what future impacts such monitoring devices could hold without regulation or policy protection.

circulation, vistas, and interactive content for participants to negotiate decisions in order to navigate through a layered space concept. The fundamental question initiating the design process inquiry was of agential space: what role does a designer have in the creation of spatial agency? Is it not counterintuitive to predetermine agential instances for such an open program, and if not, how could the condition of all possibilities be embedded without exclusion? The design response was in part an investigation of what environmental psychologist J.J. Gibson called a theory of affordances, providing conditions for humans (and other species) to interpret within the environment in subjective terms equally relational in non-human effect.

> …an affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behavior. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer. (Gibson, 1986)

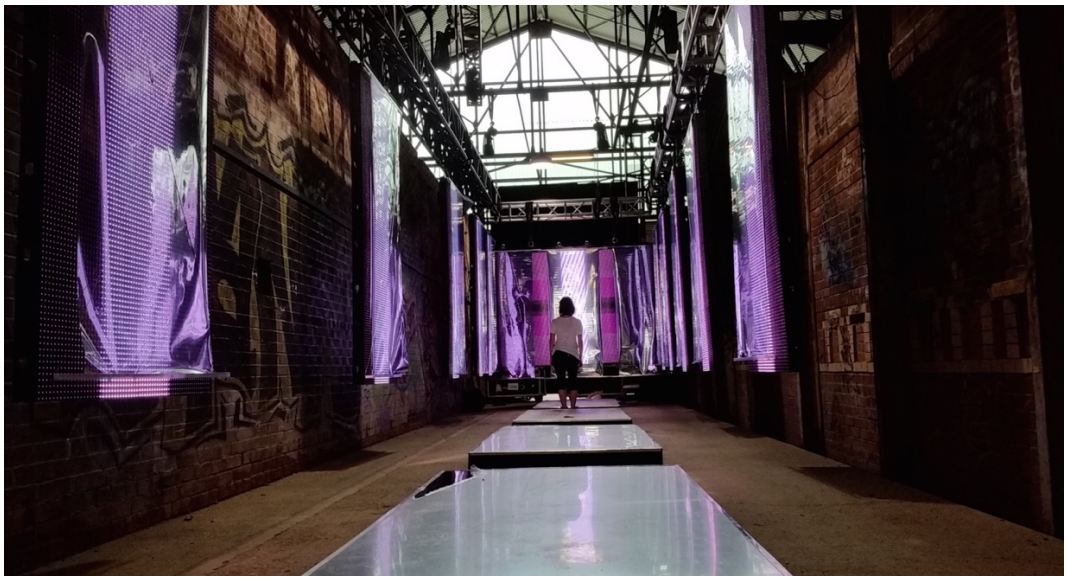

figure 27 North view Kilns building aisle 2. Extra:Muros:Intra, preview August 2016

In Gibson's view, Extra:Muros:Intra*'s* affordances were **physical contents** specific in anthropometric dimensions to the body. Circulation paths negotiated proxemics to walls in

constricted fashion; heights of platforms enacted boundaries, pathways, and seating; elevated media panels exposed and limited access to tactile surfaces and the ground plane, with a median horizon line at standing height; staggered panels of translucent fabric afforded limited but visual access, with a projection surface to walk / wheel-chair through. Affordances were also translated as *cultural identifiers* of social space through formal elements of light, acoustics, material textures, colour, scents, humidity etc. and social interaction. These elements of materiality offered cues to respond and act upon: how one navigated positioning and the speed of interaction in the environment influenced the descriptions of a meditative, peaceful and joyful experience, informed by the de/material content intended for a space of reflection not unlike the cathedral conditions participants were evoking. In non-human ways, affordances were considered in *ecocentric* relations within the environment. The reflective surfaces activated the ground plane in relation to its ceiling; air flow was limited in the aisle; ambient light was reduced; and the potential of water currents flooding the building in the context of the Don river flood plain determined elevations of media infrastructure. The behavioural space was also influenced by the affordances that could have affected the ways in which one positions the self, in stances, motion, and elevation. Early concepts of the space, for instance, incorporated a rising graded ramp, gradually elevating the body with every step / turn of wheel, thereby changing the experience of the common ground vistas into one of a subtle above-eye-level height, a simple but physical technique in changing the body plane. The final platforms implemented were used by participants in various ways, signifying a conscious negotiation of the varying levels at play.

Media programmed in visual / acoustic content were also considered in terms of the environment. Auditory bell rings amplified the open echo throughout the space at large. Visual media in light arranged in a central verticality emphasized the north lighting from above, and extended the single-point perspective of the aisle space through the darkness. Conversely, a

unifying horizon of light activated a continuous awareness of space beyond the limited parameters of the walls and curtains, as one participant described as an awareness built in to the processes of daily human consciousness:

“I did think about this horizon appearing, and then fading away. If this connection to the horizon is something we are intuitively aware of… I kept wondering if there’s a connection to our own reality, to the daily experience, to the horizon” (2b).

The effect of the horizon was an exclusive connection to the human experience of the landscape, yet was not necessarily the same reality to the ‘sentient being’ environment.

figure 28 Extra:Muros:Intra concept, active state. A rising gradual ramp initiates an altered state of physical awareness, through to a translucent threshold with a projection of the actual space, double-layering the digital and physical horizon.

04.23b Connection: Time

> Space has a connection in a continuous way. This is a little atemporal. It makes you feel like you are in an atemporal environment. time is either still, infinite, or it does not exist (3c).

A common experience participants relayed about Extra:Muros:Intra was of atemporality, a frame without reference to an absolute flow of universal time. Some participants focused on the present immediacy within the space, noting the awareness of time as a mindfulness, "making one pause, really feeling every second" (1a), and "…it slowed down for me…. (It felt) like more time is lapsing than it normally would – each little second drags out" (6f). This transformed the sense of awareness from one point of an embodied self into multiple arrays of a disembodied field-presence throughout, in simultaneity: "timeless" qualities were substantiated with feelings of "lightness", being "un-grounded", "levitating", "peaceful", "relaxing", and "meditative". Often, the notion of time was not singular, rather plural: the present enmeshed with the past, or past, present, and future states combined. One participant (4d) noted the many aspects of time operating in different scales, ranging from the site history, geographic and climatic conditions, interior time-displacement of artificial light, to future digital systems of communications. "It's a whole contrast, but maybe it's not exclusive – it's all together; it actually does all work together", the participant confirmed, acknowledging the scalar discordance(4d). For another, the present time consisted of an inhabitation of a centralized space-time: "Because this space itself has an historic background to it – and when I look at technology it is pretty much a future in itself, in a way a future to the past – I was in the middle of it somewhere. I think it was an interesting point of connecting the future to the past and me being somewhere in the middle" (5e).

Perhaps space imprints itself onto the body through ritual practice, proceeding up stairs, through corridors, towards destinations of light. These rituals of movement become absorbed, and the body remembers, recalls the moments in time to the present, assessing the patterns before us. In one sense, when we are faced with a newness of place with objects and surfaces seemingly familiar but altogether strange, we are processing the experience through apperception, using a data base of experiences and memories to evaluate its context. In another sense, we may be

experiencing what digital humanities theorist Katherine Hayles refers to as the non-conscious cognition of knowing, resourcing information unconsciously from within our minds, and simultaneously resourcing, external to our data base. "Enlarged beyond its traditional identification with thought, cognition in some instances may be located in the *system* rather than an individual participant, an important change from a model of cognition centered in the self" (italics added) (Hayles, 2014). It is a mutual exchange, a transference of information between objects and subjects in dynamic hierarchies mutually defining their relationships. Time, it seems, retains a time-space relationship, not of the classical time absolute but of a time-less time, or *time-fulness* that is immanent as the spatial field it inhabits. Fluid and dynamic, time resurfaces the past into the present, as past events and memory serve to inform us how to navigate into the unknown. A (future) history is layered onto the present surface informed by the larger system of cognition, projecting actions of a performative magnitude, towards future becomings, and of agential trajectories defining meaningful spatial matter. In essence, a space of agency is a performative action in its becoming in the quantum time-space field.

04.30 TransforMatter

Matter oscillates. It transforms, as much as it is transformative. In the act of transformation, a performative action of matter and meaning is at work – mutually exclusive, independently operational, and yet entangled in space-time. If in the material production of space, the interface of the body and the environment is designed to bring us closer to the dynamically charged field – a field of actionable relations both discrete and interconnected – the potentiality of spatial agency is that much closer to a future of plurality. Space becomes us, not only in corporeal extensions, but also in a mutually defined re/cognition of a greater ecology embedded in the

infrastructure of material, immaterial, digital, psychic and virtual worlds[21] that such classical standards of spatial constructs would delimit. Thus it is critical to consider the consequences of disciplinary practice in its systemic form of traditional language and anthropocentricism. The very language that, in the purview of Judith Butler, Barad subverts in the scientific field (Barad, 2007, pp. 59-66); Ebeling challenges toward Walter Gropius' rational functionalism (Papapetros, Future Skins: Text as Membrane, IN Space as Membrane, 2010, p. xiv); Bohr embraces in Werner Heisenberg's indeterminacy principle, to account for differencing in Complementarity (Plotnitsky, 2010, p. 222). In *Extra:Muros:Intra*, the language of spatial matter is under investigation. From transient thresholds to animated walls – or are the walls portals to the body? – , public zones to intimate thoughts, passive affordances to active surfaces, digital presence to bodily information; a re-ordering of principles are at play. Observers within the apparatus are suddenly aware of their part in the process – they are participants accountable for the program / content which is of a material force that is veritably felt – a performative language of space in recursion. In the same capacity, the definition of quantum time as an infinite material of the field, layers multiple opacities of temporality. Time is also an embodied experience in nonlinear affect, dynamically inhabiting the past which in turn informs the present layer. It reconfigures patterns in the material fibres, projecting desires into future skins. Engaging time as a material agent with generative capacities past/present/future is to consider the mutable within and beyond the architectural program, without the monument of architecture. Space and time are materials of transforMatter.

[21] Barad refers to the quantum problem of defining a vacuum state void of all particles. Since the void state of nothingness is practically impossible to determine, there may or may not be particles present: she refers to this state of being/non-being as "virtual particles". Karen Barad, Transmaterialities: Trans*/Matter/Realities and Queer Political Imaginings 2015 p395.

04.31 Transmaterial

As a material study, Extra:Muros:Intra is a reflection of the constitution of feeling. But what a quanta of feeling consists of is elusive, and even more difficult to measure. Materiality – the thing-ness of matter – has a tactility, a touch, a surface; and it possesses a feeling, an emotion, an awareness. Through the explorations of a tectonic and tactonic arrangement, a responsive architecture considers how material, immaterial, and *transmaterial* elements affect connections and actions in the hybrid space field. Transmateriality, according to Mitchell Whitelaw, is a production of "an aesthetics of presence" (Whitelaw, 2012, p. 223).

> It applies media technologies as concrete, material, and present- with-us rather than as transparent conduits for immaterial, informational content…(that show how patterns can traverse material substrates as the embodied is dynamically reembodied. This is transmateriality: a view of media and computation as always and everywhere material but constantly propagating or transducing patterns through specific instantiations.

Presence in digital media is not to be confused as representation. Transmaterial environments have a material affect in positionality, oscillating from static to live objects, from structural object to subjective protagonist, countering and re-encountering spatial conditions in transaction. In this sense, transmaterial presencing is a social and political negotiation of hierarchical orders in matter continually changing, altering transactions of dynamic relata. Consider for instance, the LED wall panel, a light-producing interface of the body's intimate rhythms. In its dormant state, the panel is mute, although ever-present in a suspended form under a reflective-mirror surface. The formal verticality in repetition contrasts the graffiti-covered brick walls, and it is a structural component mirroring the proportions of the reflective platforms on concrete below. Once activated, it is a material change, producing a dynamic condition primarily between surface and body behaviour, fluctuating in 1-second feedback intervals (the Processing visualization appears to be continuous in response, infilling the gaps between the incoming data streams). The

architectural-scale 'screen' is a reductive disembodiment of colour and light, reconstituted and distributed in digital materiality. But the question of whether one can feel this material is significant to the research. One respondent described the experience of body-media exchange in detail, noting the physical and psychic transformations that were occurring. At this point in the installation the participant had spent a duration of over 15 minutes, using the platform closest to the screens to feel the immersive effects of the medium, and described the details of the apparatus:

> I really enjoyed (when I) closed my eyes, and just let the buzzing sounds, the gongs (ringing bells), and the light… intensities wash over me and that feedback built in felt really good. ()…It was a release of tension. The focus on the now…it became a warm feeling of comfortableness – it was very relaxing, in particular with your eyes closed ….(8h).

The participant continued to describe a "disappearance of the space" as you became a part of it, the experience subsuming the physical parameters, focusing on singular details "like it's the last thing you'll hear, the last you'll see, but it was also very warming and calming at the same time … and you're leveraging that trope consciously or unconsciously through the abstraction, you're giving the user the opportunity to apply the trope". A mediated unification of body and space through digital presence was conveyed through a feeling, a transmaterialized *condition of the **im**possible*, offering an insight on what it was like to experience the wholeness of the ultimate trope: of death and dying.

Non-human matter has equal affect to the human condition, at any given moment, in qualitative material value. The ubiquity of media, digital communication, and therefore presence is inherent in material hybrid spaces, re-emphasizing the concept of matter as an ontological medium that does not distinguish between body surface and tectonic surface boundary – digital, machine, body, surface, energy – digital extensions as membrane and matter fusing together. Fluid

territories of synthesized relationships, creating, diffracting in patterns which we relate within, is an act of agential differencing.

04.40 BlackField

The experience of the transmaterial connection between the participant's biorhythms to the media content displayed at large was observed to be of a personal engagement. There was an intimacy that developed with the apparatus, as participants explored the extents of the many variables orchestrating the generation of content and the output of audio-visual patterns. As the visual and auditory media corresponded in variations of duo- tones and binary axial planes, no two intra-actions were alike. For example, some participants (of, and outside the study) would achieve variations of a full-screen effect of bright white colour, corresponding to data values consistently greater than a >80 theshold of state 2. While adults who experienced this result attributed this effect to a particular method (breathing, closing eyes), it was also noted that a young child (accompanied) experienced similar results, with little applied method of concentration, walking briskly around the space, touching the surfaces of panels. When a sibling child attempted the same, the results differed, with a low threshold in the two states of data (once again, it must be stressed that the results with the device and apparatus employed cannot be conclusive in any medical prognostication; simple variances of the contact points on the sensor input pads of the wearable device may have been a factor in the readings). Regardless of the frequency, colouration, and patterning of the A/V output, the participants had a tendency to gain interest and invest time to explore and discover, and to perhaps find a reflexive, meaningful insight into their own actions through the interpretive medium.

figure 29 Extra:Muros:Intra threshold >80 state 2, 'WhiteField'. September 2016. Still from video- Umar Amanullah

Throughout the duration of the installation set-up, testing was conducted prior to, during, and post-event, trouble-shooting technical aspects of the specific site conditions. Nocturnal creature visitors, inclement weather and flooding notwithstanding, factors such as humidity, hardware connections, auditory fields of microphone feedback, lighting, crowding and ambient noise (amongst other hardware-software nuances) changed the relationship of the experience and the site day-to-day. At the end of the cycle, specific site conditions became evident in the process of relating to the environment with the digital interface. Although subtle at first, it was overwhelmingly evident the site itself had an agency of affect on the digital material. Here I will elaborate on where I left off with the circumvention of analog sound (03.34 – Light // Sound).

As mentioned, the original program of the Processing interface consisted of a built-in feedback system (Minim plug-in), generating an awareness of sounds produced by the participant and picking up feedback in the environment. This feature was tested in its native laptop output using the comfortable parameters of a studio space, filtered from distractions. When the program was

set up on site, it was assumed that the feature was inactive for two reasons: the input microphone was analog – it was not connected to the program to generate the desired echo delay, rather it was picking up ambient sounds and amplifying it in true fidelity; feedback was not present in the activation testing…at first. At some point early on in the public installation it was discovered that unannounced feedback would occur, but not in the manner that was generated in the program. Seemingly random, the excessively loud feedback was mitigated by lowering output channel volumes. Thereafter, testing was conducted to determine when and how the space would produce the feedback. While a definitive cause is unknown, the following observations were made:

- The distance between the wearable device to the laptop from which the wireless signal was received was a potential factor. Feedback occurred more often when closer to the immersive part of the environment
- The Processing code continued to initiate the feedback in a latent state, yet was exclusive to one set of a dynamic relationship between the participant's state 1 data. In other words, when a participant consistently achieved >80 input on a particular state of biorhythmic feedback, eventually it would activate a progressive 'black' state of the colour spectrum coinciding with the overriding feedback noise
- The black field of feedback would cycle through to a full screen, then cut out abruptly, returning to the continuous waves of input as before
- Testing was conducted post-event on the native hardware as conducted prior to install. The black field state was replicated once, never repeated

Consequently, not all participants experienced the feedback potential, however this did not diminish the quality of the respondent's feedback. On the contrary, the variances in the output of the program spoke on many levels to the agential autonomy of the environment and the conditions of the TransforMatter. On speculation, possible factors of the unique feedback could be attributed to the physical condition of the structural brick wall barriers and surfaces within the space, and the proximity of the wearable device to the receiving laptop. Wifi signals had a longer distance to travel the deeper one became immersed in the environment. The laptop was not readily exposed, which may have inhibited the signal reaching the wireless receiving device (dongle). The cycling of the black field process was suggestive of a looping error that, once reaching maximum threshold, reset to the beginning. As the input data streamed once every second, there is a potential that the time delay of the wireless signal, compounded with the distance to reach the program enabled a window of time for a function to recur without refreshing, thus the BlackField effect. It is also possible that the audio speaker hardware generated feedback based on the proxemics of diffracting particle frequencies or waves in the environment.

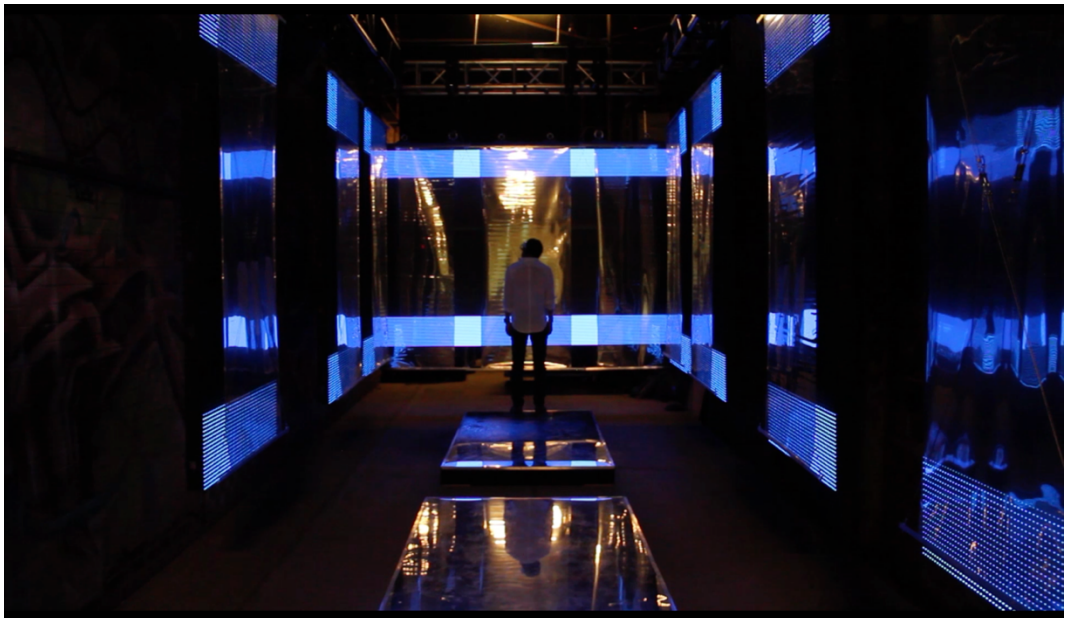

figure 30 Extra:Muros:Intra threshold >80 state 1, 'BlackField'. September 2016.

The speculative nature of the BlackField effect remains unsubstantiated, for it is not known why then the *WhiteField* (State 2>80 threshold) did not produce the same results. It is certain, however, that it was possible to achieve an affinity toward the apparatus. Not a determinate certainty of events, but an affinity toward the fields of action, understanding the nuances of specific positions in the design layout, cueing bodily movements toward a frequency, pushing a sound beyond a threshold, mindful of the zeniths and nadirs of light and the corresponding emotions. These feelings that are internal – externalized, inverted, become tangible in thought and breath. Observer-turned participant, the apparatus takes us deep into the animus of the inanimate in a quantum field that reveals but one micro view of the infinite idea Ebeling proselytized. The idea was given form, and will continue to take new forms with different sets of experiments, apparatus, and methods of inquiry. From there,

> Der Idee wird folgen die Gestalt.
> *The form follows the idea.* (Ebeling, 1947, p. 16)

04.50 Conclusion

Extra:Muros:Intra illustrates a method of inquiry of an internal structure. It poses questions in a subjective view from the interiority of the field, asking what the nature of phenomena is relative to the likeness it presents to us. On the one hand, in a post-positivist view of research, the nature of the phenomena in question may have an infinite set of variable measures, yet the ones we observe are in the subset of one common denominator. We cannot know what it is like to see beyond the lens of human comprehension, entangled in the measuring apparatus. On the other hand, we cannot know what we do not, until – as Ebeling declared – we create the content for it (Ebeling, 1947, p. 1). Ebeling upholds the process of creation as the only thing that matters in the pursuit of measuring the immeasurable. And in this way, it is imperative the unknown quantity

remains indeterminate, in order to sustain the continuity and diversity of the creative drive. To entertain this idea further, the concept of an absolute measure is the end of all desires, of heterogeneous existence, to which Niels Bohr responded in a post-structural principle of differencing through complementarity. Thus in this research, a differencing of findings are self-generated and self-referential, offering a "subject-dependent internal insight" (Biggs+Büchler, 2007, p. 68), but should not detract from the rigor of the design process that was developed for the qualitative insights of *presence* and *being* in a transmaterial field relationship.

The apparatus had set up the spatial conditions of an experiential inquiry, a space to feel and to explore the interiority of subjective experiences. In contrast, the design problem was never to valuate an application that would be a beneficial to a real world environment; no quantitative measures were applied to assess the dimensions of a successful research-creation. For this reason, rating scales of emotive or rational engagement were not included. What was beneficial (and exciting) to the study were the immediate unmitigated responses describing the indescribable experiences and emotions, through conceptual narratives that attempted to connect one's embodied journey through a specific intervention by design. The disruption of spatial boundaries opened a dialogue between the public and private world, creating a space enabling a person to inhabit both physical and psychological parameters, an interior experience which was shared in intimate detail.

In some instances, participants asked if what they were doing in the space – moving, thinking, generating patterns of sound and light – was 'right', or what the generated visualizations determined. It was important to reassure the participants there were no right or wrong actions, even if an absence of binary determinacies complicated actions. One finding is certain: in the varied interviews collected from a small but select sample of participants, the diversity of in-

depth responses helped to garner an expanded knowledge base and understanding of the spatial experience, far greater than a control group under specific direction and measured responses. This method of investigation aided the reflective analysis process, and provided critical perspectives in a collective network of non-conscious cognition. The interviews were but one aspect to the investigation: the BlackField study, transmaterial effects, materiality, site synthesis, anthropometric design, cognitive and behavioural intra-actions…all were parts of a whole from whence the idea came from (*from the whole, toward a wholeness*). Critical design research entails the rigor of creative diversity, seeking new methods to address homogeneous applications of classical space. In other words, a polyvalent interdisciplinary practice advocates for a design complementarity inclusive of many voices and approaches within the process, toward an inclusive space. As Niels Bohr did not consider indeterminacies to be a falsification of scientific methods nor a debasement of knowledge, the philosophy-science approach informed his decision to consider the infinite methods of understanding phenomena as a means to embrace diversity. As a designer operating outside conventional categories of identity, inside a multitude of singular yet differentiated practices, I couldn't agree more.

05 Conclusions

05.10 Summary

At the opening of this paper, the narrative of one of the world's leading physicists on the cusp of atomic annihilation-creation was said to have cast a long shadow of self-doubt in front of his career, speculating on the morality of a field of potentially unconscionable effects. If Werner Heisenberg's own personal uncertainty was a defining moment reflecting the ontological break-down of the scientific field, Niels Bohr's convictions in a philosophy-science was a reconciliation. Bohr's complementarity principle acknowledged and affirmed our constitutive presence in an entangled field, revealed through the different forms of apparatus. Witnessing phenomenological events of non-linear states outside of absolute definition and measurement, complementarity accepted the human condition as but one variable producing a material effect in the method of observation. If Heisenberg's dilemma was a tale of morality, Bohr's epistemological approach was an inclusive philosophy of difference. Neither rejecting nor negating variance, Bohr's framework was all-encompassing and accepting of a greater network of possibilities. This notion of inclusivity reconsidered the conventional emphasis on perception and awareness from an anthropocentric measure of the world, as Bohr understood how the inextricable entanglement of human observation through the apparatus resulted in human conceptual relations that could not have accounted for non-human phenomena actions. In contradistinction from Protagoras' *measure of man*, 'man' is decentralized; the other, non-human elements are in existence to a measure outside of the scale of human conception, but does not require mutual exclusivity; rather, quite the opposite is proposed. Barad explicates Bohr's important insight in posthuman terms: "Posthumanism does not presume that man is the measure of all things. It is not held captive to the distance scale of the human but rather is attentive to the practices by which scale is produced." (Barad, 2007, p. 136). In

acknowledgement of this shift in a consciousness, this project – in particular, Extra:Muros:Intra – first seeks to apply a method of design complementarity into the practice: a practice of epistemological plurality (Miller & Miller,Baird,Littlefield,Kofinas,Chapin,Redman, 2008) as a model of ethical values to navigate the encounters of unknown variables in the pre-determined construct of classical design; then accepts a responsibility of subjective influence as a part of the apparatus. We are faced with the question of what we bring in to the scope of observation through the apparatus used to determine properties of phenomena, and what conditions and elements we are aware of in the process. To Ebeling's point of creative exploration, we gain an insight to the part of the wholeness of an idea we do not know, perhaps cannot know in its entirety, and find new expressions of material engagement.

In regards to my own process, I have come to terms with the role a designer may have in the meaning-making of environments, which began as an uncertainty in identity, too. What role, I asked myself, could a designer have, with the intent of developing a space of agency, when the practice and industry of design requires a disciplinary mastery – a closed loop process – with a finite resolution? As Heisenberg asked, what moral right does one have, to assume authorship of a service for others? Through a reflective process, I also began to ask why I chose to consider alternate methods of practice outside of any one dominant discipline. I believe it derives from a place wherein my interiority has always been decentralized, in a real-life apparatus that has affectated, and has been affected by agential forces, positioning my identity outside of a central point of the field. There is autonomy on the peripheral edges, traversing fields. There is also the lure of the event horizon. In the end, every point in the field, the constellation, and the dynamic *freien Raum* is mutually exclusive, yet interdependent to the constitution of matter in transformation.

05.20 Extensions – further development, applications

Potential development for the BlackField experiment that emerged from Extra:Muros:Intra would include a rigorous reworking of the interactive interface, and variants of the audio-visual feedback. Haptic feedback would also be explored, with transducers in a felt presence. Simultaneous, multiple participant engagement would also be of interest, to consider the social advancement of space. Further to this, a refined exploration in the neurofeedback data is an opportunity to explore cross-disciplinary research.

Ebeling's German text Extra Muros requires a further, in-depth analysis, in particular to his affinity with Kantian concepts shared by Bohr. Ebeling's *kraftfeld* bears a similar – if not direct – relationship to the particle science of physics, wherein matter is the constitution of the intra-connected field Ebeling considers as the source of energy to be harnessed, and to be critically engaged with in ethical choices of design. A survey of German philosophical work of the early 20th century, paired with a comparative literature analysis of the Copenhagen School of physics would provide context to Ebeling's discourse outside of the Bauhaus school he rejects.

Reflections on my own agency and identity as a designer have been initiated from this process, which may provide new insights to alternate design methods of production, and meaning of the studio research practice.

figure 31 Preliminary studies: O'Keefe Lane, Toronto ON Canada 1

figure 32 Preliminary studies: O'Keefe Lane, Toronto ON Canada 2

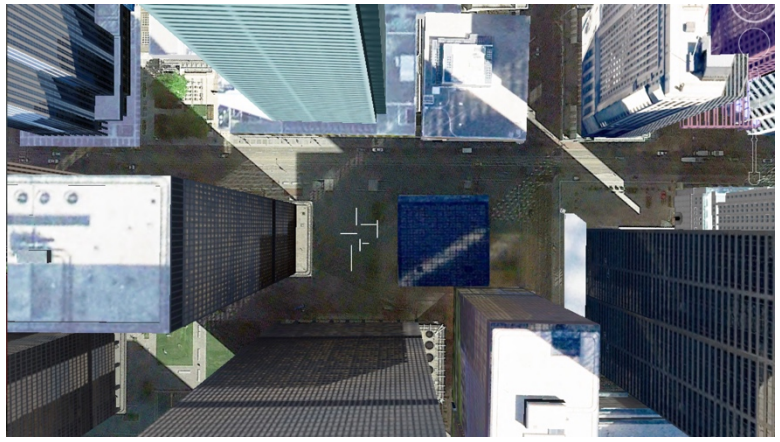

figure 33 Preliminary studies: Commerce Court, Toronto ON Canada 3

figure 34 Preliminary studies: Commerce Court, Toronto ON Canada 4

figure 35 Preliminary studies: City Hall terrace, Toronto ON Canada 5

figure 36 Preliminary studies: City Hall gardens, Toronto ON Canada 6

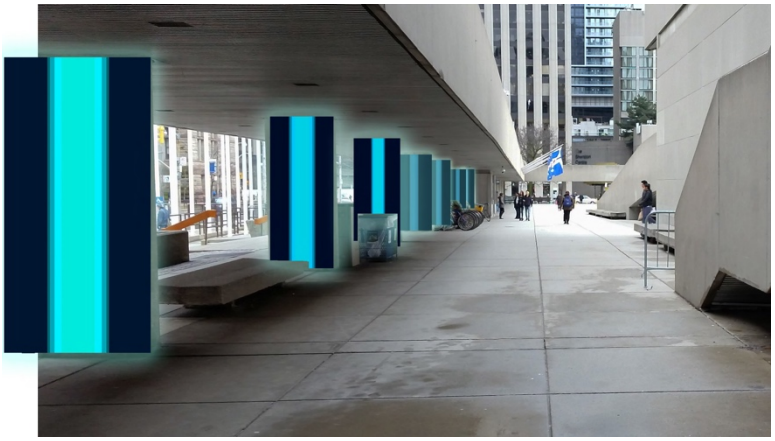

figure 37 Preliminary studies: City Hall lane way, Toronto ON Canada 7

figure 38 Preliminary studies: City Hall lane way, Toronto ON Canada 8

18mm LED panels	320sq ft
7mm LED panels	80sq ft
power cable	480 linear ft
Trussing	120 linear ft
extension cable	
1/8” x 4’ x 8’ platforms w/ acrylic mirror	4 (128 sq ft)
3/4" 4ft L aluminum channel –	232 linear ft
1/8” x ½” 3ft aluminum flatbar –	144 linear ft
reflective mylar 3ft width –	315 sq ft
white poly lycra translucent mesh fabric	136 sq ft
Stove bolts -	222
Cheeseborough clamps	80
Reinkus Heinz audio speakers	4
Microphones	2
Black draping	12’x8
Velcro tape -	100 linear ft
Aircraft cable -	400 linear ft
Aluminum sleeves -	200
Turnbuckles -	34
Angles ½” x 4” -	28
Hooks-	56
Wood screws	100
Eye bolts	56
Foam tape -	100 linear ft
Black vinyl non-slip 3M	25 linear ft
scissor lift	
liability insurance	
6 installers X 24hrs	144hrs I+D

figure 39 Pre-production assembly and materials

figure 40 Preliminary testing with 7mm LED screen

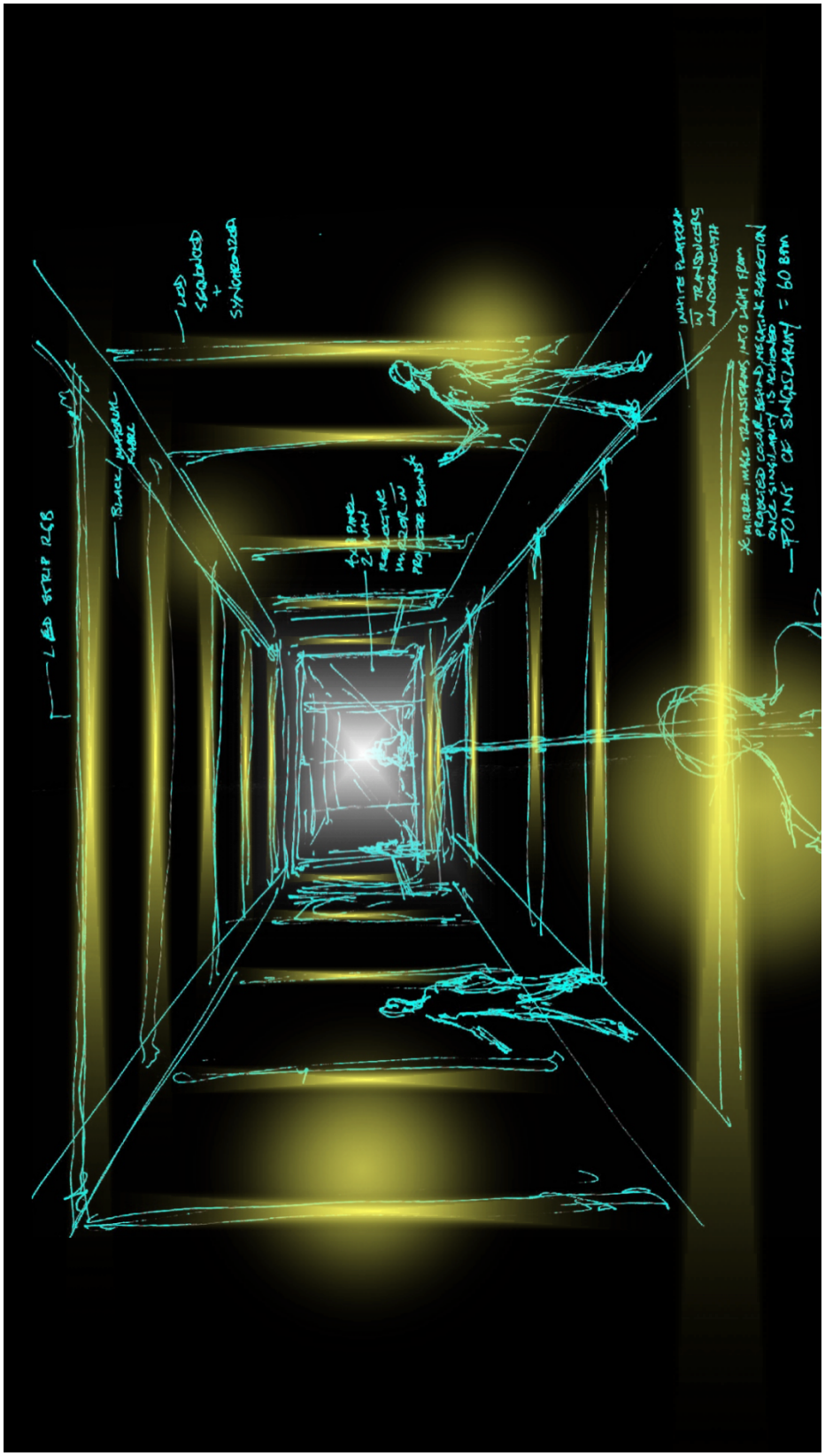

figure 41 Concept: meditative room, Point of Singularity, 2015

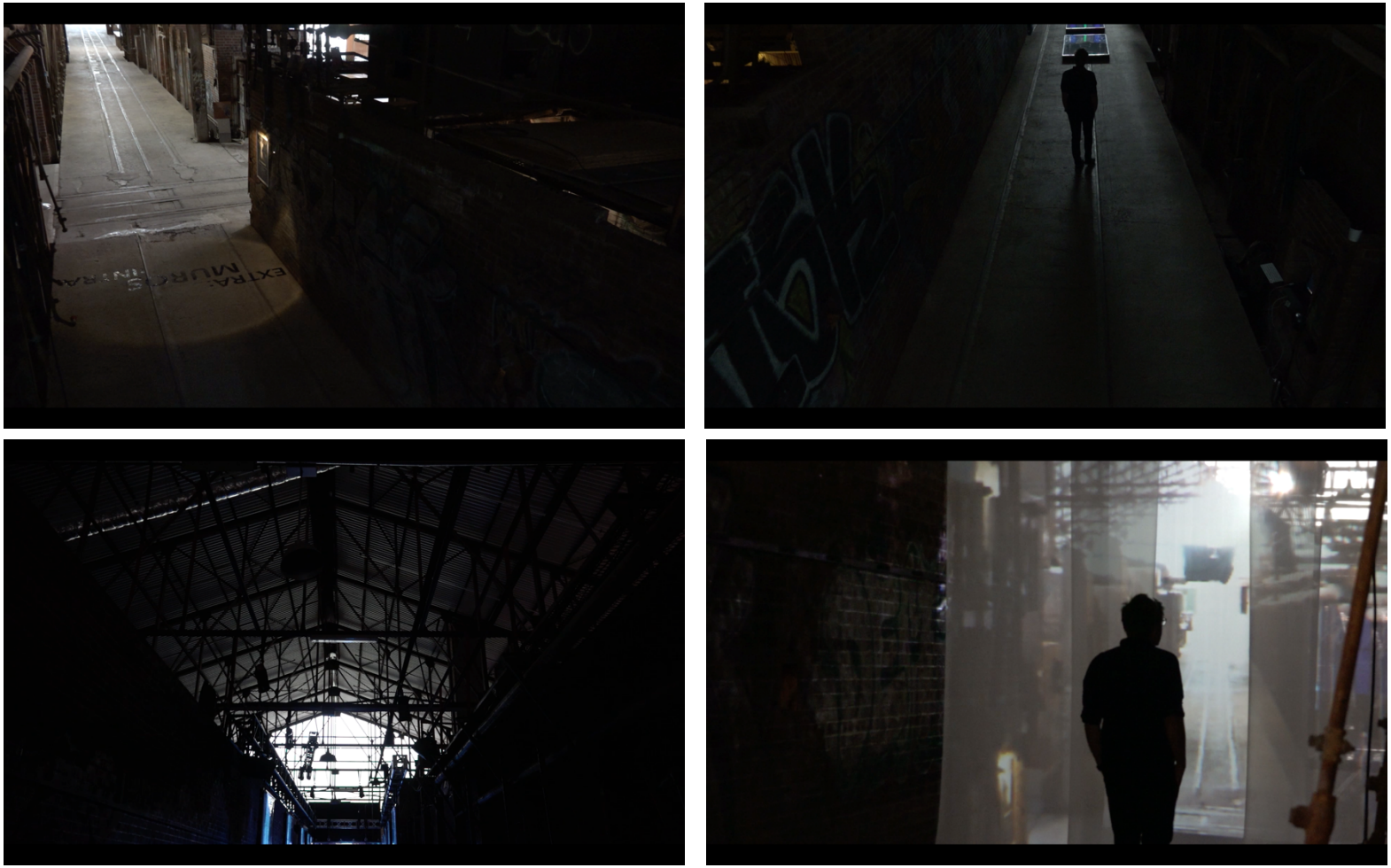

figure 42 Stills from video documentation, *Extra:Muros:Intra: Beyond the Walls*. Video Courtesy Umar Amanullah, 2016

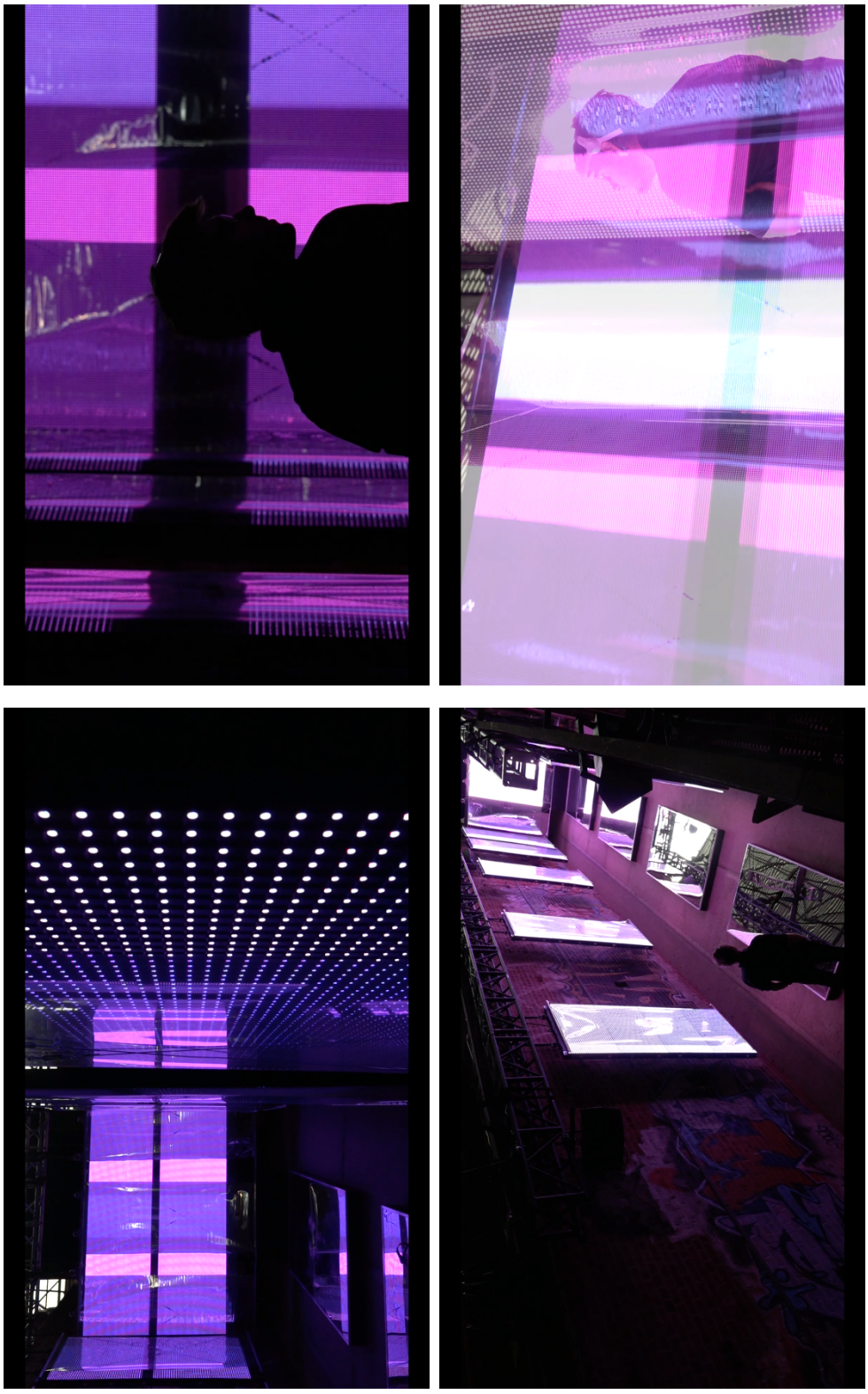

figure 43 Stills from video documentation, *Extra:Muros:Intra: Beyond the Walls*. Video Courtesy Umar Amanullah, 2016

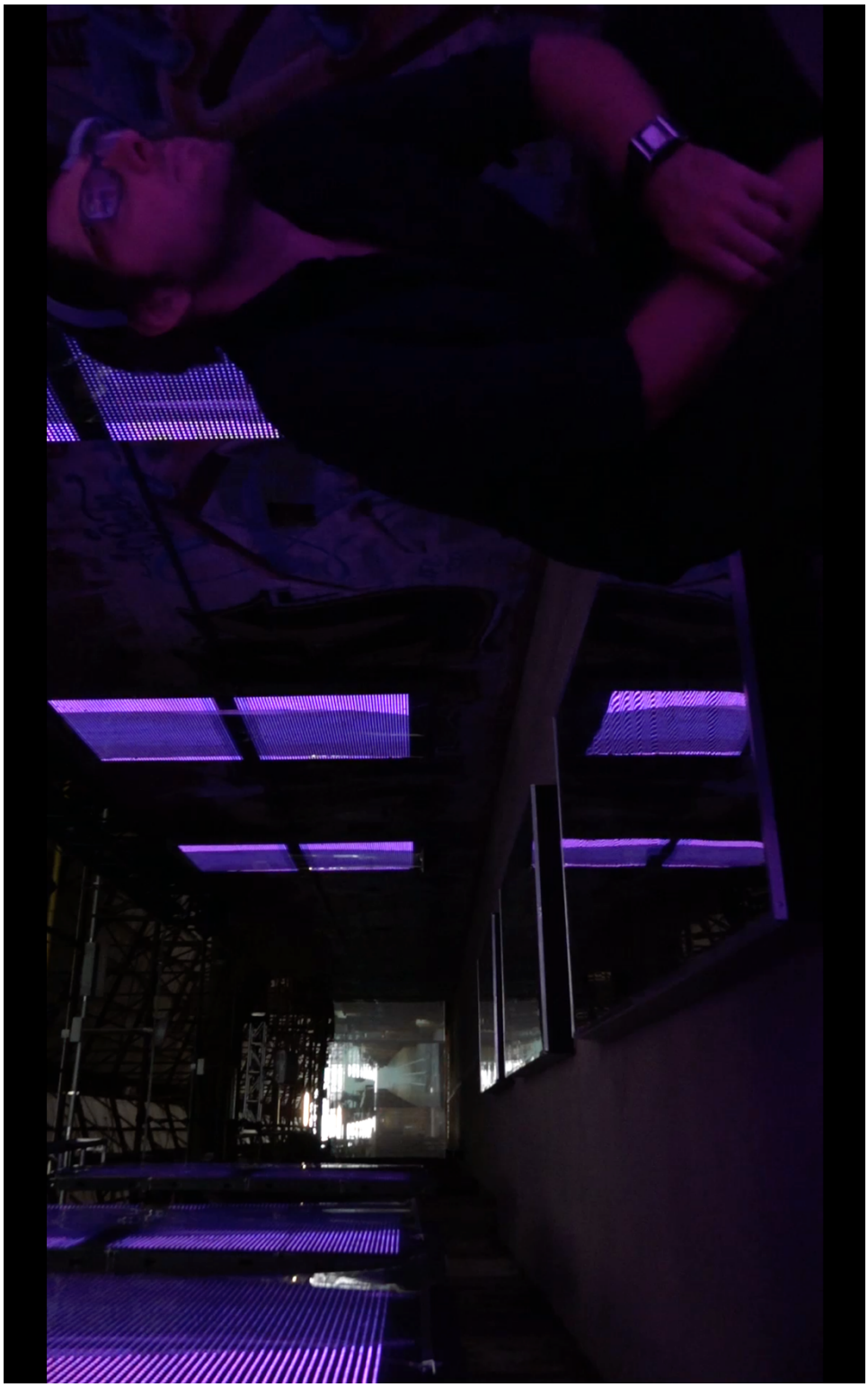

figure 44 Stills from video documentation, *Extra:Muros:Intra: Beyond the Walls*. Video Courtesy Umar Amanullah, 2016

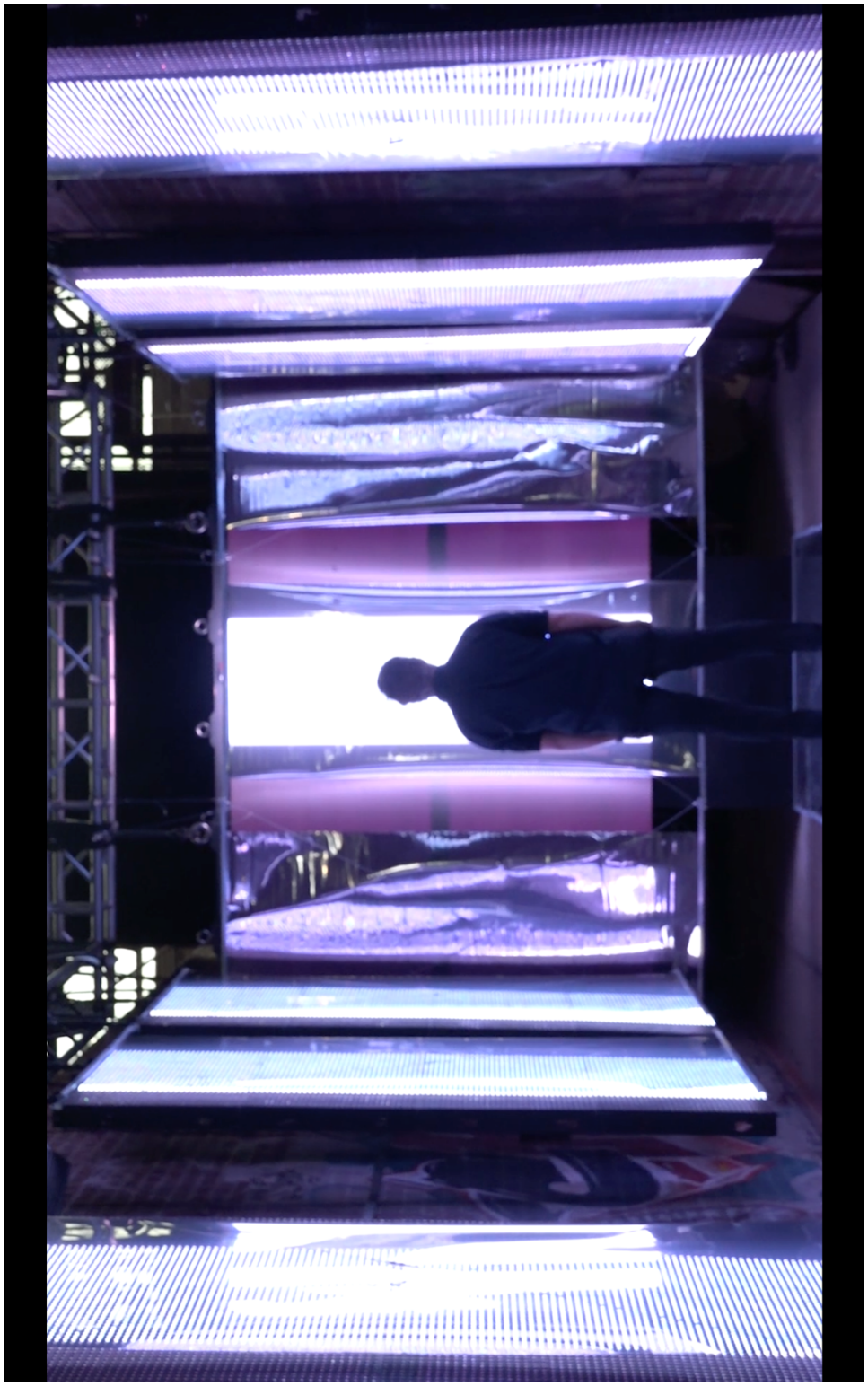

figure 45 Stills from video documentation, *Extra:Muros:Intra: Beyond the Walls*. Video Courtesy Umar Amanullah, 2016

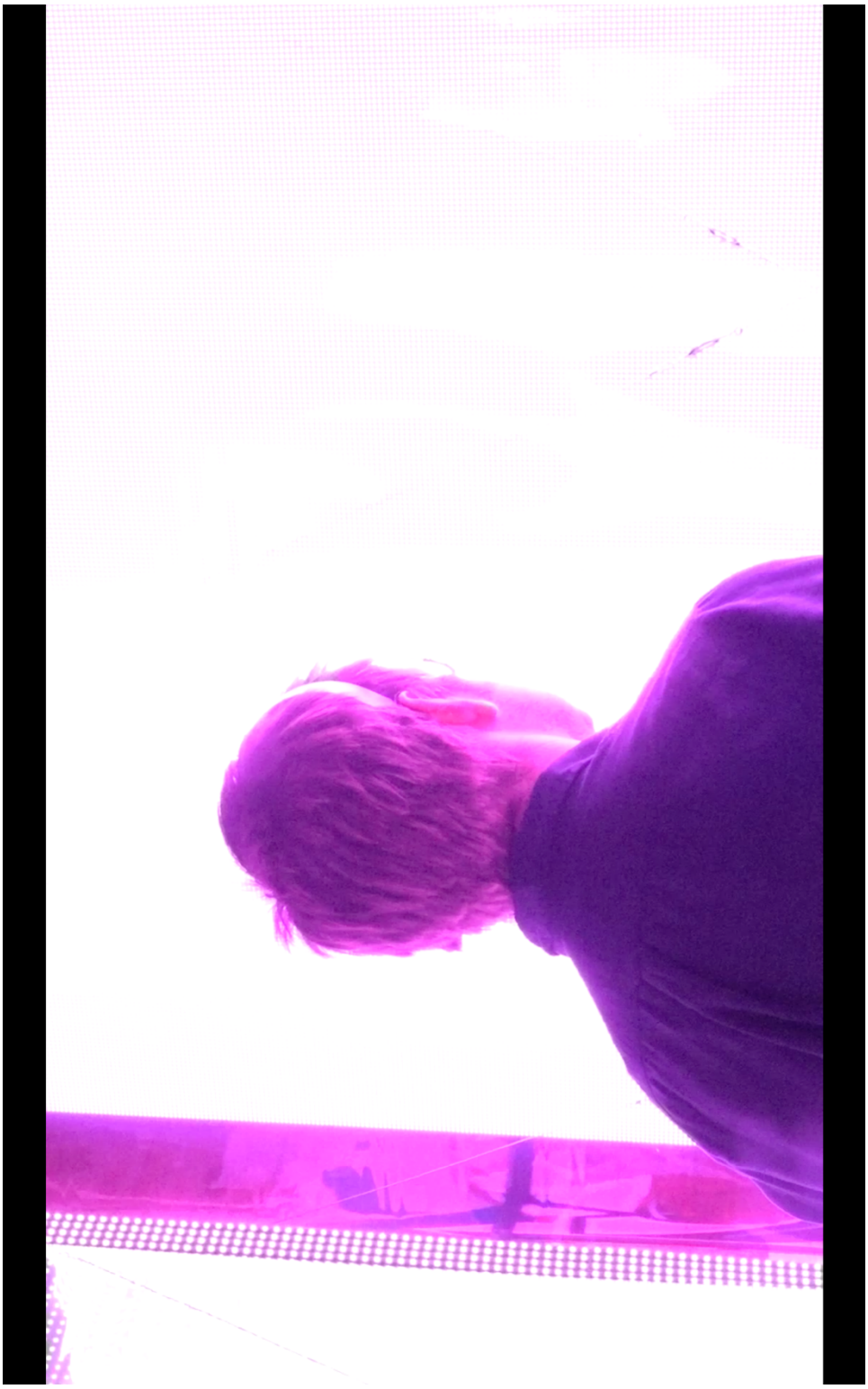

figure 46 Stills from video documentation, *Extra:Muros:Intra: Beyond the Walls*. Video Courtesy Umar Amanullah, 2016

figure 47 Extra:Muros:Intra Graphic

Art Exhibit & Demo— Extra:Muros:Intra: Beyond The Walls

Extra:Muros:Intra is an interactive space integrated into the historic site of Evergreen Brick Works. Using wearable technology, a participant's state of awareness is captured with sensors and visualized in a digital landscape of colour and sound, creating a feedback of virtual presence in the material environment.

As digital fields of communication and automation become ubiquitous in the city, Extra:Muros:Intra seeks to disrupt the invisible process, re-connecting our awareness to the present moment. The exhibit seeks to reveal the historical "presence" of the Brick Works in a virtual invocation of the senses, and to address the potential future of a digital and physical space.

Extra:Muros:Intra returns to a place of the past where the materiality of brick-building began, asking us to re-imagine what a space without static boundaries could be like, how "unboundaries" might extend beyond the walls – extra muros – of conventional wisdom exploring new connections in interdisciplinary design creation.

figure 48 Extra:Muros:Intra Site Information
https://www.evergreen.ca/whats-on/event-details/12442/

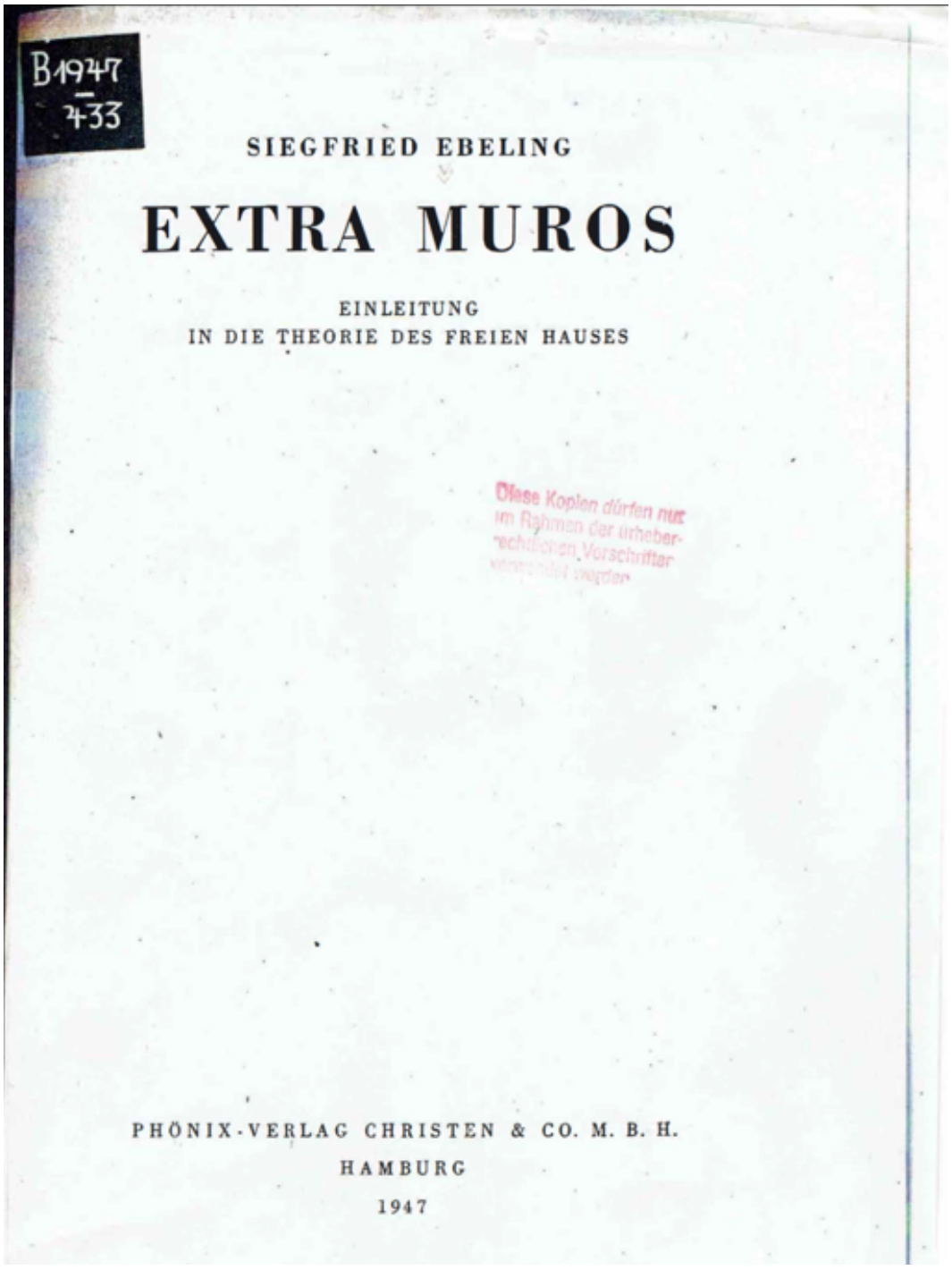

figure 49 Extra Muros Document Courtesy of the Staatsbibliothek, Berlin, Germany

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06.10 Cited works

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07 **Appendices**

07.10 Appendix A: Transcripts

AWARENESS
1. In your own words, how would you describe the experience? Key words, sensory connections, physical attributes.

Subject 1A
Psychological, intense experience, making one pause, really feeling every second…wanting to have it persist after you stop, wanting to actually go back, addictive, compelling one to go back to keep affecting the environment.

Subject 2B
Eyes were locked onto the horizon …The audio reminded me to focus (on the horizon.) this desire to walk on the shiny surface – even though it kept going down and having to climb up, I kept wanting to return back on the reflective surfaces rather than walking on the existing ground and kind of floating in this in-between space.

Subject 3C
It was interesting, a little bit confusing – because you don't understand how the connection between what you're seeing and you're hearing is related to what you're thinking and feeling so you understand there should be a connection, but you feel that you can't control it – so I was trying to think of something and focus and relax in another way, so it was confusing. Because it is in an open environment and there's other people around, you might not have the tendency to be relaxed. So if I did that by myself (and time) I'm sure I would experience it differently. I would say that it should be both (an intimate and public experience). In addition it should be an intimate experience.

Subject 4D
I was interested in what kind of colours would appear- I noticed the colours would change with my touch. I was moving around slowly around the mirror platforms, move in between the light fixtures, kind of touch the plastic. I was trying to be cautious…but I was obviously curious. I tried a little experience I started to breathe quickly and I started to notice different colours. I was curious to know if the colours would react to me, but I was kind of reacting to the colours as well.

Subject 5E
For me it was like an introception that's something I could externally experience at the same time. So I was trying to go thru a lot of different emotional states that I could probably just see them – I could not just feel it but I can use my other sense, visually see it and be more impacted.

Subject 6F
Conducive to introspection, making you hyper-aware what your body's doing. Allows you to get in touch with your boundary and you can do more things – like I felt like I could increase my heart rate or decrease it – often felt like a sensation of chills or shivers run up my spine and into my head, (thru that) I am pretty sure I was able to change the light.

Subject 7G
I felt joyful – it made me real happy to be in the space. At times it was overwhelming because of the sound. The atmosphere was quite calming – I thoroughly enjoyed it. Re: overwhelming: when you are completely surrounded by the LEDs and there is sound feedback, it can be overwhelming but not necessarily in a negative way.

Subject 8H
The key experience was of meditation and peacefulness – a recursion. It started to key in the longer I was hooked up to and experienced it …curiosity, overwhelmed. Visually, there was a contrast between the (site) and the digital work (e.g. physical attributes of the floor) and trying to figure out what is interacting with the (wearable) headpiece.
At first walking in, the space feels really controlled (less so because of the physical parameters) once we moved into the main space in front of the lights, I stood in front of them,…I found it actually better to close my eyes – that's when the sound became more acute,… and instead of focusing on the light pattern it just became an intensity of light and the buzzing that came out of that, it provided a feedback – increased both (the buzzing and intensity) qualities – and that's the purpose of the wash-over (effect). It felt cerebral, and the meditative gong did its job…klept me on track and I didn't want to leave. And so it was almost like a warm aesthetic experience when your eyes are closed and its colder when they're open.

2. In regards to the physical space, what aspects (if any) did you become aware of? Expand.

Subject 1A
The sounds definitely at certain stages made me pause – I wasn't sure if the music was affected by my state so I started probing around taking a sudden stop and taking a look at what I was looking at was affecting my mood and sounds – it was a bit of back and forth.

Subject 2B
Its immediately a space that sets you apart from the existing, so you feel enveloped in this new space also I started to perceive the resolution of the lights how they were pixelated – at first you see the entirety and the colours and then you start to focus on the lights and it becomes little pigments or pixels so you go deeper and deeper into the physicality of the surfaces.

Subject 3C
The way the environment is set up made me focus on the visual of the colours and the lines and the sound – I kind of didn't pay much attention to the site. That confused me…this same setup could have been in a closed… room. So I lost the connection of the exterior environment and was confused by the setup of this experiment with the colours, lines and sound. The stepping blocks – that you just walked on and off - was part of the experience.

Subject 4D
The space is like a hallway conventional, going up and down the mirrored platforms. It is a little bit like a room, it is different and removed. It feels intimate, even though its open.

Subject 5E
I was probably trying to grasp and intake more of my surroundings and I think because of this location, I was trying to be more mindful of what was around me – not just in terms of what was around me, but as a whole space. The space itself is so old, and I was trying to go back in time and understand how things would have worked then and how does it work now. And then I was

concentrating and focusing on my own surroundings I think I did have a point where that visual will start expanding.

Subject 6F
When I was up at the front I closed my eyes, I became more aware of the light – I sensed it peripherally – but I felt like I could feel it through my eyes, but I could just – feel it.

Subject 7G
I was aware that it was my own thought patterns that were creating that overwhelming sensation. It didn't make me panic, but it made me mentally frantic to make it stop*. That feeling like you have control but you really don't – that's the overwhelming (feeling). I guess it's about myself bc if your thought patterns are having an affect on your environment, and your environment is responding to your thought patterns, then what does it say about your thought patterns when you cannot control them enough to make your environment harmonious? It made me more joyful when it stopped the screeching.

Subject 8H
The contrast btw the space of the historic, in opposition to the techno aesthetic. It was exploratory (the circulation). The buzzing of the monitors as the light increased ended up being meditative. The longer I was there the more cohesive it felt, the more natural it felt to deal with.

3. In regards to your body, what aspects (if any) did you become aware of? Expand.

Subject 1A
The promenade through the space – I felt very connected with the largeness – the historic nature of the structure made me more aware of it with the reflection that was being cast of the ceiling on the floor back and forth, that was transformative looking down because first I was focusing on the horizon then I was noticing up and down more, and moving through the space was really enjoyable to walk thru the different paths offered.

Subject 2B
My brain. Energy and emotions were in flux.

Subject 3C
Because it's not a private environment, I wasn't as comfortable because I was standing whereas if I were able to sit – I could have sat down – it would also be different – I was crossing my hands across my chest, putting them in my pockets to find a relaxing way of being. Because standing and focusing required me to concentrate.

Subject 4D
I was trying to see if I could change my heartrate. It was very visual. And acoustic.

Subject 5E
Unintentionally, I began to breathe – I intentionally started to align my breathing. Breathing for me has always enabled me to connect with my body.

Subject 6F
(in regards to the physical space), I did like the fact that it was a contemporary installation within this old broken down exposed brick graffiti – almost like an alleyway- and I really loved the two

different components – you are exterior when you can see yourself entering. I was drawn to the graffiti, and I liked the way the 3 panels on the entrance reflected the external environment – it felt like there was graffiti of the environment imposed within it.

Subject 7G
It was an attention to my thoughts, an introspective experience. (I was nervous to walk on the mirrors).

Subject 8H
As I stood on the final mirror step and was surrounded and it facilitated a relaxed state… stopping at the far end when surrounded, stationary surrounded by lights and sound, it was the most affective area, immersed within your own feedback.

PERCEPTIONS
4. How does digital media change your perceptions of space (positively, negatively, or if at all)?

Subject 1A
It's another layer to a space that one thinks of the historic weight of the space. It's a very good thing because it makes one aware of the temporal qualities of oneself and time and how old the space is – and how the technology makes one feel you're connected with your present-ness. But I feel the importance of living in the second.

Subject 2B
The fact that it's not static, that its constantly changing, moving as you move, the static quality of the brick walls as one layer, and then this other medium you're floating through. I find the reflective surfaces performing in the same way – even though they are not digital surfaces – they are undulating, they have this water like environment that things are in flux.

Subject 3C
I think it was a positive, in the sense that it gave you the connection – even if you didn't understand it well – between what you're feeling and your environment, but it also made you focus on that aspect versus the environment without realizing it. If there were no digital aspect, it might be a more spontaneous feeling rather than a targeted state of mind. It puts you in a confined mental state.

Subject 4D
It's digital, it stands out because the context behind it is historic, analog, bc people were working with their hands with these things; digital is this other medium.

Subject 5E
For me, digital media is more like a tool. It's not always easy to be self-aware. Using this as a medium it helps you probably to know yourself in a faster an quicker way the way we are so used to. But since you have a visual thing in front of you. Although on the contrary it may build certain conceptions that may or may not be true – there could be a disconnect with what your feeling / thinking.

Subject 6F
It definitely emphasizes the important lines in the structure – the verticality. This looks very ritualistic with the daylight, symmetrical, the corridor, kind of like an altar finish at the end, very cathedral-like.

Subject 7G
Yeah (it does change my perception). Particularly the visual feedback outside the installation, the fact that you see yourself projected and presented within the space before you enter into the main part, it does make you more aware and does change your perception because you are more aware of yourself within and not just a passive observer. (sense of presence) I think It makes it more immediate – helps you drawn in, you are aware you are being watched, and your image is being projected. *It turns your insides out.* I felt like I was watching myself. There is an element of surveillance, but it felt more like I was watching myself once within the space.

I don't think the media is an amplification (of history) – I think it's an acknowledgement and a co-existence. Using a heritage site draws attention to the history of the site, and at the same time brings history into the present.

5. Where did the space start, and where did it end for you?

Subject 1A
Where I was beginning to walk past the base and what was on the entrance and of course the backlit projections. I wasn't sure if we were able to enter, but hearing some sounds seeing shadow movement I thought ok we were allowed.

Subject 2B
It started as I saw my own reflection on the projected surfaces being aware of entering into another space.

Subject 3C
It started when you stepped on the first block, and also the panels, but also when you hear and see the light.

Subject 4D
Physically it started with the mirror platform, but psychologically, past the white screens.
It ends once I'm out of the tunnel.

Subject 5E
It started in my body. It was internal and then it became external. And then I was trying to absorb what was happening. It was a loop. Yes, (it ended in the same way) I was still trying to focus on my somatic experience, different emotional states.

Subject 6F
I think there are two spaces – the mirror floors and the curtains.

Subject 7G
I don't think that it actually has a boundary on the entrance side.

Subject 8H
Intellectually it starts when you walk thru the curtain but emotionally it felt effective in its affect the further you got. The longer you stay there, the movement, stepping up made a huge difference. Maybe because you're forced to engage. It's different when you leave, because you don't *want* to leave, and so the space became bigger and extended after that because the feeling is still around when you are in it, then it really became the curtain.

6. Where did the experience start, and where did it end?

Subject 1A

I guess when I took off the device. More so than the physical space, it's the act of realizing that you're disconnecting with the space in this way.

Subject 2B
I guess it will end when I stop thinking about it, when I'm far enough, as I leave this space ill still be thinking about it so it'll probably still be with me.

Subject 3C
It ended when I stopped focusing on it (the content) even though I was at the end (of the display parameters) and I had to walk back; I really forgot about the state. I just walked off.

Subject 4D
I thought that everything was part of it (the building) – I think the real experience is right here inside, the ceiling above, looking into it.

Subject 5E
I was more able to connect when I felt my inner self became externalized, observing, absorbing. It started when I could externalize my inner experience (with the media space).

Subject 6F
It starts a few metres in from the curtains.

Subject 7G
It started for me as soon as I became aware that I was being watched. And once you are aware of the fact, it ends when you are outside of the view of the camera. It's a project about awareness of your inner mental state. You realize you are already a part of the thing – it already started. That means that, it doesn't start when you become aware of it, but for the installation, the sentient being, it would start for the individual as soon as you move in the camera.

Subject 8H
The experience and the aura lingers after you leave, but there's a delay when you first enter. At one point the intellectual gave over to feeling.

CONNECTIONS
7. In terms of time, does the space possess qualities of the Past? Present? and / or Future? If so, in what way?

Subject 1A
Definitely the past – very strong. The present; – it feels like an early roman basilica in some way where you're nearing the altar, the narthex, this feeling your connecting with something or yourself in a meditative way.

Subject 2B
The ring of the sound, marking time, intervals. The sort of mark of time as rhythm.

Subject 3C
All three obviously. Space has a connection in a continuous way. This is a little a-temporal. It makes you feel like you are in an a-temporal environment. time is either still, infinite, or it does not exist.

Subject 4D
I don't know. Time is sometimes measured by impressions daylight, you can see the daylight coming into the building, but you do have artificial lighting too, but then there's this perception of history, these are kilns in the historical area, but then you've got this digital medium that's controlling electronics laptops, and this headset which seems kind of like sci-fi movies, it's a whole contrast, but maybe it's not exclusive – its all together it actually does all work together.

Subject 5E
Bc this space itself has a historic background to it, and when I look at technology it is pretty much a future in itself, in a way a future to the past, I was in the middle of it somewhere. I get really fascinated with old architecture, so for me going back in time mattered the most. If the installation was in an open space, it would have a totally different experience. I think it was an interesting point of connecting the future to the past and me being somewhere in the middle.

Subject 6F
I felt like it slowed down time for me. When you are more aware of the little things that are going on, on in your body, it feels like more time is lapsing than it normally would each little second drags out.

Subject 7G
Visually with the heritage site and the graffiti it contains elements of the past. Present – it does have a clear sense of immediacy bc your thought patterns have an immediate affect on your environment so it actually is about being and being aware of the moment.
Future- I guess I will always wonder why, thinking about my parents – made the installation yell at me the way it did….

Subject 8H
Contrast btw this old ailing factory, vs the techno-futurism – it points to a future but the discordance of it is critical, but as I moved thru the experience it became more timeless. It's just about that moment so that was a great break from the expected. (In terms of engagement) – once I started to let myself buy into it, I was hitting a 9 or 10 really enjoying it.

8. What did you feel in the space?

Subject 1A
I felt like taking off layers. First trepidation, after it was different. A feeling of lightness. I was expecting to feel in the grip of the technology but I felt more light than as if it was just the historic shell.

Subject 2B
Feeling this lightness – un-grounded. (opened arms). As though you are flying or levitating.

Subject 3C
Overall it made me feel good. Because it was Interesting intellectually, relaxing. Not enough time to benefit or enjoy the relaxing mode or environ. Not only intellectually but it felt good

Subject 4D
It's kind of child-like – it was fun. Because it's like you're exploring this physical space. There's a curiosity – something youthful. Its pleasant.

Subject 5E
A little bit nostalgic because of all these brick – because from my hometown – and also because it's a part of my own culture too.

Subject 6F
I was feeling a lot of emotions (regarding a relationship).

Subject 7G
Joy, mostly. Pleased. Overwhelmingly joyful.

Subject 8H
Curiosity. As the experience progressed, … it became more peaceful of the moment because it became about the feedback and the sound. A meditative peacefulness.

9. What did you think of during the experience?

Subject 1A
I really enjoyed the sound. Sound is really important to me. I felt like it contributed to the shifting gradations of light.

Subject 2B
I did think about this horizon appearing, fading. If this connection to the horizon is something we are intuitively aware of, I kept wondering if there's a connection to our own reality to the daily experience to the horizon. That moved me – it was quite transformative.

Subject 3C
During the experience, I was thinking about the experience - what it means, what does it mean to understand, questions about analysis, how my own character could be reflected. How come I don't see the vertical lines? Maybe I'm not able to get into the relaxed environment.

Subject 4D
I was wondering how in the future if people were going to invade my privacy by getting my brain waves. And I question whether you were invading my brain waves – well, I've given you consent, but I wonder how it can be used.

Subject 5E
I was trying to calm myself down, and I was also inducing a distraction within my emotions too. I wanted to feel tense to see a representation, but when I started to look at these things – the brick graffiti - then my mind started to wander .

Subject 6F
There might have been a disconnect (from what I was feeling vs thinking).

Subject 7G
I was trying to focus on the experience. I know that at certain points I didn't have much of an effect while I was taking it in.

Subject 8H
Curiosity, why. (The sound) always brought me back to the present. It moved from an intellectual…what is this doing, why is this recording me…as I accepted the piece, I felt more.

10. What aspects of the space did you enjoy, and / or dislike? What do you wish you could explore more of?

Subject 1A
The ability to play to see if you could affect the noises – I wanted to understand who was the controller, who was the controlee. How as space was controlled. (that's important?) – yes it makes one feel – not knowing if it is scripted or if you are part of the experience. It's really important especially when you are presented with an opportunity to see a part of you reflected in a way you've never seen it reflected – subtle changes of mood, or other things.

Subject 2B
I enjoy the sleekness of surfaces – the layering of touch, levitation.

Subject 3C
I would have liked to understand more so I could fully benefit and also make the experience fully benefit. Let me try and do it again. Does it make a difference in the site environment?
Subject 4D
I think it's a current topic – VR, and sensory things.

Subject 5E
I'm pretty ok with this – the old architecture fascinated me (site). Two opposite things attract – this thing is so old, and you have all these mirrors, digital aspects, to me it's a contrast that is stark but interesting.

Subject 6F
The (structural) form – cathedral-like, ritualistic. I liked the mirrors when I was looking down at myself – it was even more powerful than peripherally having them reflect the light. Panels are

offset (not symmetrical). I'm imagining a heat map aesthetic. This could be outside, larger scale, like a public intervention.

Subject 7G
I wish I could have experienced it more, (see) more people's reactions. To guage what the range is, and how their thought processes manifest.

Subject 8H
I really enjoyed (when I) closed my eyes, and just let the buzzing sounds, the gongs, and the light… intensities washed over me and the feedback built in felt really good. As it started to ramp up and you started to key yourself into the experience, it started to work really well. It was a release of tension. The focus on the now…it only became warm, feeling of comfortableness. Being relaxed. It was actually very relaxing. In particular with your eyes closed because of the intensities as opposed to seeing the individual light bulbs. And it was a little more intense – if you looked at it I found it was harder to…meditate because there was a certain kind of harshness to the light. It was hard to feel as calm through the detail.
Me:
That's an interesting dichotomy because its almost as if you started to tap into your own awareness once you started to develop your own filtration system - as in closing my eyes, and even though this is completely mediated space, you were still aware of that mediated space without having to have your bare eyeballs on it so that perhaps it started to develop something else, other affects that weren't necessarily directly related to those sensory inputs.
Subject 8H
The disappearance of the space, where it becomes a part of the experience – you realize that you are entangled with this thing –
(discussion about the wearable – could be detrimental)
You're dealing with tropes – that all-encompassing light as it increases literally is like: move towards the light.
That buzzing is kind of like "ok, well now I'm dying" like it's the last thing you'll hear, see, but it was also very warming and calming at the same time … and you're leveraging that trope consciously or unconsciously through the abstraction, you're giving the user the opportunity to apply the trope (of death).
Me: maybe it's because: at what times in your day-to-day experiences are you offered a means to just focus on sensation or this immersive type of feeling? Maybe when you go to the beach, lying in the sun, totally immersed in the moment….

```
/*
The NeuroSky MindWave device did not ship with any proper Java bindings.
 Jorge C. S. Cardoso has release a processing library for the MindSet device
 but that communicates over the serial port. NeuroSky has since release a connector
 application that talks JSON over a normal socket.

 Using the same API as the previous library this talks directly to the ThinkGear
 connector.

 Info on this library
 http://crea.tion.to/processing/thinkgear-java-socket
 Info on ThinkGear
 http://developer.neurosky.com/
 Info on Cardoso's API
 http://jorgecardoso.eu/processing/MindSetProcessing/
 Have fun and get some peace of mind!
 xx
 Andreas Borg
 Jun, 2011
 borg@elevated.to
 */

import processing.serial.*;
import pt.citar.diablu.processing.mindset.*;
import neurosky.*;
import org.json.*;
import ddf.minim.*;
import ddf.minim.ugens.*;
import ddf.minim.spi.*; // for AudioStream

Minim minim;
AudioPlayer player1;
AudioPlayer player2;
AudioOutput out;
LiveInput in;
Delay myDelay;

ThinkGearSocket neuroSocket;
MindSet mindSet;

float attention=1000;
float meditation=1000;

PFont font;
boolean pulse = false;

//float esize = attention;
//boolean pulse = false;

void setup() {
  size(1280,760);
      mindSet = new MindSet(this, "/dev/tty.MindWave");

  ThinkGearSocket neuroSocket = new ThinkGearSocket(this);
  try {
    neuroSocket.start();
  }
  catch (Exception e) {
    //println("Is ThinkGear running??");
  }
  frameRate(10);
```

```
  smooth();
  //noFill();
  font = createFont("Verdana",12);
  textFont(font);

  minim = new Minim(this);
  player1 = minim.loadFile("Bell_Gong.wav");
  player2 = minim.loadFile("Bell_Gong2.wav");
  out = minim.getLineOut();
 //myDelay = new Delay(1, .5, false, false);

  // we ask for an input with the same audio properties as the output.
  AudioStream inputStream = minim.getInputStream( out.getFormat().getChannels(),
                                                  out.bufferSize(),
                                                  out.sampleRate(),
                                                  out.getFormat().getSampleSizeInBits());

  // construct a LiveInput by giving it an InputStream from
minim.
  in = new LiveInput( inputStream );

  // create granulate UGen so we can hear the input being modfied before it goes to the
output
  GranulateSteady grain = new GranulateSteady();
    // initialize myDelay with continual feedback and audio passthrough
 myDelay = new Delay( 1, .9, true, false);

  // patch the input through the grain effect to the output
  in.patch(myDelay).patch(out);
}

void draw() {
  //background(0,0,0,50);
  fill(0, 0,0, 10);
  noStroke();
 // rect(0,0,120,80);

 // fill(0, 0,0, 10);
  //noStroke();
  rect(0,0,width,height);
 fill(meditation*2, 255-meditation/2, meditation*4, meditation/2);
  //fill(255,255,255,255);
  //stroke(0, 116, 168);
    text("Attention: "+attention, 10, 30);
    text("Meditation: "+meditation, 10, 50);


  // } else if (attention>meditation) {
  //}
     float delayTime = map( meditation, 0, 100, .5, 3 );
  myDelay.setDelTime( delayTime );
  float feedbackFactor = map( attention, 0, 100, .0001, 0.5 );
  myDelay.setDelAmp( feedbackFactor );

 if (attention>=meditation) {
  pulse = true;

 // background (0,0,0,10);

  //    fill(0, 0,0, 0);
 // noStroke();
 // rect(0,0,120,80);
    //  fill(0,0,0,10);
    //  delay(100);
   // rect(0,0,width,height);
```

```
 // rect(0,height/2-attention/12, width, attention/6);
smooth();
frameRate(10);
     fill(meditation*4,0,150+attention,5);

    text("Attention: "+attention, 10, 30);
    rect(0,0,width,height);
   fill(0,0,0,255);
 //    fill(255,attention*2,attention*3,255-attention/1.5);
  rect(0,height/2-attention/4, width, attention/2);
     fill(0,0,0,attention/2);

  //  rect(0,height/2-attention/8, width, attention/4);

 //scale(4.0);
 if (attention < attention++) {
 pulse = true;
   smooth();
    attention = attention+1;
    if (attention > attention++) {
      pulse = false;
      smooth();
        rect(0,height/2-attention/12, width, attention/6);
             fill(0,0,100,attention/8);
    //  scale(2.0);
    }
      } //if (pulse) {
       // smooth();
  //  attention = attention+1;
   // if (attention < attention+100) {
    //  pulse = true;
    //  attention = attention+1;
   // }
      if (attention++ > 80) {
          pulse = true;
              smooth();
        // attention+=attention+1;

//frameRate(10);
     // background (255,200,50,0);
 rect(0,height/2-attention/2, width, attention);
smooth();
//frameRate(10);
attention = attention++;
scale (4.0);

   if ( player2.isPlaying() )
  {
    player2.play();
  }
  // if the player is at the end of the file,
  // we have to rewind it before telling it to play again
  else if ( player2.position() == player2.length() )
  {
    player2.rewind();
    player2.play();
  }
  else
  {
    player2.play();
  }
}

// popMatrix();
   }
```

```
   else if (meditation>attention) {
   frameRate(10);
  rect(width/2-meditation,0,meditation*2,height);

  if (pulse) {
    meditation = meditation+1;
    if (meditation > meditation++) {
      pulse = false;
    }

  }  if (meditation < meditation+100) {
   meditation = meditation-2;
   pulse = true;
    }

      if (meditation++ > 80) {
       pulse = true;
            rect(width/2-meditation,0,meditation*2,height);

      meditation=meditation+2;
        scale(6.0);
      smooth();
      frameRate(5);
     // background (255,200,50,0);

     smooth();
    // frameRate (10);
    // meditation = meditation++;
    // scale (2.0);

    if ( player1.isPlaying() )
  {
    player1.play();
  }
  // if the player is at the end of the file,
  // we have to rewind it before telling it to play again
  else if ( player1.position() == player1.length() )
  {
    player1.rewind();
    player1.play();
  }
  else
  {
    player1.play();
  }
      }

 //}
/*
  //noFill();
  if (meditation <= meditation++) {
       fill(0, 10, 200);
  rect(width/2-meditation/4,0,meditation/2,height);
  meditation+=y;
}
 //rect(299,0,-meditation/4,height);
 if (meditation < meditation--) {
   rect(width/2-meditation/4,0,meditation/2,height);
   //scale (2.0);
 meditation+=x;
  }
 */

/*if (meditation < attention){
```

```
  fill(255, 255, 255);
  //noFill();
  text("Meditation: "+meditation, 10, 50);
  //stroke(209, 24, 117, 100);
  //noFill();
}
else {
  rect(299,0,meditation/4,height);
  rect(299,0,-meditation/4,height);
  }
   }
   */
//}
//}
}
}
/*
void myDelay() {
    //set the delay time by the horizontal location
 float delayTime = map( meditation, 0, 100, .01, 1 );
  myDelay.setDelTime( delayTime );
}
*/

void poorSignalEvent(int sig) {
  println("SignalEvent "+sig);
}
public void attentionEvent(int attentionLevel) {
  println("Attention Level: " + attentionLevel);
  attention = attentionLevel;
   // set the feedback factor by the vertical location
  //float feedbackFactor = map(attention, 0, meditation*attention, 0.0001, 0.01);
 // myDelay.setDelAmp( feedbackFactor );
}

void meditationEvent(int meditationLevel) {
  println("Meditation Level: " + meditationLevel);
  meditation = meditationLevel;
    // set the delay time by the horizontal location
 //float delayTime = map( meditation, 0, meditation*attention, 0.5, 0.0001 );
 // myDelay.setDelTime( delayTime );
}
void blinkEvent(int blinkStrength) {
  println("blinkStrength: " + blinkStrength);
}
public void eegEvent(int delta, int theta, int low_alpha, int high_alpha, int low_beta,
int high_beta, int low_gamma, int mid_gamma) {
 /* println("delta Level: " + delta);
  println("theta Level: " + theta);
  println("low_alpha Level: " + low_alpha);
  println("high_alpha Level: " + high_alpha);
  println("low_beta Level: " + low_beta);
  println("high_beta Level: " + high_beta);
  println("low_gamma Level: " + low_gamma);
  println("mid_gamma Level: " + mid_gamma);
  */
}
void rawEvent(int[] raw) {
 // println("rawEvent Level: " + raw);
}

void stop() {
  neuroSocket.stop();
  super.stop();
}
```

CONSENT FORM

Date: **September 01 2016**
Project Title: **Extra:Muros:Intra**

Principal Investigator:
Jay Irizawa, Graduate student
OCAD University

Faculty Supervisor (if applicable):
Patricio Davila, Principle Advisor
Faculty of Design
OCAD University

INVITATION
You are invited to participate in a study that involves research. The purpose of this study is to investigate experiences of new designs in digital and physical spaces, contributing to the body of knowledge in environment design, and the emerging fields of digital media. Your feedback will be invaluable in gaining insights to the potential future of urban environments, and to the challenges offered by new technologies.

WHAT'S INVOLVED
As a participant, you will be asked to engage in a multi-media environment that responds to your presence and state of mind with audio and visual feedback. The feedback is facilitated with a head-mounted wearable device that sends data from your body to the environment. Your account of the experience will be taken in an interview format, recording your thoughts, feelings, and perceptions about the space. 6-10 questions will be asked. Participation will take approximately 10 minutes of your time.

POTENTIAL BENEFITS AND RISKS
Possible benefits of participation include a first-hand look into new design processes in interior design, architecture and urban landscaping, contributing to the body of research in digital and physical interaction space.
There are no known or anticipated risks associated with participation in this study.

CONFIDENTIALITY
The information you provide will be kept confidential, i.e. your name will not appear in any thesis or report resulting from this study. If you would like to hear more about the study, please check mark the box provided with your email contact info at the bottom of this form. A follow-up email will be sent to the one provided, within 6 months.
Data collected during this study will be electronically stored in a secure drive, separate from the consent forms. Interview responses will be assigned alpha / numeric ID (e.g. subject A1). Data will be kept for 6 years after which time the stored data will be disposed of. Access to this data will be restricted to Jay Irizawa (researcher) and Patricio Davila (Primary Advisor). Note: Data from the bio-feedback is not recorded and is not stored.

VOLUNTARY PARTICIPATION
Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study. Further, you may decide to withdraw from this study at any time, or to request withdrawal of your data prior to data analysis September 30 2016.

PUBLICATION OF RESULTS
Results of this study may be published in reports, professional and scholarly journals, students theses, and/or presentations to conferences and colloquia, book publications. In any publication, data will be presented in aggregate forms. Quotations from interviews or surveys will not be attributed to you without your permission. Feedback about this study will be available in electronic form via email within 6 months of the study. Please contact the researcher Jay Irizawa at An electronic version of the research will be sent to your email provided.

CONTACT INFORMATION AND ETHICS CLEARANCE
If you have any questions about this study or require further information, please contact the Principal Investigator Jay Irizawa or the Faculty Supervisor Patricio Davila using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University 1486. If you have any comments or concerns, please contact the Research Ethics Office through cpineda@ocadu.ca.

CONSENT FORM
I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____ ☐ *I am over the age of 18*

Signature: _____ Date: _____

☐ *Yes, I would like to hear more about the study. You may reach me by (provide contact information):*
Email:

Thank you for your assistance in this project. Please keep a copy of this form for your records.
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