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Sitting under a highway: **exploring the integration of place mindfulness and immersion in audiovisual art practices**

by

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A thesis exhibition presented to OCAD University
in partial fulfillment of the requirements for the degree of
MASTER of FINE ARTS (MFA)
in DIGITAL FUTURES
April 2016

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Abstract

OCAD University
Digital Futures

Master of Fine Arts, 2016

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Postmodern society is characterized by an increasing disconnect with our inhabited spaces. The *glocalization* efforts made by commercial interests and the emphasis on the utilitarian conceptualization of the world affect local culture, contributing to a thinning out of the relationships with our lived places. Making reference to the standing-reserve theory of Heidegger; the geophilosophy of Edward Casey; Zen meditation; soundscape composition and other audiovisual art practices, I suggest that artistic processes informed by the attentive exploration of a geographical location may contribute to create awareness about the nature of this disconnect.

Sitting under a highway is a research-creation project presented as an interactive audiovisual virtual and presential space. By wearing a head-mounted display, a hand tracking device, headphones and an electroencephalography band, the audience experiences photorealistic 3D visuals and spatial audio that are the product of an artistic practice centred on the attentive aesthetic exploration of a physical place.

Keywords: Audiovisual Art, Mindfulness, Virtual Reality, Landscape, Soundscape, Acoustic Ecology, Geophilosophy, Interactive Art. Spatial Audio

Acknowledgements

I would like to express my most sincere and deepest gratitude to everyone who supported me and facilitated the knowledge and resources required to produce this thesis project.

To my thesis supervisors, Adam Tindale and Bentley Jarvis for being always available and willing to assist me with their highly valuable insights and knowledge.

To the Digital Futures faculty members in general, but particularly to those whose high academic qualities and admirable human integrity were a source of motivation and contribution to my learning experience: Paula Gardner, Emma Westecott, Suzanne Stein, Martha Ladly, Nick Puckett, Greg Sims, Kate Hartman, David McIntosh and Ilona Posner.

To Emma Westecott and the Game:Play Lab for facilitating an amazing place where to perform the research, exploration and creation of this thesis project.

To my Zen teacher, Master Samu Sunim, for his life changing teachings and inspiring energy.

To the loving care, patience and sustained support of my dear wife Lilibeth and our son Enrique; and to my parents and sisters for their unconditional support, love and exemplary integrity.

To my beloved Lilibeth and Enrique.

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1. Introduction

In our everyday life as city dwellers, we often traverse a complexity of physical spaces, framed by a large variety of architectural and natural configurations, without being aware of the richness and dynamics of the acoustic and visual manifestations that inhabit them. Our perception is usually focused on our inner streams of thoughts and emotions or on the self imposed, technologically delivered, musical soundscape injected directly into our ears through headphones.

This is not without reason. The urban soundscape is mostly of low-fidelity, that is, it lacks a distinguishable acoustic variety and is predominately composed of the noise produced by the antrophonies (Farina, 2014), hence the human need to apply over it an acoustic, high-fidelity musical curtain to embellish it. This low-fidelity concept could also be extended to how we visually engage with our urban places, which are increasingly being homogenized and emptied of local meaning (Cannavo, 2007). Nevertheless, if seen and listened to attentively, the urban landscape can reveal a hidden richness that can also be an aesthetic experience in itself, as many artists have revealed through their soundscape compositions, *phonographies* (field recordings), video installations and other technologically created art works.

Paired to the apparent unattractiveness of the urban landscape, and possibly one of its main causes, the economical models prevalent in the capitalistic world encourage an utilitarian attitude toward everything presented to our perception. This is very well described in the standing-reserve theory

by Heidegger (1977): everything ends being perceived as means or a tool to achieve a goal and not by its pure intrinsic and unique qualities. Such a worldview leads to generalization and classification of all that appears to our senses, then subsequently to a lack of insight regarding their intrinsic and unique nature. We as humans tend to go through our everyday lives in a way that even our existence itself is valued more prominently by its goals or purpose rather than by what we are at this present point in time and as integral part of a larger system of existence.

I then propose that this sensory apathy or desensitization is one important source of our disconnect with our environments, both natural and human made, and a contributing factor to ecological and social imbalance. Practising attentive perception, free of conceptualization or classification, can very likely help alleviate this imbalance and create a better sense of our place within our natural and social systems.

As it is particularly recognized by sound artists who adhere to the Acoustic Ecology discipline, such as Barry Truax (1996) and Hildegard Westerkamp (2002), the process of listening attentively to the natural and urban environments, in order to collect sound materials that determine the contents and form of sound art pieces, can lead to a valuable revealing of the nature of our ecology, social dynamics and perception of reality. The insights acquired through a mindful exploration of a place influence the artistic process and final result, thus then being transmitted to the audience in an objective and subjective way.

It is at the juncture between the aesthetic revealing of soundscape based sound art, the attentive observation and listening of our surroundings, and the use of immersive visual and sound narratives where *Sitting under a highway* intends to stand. The artistic experience, product of this research-creation project, is presented as an interactive installation consisting of a peaceful and clean space, in the style of those used for the practise of Zen Buddhist meditation. In this space, a seat, a head-mounted stereoscopic display (virtual reality viewer), a pair of headphones and an electroencephalography (EEG) sensor band are found and worn by the visitors to allow them to enter into a presential

virtual space created through mindful artistic practices.

Sitting under a highway is also a personal artistic exploration into translating and expanding the abstract acoustic spaces that emerge from a soundscape composition into a visual tridimensional and immersive space. This equal integration between sound art and visuals, albeit only in a two-dimensional visual medium, has already been explored by artists such as Jean Piché, in a genera that he refers to as vidéomusique (Piché, 2003). In this genera, both the visual and sonic components have equal importance in building an aesthetic discourse, as opposed to the way a "video with a sound track" or a "musical video" is constructed, where either the visual or sound component have a leading role while the other functions as an accompaniment or secondary counterpoint.

In the process of creating a soundscape sound art piece, an artist usually performs an attentive exploration of the sounds that compose the soundscape of a natural or urban location (or locations, in the case of *soundwalks*) while simultaneously capturing them using audio recording equipment. By performing this process mindfully, the artist not only becomes aware of the acoustic nature of the locations but also creates an intimate, intuitive connection and integration with the traversed environments. The development of this type of integration through mindful listening is what sound artist Kim Cascone refers as developing organs of subtle perception (Cascone, 2014) or also referred as Deep Listening by sound artist and musician Pauline Oliveros (2005). The field recordings are then taken to the artist's studio to be listened, selected and transformed using technology (analog and/or digital) in order to generate new sounds and build an aesthetic discourse that connects with the perceived essence of the location.

I find this creative process to resemble a phenomenological research as, for example, described by Don Ihde (2012), where the research is performed first through an initial stage of pure observational epoché, followed by an analysis of that experience. From this perspective, *Sitting under a highway* can be seen as a phenomenological research-creation project of a physical place.

In the case of my previous soundscape based sound art work, I have been interested in following the creative process just outlined, but also particularly in being attentive to successfully capturing the spatial configuration qualities of the soundscapes and in exploring the aesthetic potential of those qualities. This has lead me to research and develop spatial sound reproduction techniques, and microphone equipment that improves the spatial accuracy of stereo (baffled and binaural) and soundfield (ambisonic) recordings. This techniques have also been integral part of the development of the work presented as part of this thesis.

The construction of the visual tridimensional components of *Sitting under a highway*, were performed in a similar way, by mindfully exploring the visual landscape of the location and capturing the spaces, textures and found objects with a photorealistic and volumetric technique using a still image digital camera (photogrammetry). Both the processing and transformation of the visual and sound elements were performed in an attempt to create an integrated audiovisual narrative, in a similar way as it is done in the previously described vidéomusique genre, but in this instance through a tridimensional audiovisual space.

The interactive layer of *Sitting under a highway* was implemented to perform a simple analysis of the brainwaves of the user in order to determine their levels of concentration and relaxation. These readings, windowed and averaged over time, influence the course of both the audio and visual components of the piece. By linking the biometric data to the audiovisual discourse, the element of awareness or mindfulness in the audience's consciousness is then made an integral part of the piece, referring then to the underlying thematic of mindful observation and insight.

As in any soundscape based sound art composition, *Sitting under a highway* refers to a particular geographical location. I consider the existence of this connection essential to the purposes of this project's nature of being an artistic exploration of mindfulness and human interconnection with the inhabited places. In this case, I chose the area framed by the intersections between the elevated Don Valley and the Gardiner Expressway highways, and the mouth of the Don river at Lake Ontario. a location

in the city of Toronto that has always interested me due to its particular qualities. At this location, the limit between human technology and nature is very prominent but at the same time it is a space almost devoid of the presence of human bodies and hidden from the everyday life perceived soundscapes and landscapes of the city dwellers. These characteristics create a space that reads as a metaphor of human obliviousness and at the same time of natural redemption manifested in the eroded urban structures that are slowly being overtaken by plant growth and water degradation.

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2. Context

2.1 Motivation

On a summer day in Toronto, I take a pair of binaural microphones and a portable sound recorder to go out for a walk across the city. The microphones, placed over my ears, will capture the soundscapes I encounter, preserving their spatial qualities, but at the same time their design allows me to listen directly to the sound waves reaching my ears. I don't have a preplanned route but just a starting point. From there, I mindfully walk and record, being present, looking and listening, allowing the soundscapes and the physical spaces to determine the route I follow.

Departing from the downtown neighbourhood known as The Annex, and as I proceed with my walk, I encounter soundscapes constantly changing in subtle and dramatic ways. I hear: the subway train, the reverberating footsteps inside the station, the turnstiles clicking and beeping and suddenly the openness of the outdoors, the street noises, people chatting, birds chirping. I enter an old church: creaking doors and floors, narrow corridors with muffled resonances, then a door opens and the echo of piano music inside a large room, a dance class is happening. Walking my way down toward the lake: Chinese vendors enthusiastically announcing their offers, office towers reverberating with the noise of engines, beeping alarms, sirens, explosive construction noises. At the end of my walk, I am standing surrounded by a thunderous soundscape and under the imposing view of the concrete and

steel mass that makes a highway overpass. Below it, the Don river quietly runs while a solitary goose slowly walks back and forth on the shore, honking repeatedly and almost mechanically. The honks echo on the monumental structure, and as a counterpoint to the honking and its spatial resonances: the never ending roar of cars, trucks, engines and tires, cracking loudly when hitting the uneven joints of the massive concrete slabs.

This is the journey I followed to begin the creation process of the piece *What is it?*, produced during an artistic residency lead by sound artists Trevor Wishart and Barry Truax in the summer of 2007. A few days later, while listening to the recordings, the captured soundscapes immediately re-triggered in me the rich stream of sensations and bodily reactions connected to the traversed places. These reactions also seem to contribute to further the conscious and unconscious insights that I acquired while walking through them. The knowledge, or in Heidegger's term, the *poietic revealing*, that a mindful experiencing of a place or phenomenon brings, is what then drives my creative process of digitally transforming and layering the recorded sounds into an electroacoustic sound art piece.

The resulting art work is important to me but the experiences acquired through the process itself, from sound walking to creation, have a deeper impact that persists over the years. My relationship to the physical spaces has been transformed to become much more intimate. There is a sense of connection and expansion of the self that reaches from the body into the environment. In this case, a mindful artistic practice has contributed to the dynamics between self and place, as described by the American philosopher Edward S. Casey (2001), where the emergence of *place* thrives, as a product of the activation between *self* and physical *space*, via the *body*.

It is obvious that a key component in the foundation of this self expansion process is the state or quality of the attitude an individual has about the surrounding environment. A perceptual sensitization toward the outside is required, characterized by a high quality attention and concentration that is not clouded by preconceptions or conceptual thinking in general. This is the kind of attitude that the practice

of traditional Buddhist meditation seeks to elicit in the practitioner, and also the kind of attitude that has become integral to some artistic practices (as discussed in section 2.3).

I've been practising Zen meditation for over a decade. This has included learning closely from a Korean Zen master and living for one year at a Zen Buddhist temple as a full time monastic (for further reading about this experience and its context, see Campbell, 2010, where I appear under the author's chosen pseudonym of Macario). The effects of meditation have greatly influenced my artistic work as well as almost every other aspect of my life. It also changed the quality of presence I have when being at a physical space, which has helped me better understand, at an intuitive level, the disconnect that can exist between us and our inhabited places.

When I refer to the disconnect, it is not just one where the individual is somewhat unaware of the detailed qualities and richness of what constitutes the physical world. It is also one where almost everything has lost its most primordial and immediate nature to only become an element in the utilitarian complex, part of the abstraction we believe is the purpose of society. This is a core idea that I will try to explain in the following sections, by referencing existing theory that I believe can constitute an initial framework to understand the nature of this disconnect and to inform my artistic practices.

I believe that the disconnect has placed us on the verge of ecological and social disaster, and that art created departing from higher levels of connectedness between the artists and their environments has a greater potential of helping their audiences to also realize and improve their own disconnect. This is evident in the analysis and theory developed by artistically motivated disciplines such as Acoustic Ecology (Schafer, 1993), and what, as an example, constitutes the core motivations of artistic organizations such as *Ear to the Earth* (http://eartotheearth.org). It is also with this same motivation that I've been looking to develop processes within my own creative practice, highly influenced by the practices of meditation and the qualities of mindfulness.

In the particular case of *Sitting under a highway*, I'm also exploring the expansion of my sound art soundscape based work into the virtual visual 3D space. This interest emerged from my initial contact

with the recent head mounted display (HMD) technologies for virtual reality such as Google Cardboard,
first, and Oculus Rift later. The recent advancements in this area have granted an easier access to tech-
nology with the potential of delivering a vastly improved experience of presence in a virtual space, as
compared to the technologies previously available (Rubin, 2014). These improvements, in combination
with the high performance capacity of graphic processing units (GPU), appeared to me as a great op-
portunity to create an audiovisual experience equivalent to the acoustic one produced by soundscape
compositions. In the same way that acoustic materials are treated in this genre, I could now create
a visual counterpoint by sampling reality, preserving its spatial, textural and volumetric qualities, and
transforming them to create new virtual spaces that still remain linked to their original source. I will
describe this process in detail in Chapter 3.

The theory and literature review that follows is a synthesis of the findings and reflections that
emerged from the creative process of this project (see section 3.1 Method for a full definition). Each
of the three sections represent, first, a philosophical framework that could be used to understand the
nature of the disconnect, second, a review of artistic practices that influenced this work and that relate
to the same philosophical matters, and third, a discussion of the artistic medium itself that was used
for the realization of *Sitting under a highway*.

2.2   Theorizing the Disconnect

2.2.1   The phenomenology of the inhabited space

To understand the idea of the disconnect I introduced in the previous section, it is necessary to
first identify its origins. We could hence focus on analyzing the external circumstances (e.g. social,
political, economical) that elicit such behaviour. This external analysis is indeed a useful approach, and
I will talk about some of these external factors later. On the other hand, I believe that an important place

to look at first is within ourselves, that is in the qualities or characteristics of our own perception and understanding of the environments we inhabit. This means then that a study of the disconnect should begin with a phenomenological study: how do we, as humans, see the world, the objects, spaces, landscapes and living beings that populate it? How is that we have placed ourselves in a state of disequilibrium that threatens the existence of life itself?

As conscious arises, we experience phenomena and react to it in a highly complex manner. In formal phenomenological terms, *I* (my consciousness), the *noema* (phenomena) and the *noesis* (the experiencing of the phenomena) is the most fundamental triad that defines our existence or *being-in-the-world*, as defined by Heidegger (1993). The *I* is an integral part of the experiential process that does not hover detached above the experience itself in order to evaluate it (Ihde, 2012, p. 26). On the must fundamental stage, the phenomena, the experiencing and our consciousness coexist and become one and the same. I believe that the possible cause of the disconnect does not happen at this very fundamental perceptual stage. What follows this holistic experiencing of the world is where the fragmentation can happen. The formation of conceptual, emotional and rational constructs that follow the perceived phenomena, and the way those are allowed to influence our view of the world, are what determine our behaviour.

Our being-in-the-world implies dealing with practical matters required to secure our survival. Objects appear to our perception as what they simply are, or in Heidegger's nomenclature, in their *presence-at-hand* state (1993). For practical reasons, we instantly switch to perceive them beyond their primary state so that everything becomes tools, machines, food, transportation or whatever we understand is their commonly agreed purpose. They pass from being presence-at-hand to become ready-to-hand. It is then when objects enter what Heidegger calls their deficient mode, for example when they break apart or stop functioning for their intended purpose, that we might pause instant conceptualizations and see them again for what they are and what composes them. However, even this state does not last for long time since we often again move quickly to see the broken object as a ready-to-hand that could be potentially fixed.

The majority of what enters our perception is often appreciated and understood as something that has a function or purpose, existing in a constant state of readiness to be used (Heidegger's standing-reserve (1977)). What I am proposing here, is that humans get so deeply involved in seeing the world as a standing-reserve that we start missing the fundamental nature of our existence and its context. This seems notoriously evident in the workings of present day economical systems where society has a strong focus on the constant production and consumption of goods and services as a way to survive and thrive. In this context not only all the inanimate objects are seen and valued mostly for their usefulness or purpose, but living beings are also seen as consumable products where even humans themselves come to perceive each other as a tool with a purpose, as a standing-reserve that can be used and commercialized (the commodification of the workforce). It seems that over the centuries humanity has been working very hard in designing and constructing a world where there is no place for purposelessness.

It is evident that the physical space we inhabit plays an important role in our existence. We not only move through it, as living matter organized in the shape of a human body, but we feed from it, breath and connect emotionally with it. Using terminology created by geography philosophers, by living in it, physical *space* becomes *place*. A place includes our living body, together with the *self* that gives us a sense of agency and connection with space. Place "is the immediate ambiance of my lived body and its history, including the whole sedimented history of cultural and social influences and personal interests that compose my life-history" (Casey, 2001, p. 404). It is our existence and relationship with the physical space that transforms it into place. The collection of places is what constitutes the *landscape*.

In geographer Yi-Fu Tan's words:

Place supports the human need to belong to a meaningful and reasonably stable world, and it does so at different levels of consciousness, from an almost organic sense of identity that is an effect of habituation to a particular routine and locale, to a more conscious awareness of the values of middle-scale places such as neighbourhood, city, and landscape, to an intellectual appreciation of the planet earth itself as home. (1995, p. 44)

The emergence of place is then a reflection of the interaction and level of connection we establish with space. But ultimately, the concept of space is an abstraction (Casey, 2001), and as living beings, as long as we are present in space, it will be always transformed into place. On the other hand, the depth of this transformation is variable, that is, the richness of meaning or the degree of influence back and forth between self and place can be reflective of our level of disconnect with it. Those places with which we engage in a superficial or almost meaningless way become what is know as *thinned-out* places. "We are less committed to thinned-out places, less willing to understand them, and less willing to try to shape their destinies. The landscape ... begins to seem more like abstract space" (Cannavo, 2007, p. 191).

This thinning-out is a symptom of the disconnect and characteristic of the *scattered self* of post-modern society. The thinned-out place is that which early modern society wanted to avoid. Nowadays, spaces loose their depth and character to become linked indifferently to any other place in the global space (Casey, 2001). This is what Roland Robertson called *glocalization* (1995). Local culture is overpowered by the emergence of global economical empires that utilize globalizing communication technology, in order to spread a lifestyle culture for the benefit of profit. This is made evident in the analysis performed by Jody Berland (2009) in her book *North of Empire*. The glocalization process is the targeted exportation of culture and ideas around products that local social groups take and assimilate into their own local culture. This now includes music, food, clothing, entertainment, sport practices and even religious practices and knowledge. These cultural influences are reflected also in the construction of place. The rich *habitudes*, that is the composite of all the everyday life interactions that emerge with a connected habitation of a space, are what Casey identifies as key mediator in the creation of place. Due to glocalization, these are replaced by dislocated and globalized habitudes that have a stronger connection with global commercial interests rather than organically relating to the locality of the inhabited place.

The excessive conceptualization of everything as a standing-reserve also weighs against the emergence of rich places, as space itself is also seen as a standing-reserve, ready to be traded or exploited. To facilitate this readiness and the control over the landscape, places are stripped down and

simplified in order to accommodate easier survey, monitoring and re-purposing (e.g. forestry, mining, industry, retail). This is also visible in urban architecture, where "The rise of mass production and more mechanized technologies in housing and construction enabled the creation of vast suburban tracts and large retail centers as well as homogeneity in architecture irrespective of location." (Cannavo, 2007, p. 101). The design of retail buildings and surrounding spaces, even though intended to be pleasing to the eye, lack a deep local connection with the habitudes of the social communities where they exist.

By not capturing or engaging our attention, the thinned-out places become increasingly distant and detached from our existence. This happens to such extent that we become a highly scattered and mediated society, desensitized to the faith of the ecological, cultural and social wellbeing of our landscapes. We have somehow abstracted ourselves and disconnected from the spaces that sustain our must basic organic nature, and to which we are intimately and fundamentally linked.

2.2.2   Mindfulness

> Hyakujo wanted to choose an abbot for the Daii Monastery. He told the head monk and all the rest of his disciples to make their Zen presentations, and the ablest one would be sent to found the monastery. Then Hyakujo took a pitcher, placed it on the floor, and asked the question: "This must not be called a pitcher. What do you call it?" The head monk said, "It cannot be called a wooden sandal." Hyakujo then asked Isan. Isan walked up, kicked over the pitcher, and left. Hyakujo said, "The head monk has been defeated by Isan." So Isan was ordered to start the monastery.(Mumonkan Case 40, trans. 2000).

As I proposed earlier, at its core, the solution to our disconnect can lie in addressing the deeply embedded concepts we build about our world. It is not unknown to us that creating a change in attitude at a global social level has often proved to be an almost impossible task that requires more than one generation. Breaking through our conceptual habits is a difficult task, particularly when those habits have been intentionally ingrained in our consciousness through cleverly crafted persuasive and global-ized media. It is here where the use of techniques such as the ones practised as part of Zen Buddhist meditation, can be of great help in breaking apart these world views and restore a connection with our

immediate world. The transformational potential of meditation has been the focus of several scientific studies that, thanks to the recent availability of brain imaging, have looked into the relationship between meditation and conceptual processing.

> The Buddhist meditative exercise has its roots in the metaphysical tenet of "emptiness" particularly emphasized by the Zen schools. According to this view, reality is originally devoid of ontological properties and it is only via an incessant and largely unconscious habit of emotional self-reference and categorization that a conceptual structure is created and ultimately reified; a process necessary for daily life, but that also tends to condition the individual into predefined patterns of thoughts, feelings, and behaviors. Meditation is believed to counteract this tendency in favor of a condition of equanimity where the provisional nature of one's own conceptual structure is realized, bringing about a greater freedom of thought and action as well as a decreased sense of self-attachment. (Pagnoni, Cekic, & Guo, 2008, p. 1)

The key point in the previous quotation is the conceptual reification process that we constantly exercise as part of our everyday interactions with the world. To be able to dismantle the accumulation of preconceptions and emotional responses we have given for granted as constituents of reality, a strong effort is required that goes beyond a simple act of rational understanding and that requires an act of *seeing* or *presencing* the nature of our mind. This is where the practice of meditation seeks to help as a tool for *awakening* to our true nature or functioning. To put it in a poetical way, meditation reveals to us the nature of the scaffold over which our mental constructs are built. It is a change of perspective or, to be more precise, a widening of perspective that places our awareness above our conceptual and emotional processes so we witness their workings. The wider perspective also helps us realize our place within the world, and the interconnectedness and interdependence existing between our body and its inhabited space.

When compared to other meditation traditions, Zen meditation in particular does not promote absorption or sensory withdrawal from the surroundings. By the pragmatic use of determined physical postures and mental attitudes, the withdrawal from the environment is vigorously discouraged and considered to promote a state of dreaminess. The seated posture with eyes opens and a well balanced level of tension and relaxation are considered to be conducive to a better clarity of mind (Austin, 1998).

... the habitual practice of being heedful to distraction from spontaneous thoughts during meditation renders regular meditators, as compared to control subjects, more able to voluntarily contain the automatic cascade of conceptual associations triggered by semantic stimuli. (Pagnoni et al., 2008, p. 2)

Once it has been practised to certain extents, this state of awareness can be extended and preserved during physical movement and into common everyday activities. The first stage toward achieving this is performed by practising walking meditation, a form of practice that is commonly included as part of the regular routines of Zen meditation. From walking to working and to everyday life the mind is kept aware, awake and mindful of the task at hand and in connection with the surroundings.

The *case* or *koan* quoted at the opening of this section belongs to a 13th century collection of koans gathered by the Chinese Zen master Wuimen Huikai or Mumon Ekai in Japanese (which gives the collection the name of Mumonkan). A koan is a kind of riddle that Zen practitioners use as a tool to strengthen their one-pointed concentration. This particular case narrates an instance of time when a senior monk was being tested to occupy the position of head master of the new monastery. As many other Zen koans and stories, it is usually the humble monk, a cook in this case, who has the correct answer (simplicity and humbleness are usually given high value in the Zen tradition). His pure action, free from conceptual ties, of kicking the pitcher is also a kick to the conceptual mind. Placing it under Heidegger's perspective, the pitcher appears in the world as a presence-at-hand that has been instantly conceptualized as an object with a purpose, a standing-reserve, ready-to-hand and to be used to contain a liquid and pour it into a cup. By kicking the pitcher, it suddenly enters its deficient mode and for a moment appears to us again as a presence-at-hand, its state of *suchness* is manifested, it is seen for what it simply is.

To further clarify the aforementioned concept of suchness, lets consider what happens when we look at this pitcher or, for example, at an ordinary pebble. In the very few milliseconds after we have discovered it, we would have already catalogued it as a pebble, and further ahead start wondering about its weight and mineral composition. It will then possibly be transformed into an object of desire to be taken and collected or thrown to a pond.

> What happened to the stone itself in all this? The pebble got lost. For its true suchness is none of these extra, human, layers. It is the stone, seen thoroughly but spared from being processed further. And seen not as our object. But just as it is, the thing-in-itself, uncomplicated by any of our autobiographical references. In suchness, viewing perceives that very stone, and it relates directly to it. Immediate perception. Uncluttered by any personal reverberations. (Austin, 1998, p. 549)

The departure from a direct relationship with suchness into seeing things for their conceptual purposelessness has a parallel in the theory presented by Manning and Massumi (2014). Looking into the perceptual qualities of the environment that individuals with autism experience, as compared to neurotypical (non autistic) individuals, the autistic seem to naturally be able to perceive their environment as it is presented, in a whole, undivided form without discrimination. This lack of discrimination is not to be seen as indifference, but as a focus on the qualitative relationality of emergent environments:

> it is to pay equal attention to the full range of life's texturing complexity, with an entranced and un-hierarchized commitment to the way in which the organic and the inorganic, color, sound, smell, and rhythm, perception and emotion, intensely interweave into the "aroundness" of a textured world, alive with difference … a dance of attention is the holding pattern of an immersive, almost unidentifiable set of forces that modulate the event in the immediateness of its coming to expression. Attention not to, but with and toward, in and around. Undecomposably. (2014, p. 4).

This quality of attention is one that does not seek to divide between human and non-human, subject or object but rather focuses on the immediacy of mutual action and emergent relation. It is not the intention of Manning and Massumi to claim that neurotypicals are unable to perceive the environment in a similar way, but neurotypicals do emphasize more the human-centric, use-value of the objects that are conceptualized out of it. As an example, upon encountering a flower, the neurotypical experiences a

> call to smell a flower upon seeing it—the welling sense that a flower is for something, for smelling—is a neurotypical response that is already moving toward grasping the flower as an object against the environment as a background … it is already tending toward expression in use-value—rather than entertaining expressibility on its own account. For the autistic, the flower and the environment, … are not immediately separable. Flower and environment are not reciprocally delimited as foreground and background, separable object and surround, but feature jointly in co-activity. (2014).

2.3   The landscape, mindfulness and the artistic

From the discussed in the previous section, we could conclude that the effects of glocalization on the dynamics of our inhabited spaces, together with a rooted world view that transforms everything into predetermined standing-reserves, are what I believe two important contributors to the postmodern disconnect with our environment. It is also important to consider a key aspect within the glocalization process in itself: in order for the global flow to exist, there will always be the need for the local. It is through the local that the global is communicated, transformed and assimilated (Kennedy, 2010, p. 144). For example, a global view of urban design will always be seen first through the eyes of local urbanization traditions, then assimilated as a recombination of both. This is also explained by the railroad example that Bruno Latour utilizes when talking about the technological networks and their global impact.

> Is a railroad local or global? Neither. It is local at all points, since you always find sleepers and railroad workers, and you have stations and automatic ticket machines scattered along the way. Yet it is global, since it takes you from Madrid to Berlin or from Brest to Vladivostok. However, it is not universal enough to be able to take you just anywhere. It 'is impossible to reach the little Auvergnat village of Malpy by train, or the little Staffordshire village of Market Drayton. There are continuous paths that lead from the local to the global, from the circumstantial to the universal, from the contingent to the necessary, only so long as the branch lines are paid for. (1993, p. 117)

The nature of this global-local continuum corresponds with the space-place continuum discussed earlier: there cannot be pure space but only thinned-out places that almost resemble space, and likewise there cannot be pure globality but thinned-out locality that can resemble pure globality. I believe then that the intense strength of the global flow sustained over long periods of time has a high potential to push aside or dilute the local culture, particularly thanks to our confused reification of disconnected conceptual structures that are highly promoted by the globalizing forces. It is then by strengthening our connection with the local through a mindful approach that cultural richness, and environmental balance can be preserved, without meaning with this that I believe the global flow needs to be completely stopped.

It is here where the role of art enters the scene. Mindfulness practice alone could be all that is necessary to alleviate the disconnect, but it is through the representational creative process of art making, and the theoretical research and insights triggered by artistic practices that new ways of understanding the problem can be found and communicated; this is what this thesis project hopes to attain, at least at a minimal degree.

It is ultimately through the development of my artistic practices, in combination with Zen meditation, that the insights that elicited this thesis project came to exist. However, it is obvious that achieving or promoting a higher level of connect with our inhabited places has been a characteristic of other artistic practices that have gained enough importance to constitute artistic trends or movements. These practices have in common the attentive exploration of the landscapes, from the acoustic or visual perspective, although not always openly associated with Zen traditions or meditation, but essentially focused equally toward a mindful experiential assimilation of the landscape as a trigger of research and artistic production.

In particular, the production of *Sitting under a highway* was highly influenced by the sound art practices that have emerged from the Acoustic Ecology discipline. As I will explain in the following section, it is evident that many of the creative practices followed by artists who identify with the discipline's theory and philosophies have similar qualities to the practices of mindfulness or Zen meditation, for example, *soundwalking* and its aural mindful awareness elicited in their practitioners. As a personal anecdote related to this, in 2009 while attending the Gabriola Speakers Series organized by the Canadian Association for Sound Ecology (CASE) and after a talk by Hildegard Westerkamp on soundwalking, I asked her if she had ever practised mindfulness meditation. It seemed to me that the qualities of the experiences she had talked about where very similar to those encountered while meditating. Her personality also resembles one of someone who has practised meditation for many years. She admitted to had been asked the same before and that she actually had never formally practised traditional meditation.

2.3.1 Attentive listening

The electroacoustic music or sound art genre known as soundscape composition was born from the work of Canadian artists and composers who also participated in the creation of the Acoustic Ecology discipline in the late 1960's. Composers and theorists such as R. Murray Schafer, considered father of the discipline (1993), and composer Barry Truax defined the concept of soundscape as any sonic environment, with an emphasis in the relationships that emerge between this environment and the individual or society. A soundscape can be either real and emerging within a specific geographical location, or virtual and artificial as the ones created by the works of sound artists (Landy, 2007, p. 106).

In a soundscape composition, the source materials are taken from sound field recordings, often performed by the artist, of a specific geographical place. Those materials are then presented and transformed using technology to create an aesthetic discourse where the characteristics of the locations are communicated with varying degrees of abstraction. The acoustic characteristics of these materials also determine the acoustic qualities and narratives of the resulting piece. Equally important for the composition process are the experiential insights of the physical space that the artist acquires which also inform and influence the creation process (see Westerkamp, 2002).

According to Barry Truax, composer and theorist member of the founding group of the Acoustic Ecology discipline, soundscape composition can be summarized by the following principles: (a) the recognizability of the acoustic source materials is maintained, even after being transformed; (b) the listener's knowledge of the environmental and psychological context of the soundscape materials is present in the meanings of the work; (c) the composer's knowledge of the environmental and psychological context of the soundscapes shapes the resulting piece at all levels; (d) the work aims to enhance our understanding of the world and influence our everyday perceptual habits. The goal of soundscape composition is to reintegrate the listener not only with the environment in a balanced ecological relationship (Truax, 1996, p. 63) but also help to trigger social transformation.

Considering the point (c) from Truax's summary, it can be assumed that it is of key importance for the artist to develop a close relationship with the environment from where the source materials will be gathered. Soundwalking is a technique that soundscape composers often use as a sensitization and exploration process, sometimes also done in groups for the purpose of creating an environmental awareness in the general public. These walks are performed in silence, traversing a geographical place, while exercising a sustained aural awareness and mindfulness of the encountered soundscapes. They can be accompanied by field recording or done just for acquiring a deeper connection with the environment through sound. "The reflective process that shapes walking attitudes and creative processes results from changes in the auditory perspective of the recordist, for whom walking, stopping, turning around, or accelerating their pace all become potential compositional techniques" (Paquette & McCartney, 2012, p. 138).

FIGURE 2.1: Performing a soundwalk On Musqueam (Coast Alish) ground (Andrea Dancer, 2012)

As eloquently stated by Kim Cascone (2014), the current availability of affordable digital recording equipment has created an explosion of artwork based on field recordings. These works are very often performed with the lack of a deeper insight of the spaces where they come from. The widespread materialistic view that characterizes modern society, sees the world as objects to be consumed, controlled and transformed (standing-reserves). This view also affects the artistic process where an artist might be more preoccupied by the technology used during the recording process or the digital post-processing techniques applied to the recordings in order to reproduce what can seem a lifeless recreation of reality.

> Technology reduces the creative process to a set of primitive actions, a series of functional modules that, when patched together, form a workflow which produces a cultural artifact. (p. 2)

The quality of the mind and the attitude of the artist while exploring and recording a location will determine the depth of the insights and the artistic quality of the work produced. This is why creative techniques such as meditation or mindfulness can be of great value. Practising meditative or mindful listening reorients the artist to a less materialistic and more holistic attitude toward the environment, particularly if extended not only to listening but to all aspects of life. The recorded materials are not anymore materialistic objects that need to be transformed and presented in a composition, they truly become a rich trigger of the deep insights that the artist has attained.

> Again, we see the sound recordist with their microphone and recorder, but rather than perceiving sonic event-objects as existing in the outer world, they are perceived as contiguous with the imagination. In this heightened state of imaginative awareness one becomes open to the myriad narratives that surround oneself. Transcending the technology, one becomes attuned to the subtle synchronicities in the fabric of sound flows. In the forest, not only are the patterns heard, and the meaning contained in the whole understood, but the whole forest is heard in each sound as well. A fabric of sonic synchronicities permeates the forest, the mundus imaginalis unfolds, the veil is lifted and the continuity of nature is revealed. Back in the studio, the narrative re-emerges from a palimpsest of synchronicities hidden in the recordings. Technology recedes into the background as imagination becomes foregrounded. (p. 4)

Sound artist and musician Pauline Oliveros also addresses mindful listening within her practice, to not only asses the soundscape itself but also as a way of cultivating attitudes toward changing the health of the sonic world. She created the term *deep listening* to describe a "total, mindful, reflexive sonic awareness that moves between trying to hear everything at once and deep attentive focus on a

single sound or set of sounds" (Sterne, 2012). In her book *Deep listening : a composer's sound practice* (2005) she describes series of exercises that are part of the Deep Listening practice she has been teaching for several years in the form of workshops and retreats. Embedded within this exercises is explicit reference to breathing and mindfulness techniques as used in traditional meditation practices such as Yoga, Taoism and Zen.

The theory and artistic revealings within the Acoustic Ecology discipline and soundscape composition are, not surprisingly, connected with the landscape-place-space theory formulated by geographers and discussed in the previous section. In the same manner that place emerges from space, that is, physical space converted into a humanly meaningful place, the *sound field* (or physical manifestation of sound as air pressure waves) is converted into a soundscape, rich in social, cultural and ecological meaning (see Schafer, 1993, for an in-depth discussion of soundscape and society). In addition, the thinning-out of places is also a phenomenon that is reflected in the soundscape and equally strongly originated in the globalized and disconnected qualities of postmodern life.

> Now in the 21st Century, that soundscape is considerably thinned out by asphalt, concrete pavements and building developments. Houston still has cicadas in stereophonic corridors as you walk or drive the streets but the frogs have mostly disappeared, leaving their sonic niches unfilled except for the sounds of combustion engines. A modern technological soundscape has emerged. (Oliveros, 2005)

> On a more activist/political level, one could perhaps say that soundscape composition can and should create a strong oppositional place of conscious listening – that is, in the face of widespread commercial media and leased music corporations, who strategically try to use the schizophonic medium to transport potential customers into a state of aural unawareness and unconscious behaviour and ultimately into the act of spending money. Rather than lulling us into false comfort, it can make use of the schizophonic medium to awaken our curiosity and to create a desire for deeper knowledge and information about our own as well as other places and cultures. (Westerkamp, 2002)

It is also interesting to note that the Acoustic Ecology discipline is a great example of creation-as-research (as defined in Chapman & Sawchuk, 2012) as it has been through the artistic work of composers and sound artists that new revealings have taken place of concepts, phenomena and knowledge about the social, cultural and ecological functioning of the soundscapes embedded in the landscape.

This new body of knowledge that initially constituted the Acoustic Ecology discipline, has then been used by researchers from other scientific disciplines to expand into other fields such as Soundscape Ecology (Farina, 2014; Westerkamp, 2002).

2.3.2   Attentive seeing

For the development of this thesis I was interested in researching those artistic practices that combined the use of mindful observation directed toward the places we inhabit, and exploring, assimilating, and revealing them through the artistic transformation of materials gathered at those locations. As evidenced by the previous section, this modality of research-creation is quite characteristic of the sound art practices performed in the context of acoustic ecology and soundscape composition. Due to the audiovisual nature of *Sitting under a highway*, I wanted to identify similar practices performed in the visual arts, particularly those that are temporal in nature such as video art and other forms of computer art. So far I haven't been able to identify a well defined and documented movement or trend with equal characteristics.

The attentive or mindful seeing of the environment as an important part of the artistic process, is present in the photography movement known as *contemplative photography*. In the words of Andy Karr, Canadian photographer and one of its advocates:

> The word *contemplative* sometimes means to think things over, but when we use the term, we are indicating a process of reflection that draws on a deeper level of intelligence that our usual way of thinking about things. The root meaning of the word *contemplate* is connected with careful observation. It means to be present with something in an open space. This space is created by letting go of the currents of mental activity that obscure our natural insights and awareness. (Karr, 2011)

Even though contemplative photography is explicitly connected with traditional mindfulness and meditation practices as part of its process, its artistic output is not strongly focused on the characterization of a specific location. Its main goal is not the exploration of place but rather that of isolated texture, form and visual composition. The artistic process is also limited to capturing and presenting

FIGURE 2.2: Light on Wire by Andy Karr (2015)

but not capturing and composing through material processing, in the way soundscape sound art does. From this perspective, contemplative photography could in some ways be compared to the sound art practices of *phonography* were the artists capture the soundscapes to later present them to an audience in an unaltered from (Landy, 2007, p. 109).

2.4 The Artistic Medium

Sitting under a highway is constituted by a synthetic virtual digital space product of the intuitive, abstract and interpretative mapping of a specific *place* within a real *landscape*, both as defined in section 2.2. The interpretative process happens through a creative process where mindfulness was practised throughout the exploration, collection, digital processing of visual and acoustic materials and creation of the interactive synthetic virtual spaces. The visual and acoustic spatiality of reality is also

FIGURE 2.3: Photography by Chögyam Trungpa (2011)

captured and thanks to the audio and visual technologies utilized (see chapter 3), these characteristics are also mapped in a literal or creative form.

Soundscapes are primarily spatial and tridimensional in nature. In the soundscape composition practice, artists mindfully traverses a space with an open perception and attentive mind. During this process, the spatial acoustic characteristics of the space inform the listener about the physical structural configuration of the location (e.g. the dimensions of an enclosed or open space), the social or cultural practices performed in the space (e.g. the sound of church bells, farming machinery), the quality of the social interactions that can be performed (e.g. a space devoid of reverberation allows for a private conversation as opposed to one where sound travels easily) (Blesser & Salter, 2009). These spatial dimensions are often expressed in soundscape compositions, by the use of sound spatialization techniques, such as multichannel, binaural and ambisonic recording and reproduction, and by the use of acoustic spatial dynamics (sound placement and movement) as aesthetic gestures (D. G. Malham,

1998).

Through the spatial characteristics of the natural (i.e. unmodified recordings) or artificial sound-scapes (i.e. the transformed recordings) presented in a sound art composition, a virtual space emerges and immerses the listener's perception. This thesis project also aims to explore the artistic augmentation of these soundscape-based, acoustic and synthetic virtual spaces, by the use of visual virtual spaces. The visual virtuality can also be experienced in an immersive way thanks to the tridimensional nature and stereoscopic presentation of the visual component. Both the acoustic and visual spaces are then magnified by the use of head-tracking technology that effectively produces an experience of *presence* within the virtual space.

At a higher level I could say that, *Sitting under a highway* is about the creative mapping of the mindful experiences of presence within a real place, into experiences of presence within a synthetic digital virtual space. Through the experiencing of these, the artistic revealing about our connection with and the essence of our inhabited environments can hopefully manifest in the audience.

2.4.1 Audiovisual Space

With the term audiovisual I am referring to the digital media art practice that utilizes a non-hierarchical combination of sound and video, as it is understood in the definition of *vidéomusique* used by the Canadian artist Jean Piché (2003). This art form, sometimes contextualized within electroacoustic music or sound art, utilizes sounds and visuals that are conceived as integral components of the expressive aesthetic gestures. For Piché, such integration creates its own language or audiovisual poetics. Some of his work also utilizes materials shot at a specific geographical location—as in the case of his vidéomusique piece *Bharat* which uses sounds an video captured in Northern India—that is then digitally processed without completely loosing its evident connection with the location.

FIGURE 2.4: Frame capture from *Bharat* by Jean Piché (2002)

The pairing of sound and visuals in audiovisual art produces a particular phenomenological response in the audience where the visual and acoustic materials influence each other in the process of construction of artistic gestures. This has been demonstrated in scientific research where, for example, audiences presented with a completely white video projection while listening to electroacoustically generated sounds, were able to feel as if the sounds were themselves somewhat "white" in nature, despite the fact that their perceptual focus was mostly placed in the acoustic space (Coulter, 2010).

The multisensorial integration capability of human perception is what audiovisual art relies on for constructing an artistic discourse. The information acquired via different senses, in this case vision and hearing, is combined in such a way that it is not perceived as two different sources but as an integrated phenomenon. This is also noticeable in those cases where the actual physical location from where a sound originates can be altered by a visual stimuli.

A simple example of this effect is what is known as the ventriloquist effect, where by presenting spatially distorted visual stimuli simultaneously with their unaltered acoustic component resulted in sound being perceived as originating from the distorted visual location (Kohlrausch & Par, 2005). The perception of space and distance within that space can also be affected by visual stimuli. The research done in this area has found that by presenting 3D images of rooms of different sizes, the subjects perceived sound recorded in a fixed space as originating from different distances.

The phenomenological characteristics of audiovisual art can be then used to understand the creative technique followed for the creation of *Sitting under a highway*, with the difference that must

of the existing audiovisual work is presented in the bidimensional space of a video projection or video display. It seems to me that the audiovisual space expanded with the addition of interactivity and the experience of presence, provided by a tridimensional visual virtual space, constitute a rich medium to explore.

2.4.2   Immersion and presence

Computer generated virtual reality, delivered through an HMD, is a fairly recent technological manifestation, The earliest experiments date back to the 1960's but with most of the development happening from the late 1980's to the present (Dixon, 2006, p. 24). This fact, in conjunction with the also relatively new theories of technologically produced media, means that a solid descriptive terminology has not been completely formalized. Terms such as "immersion", "immersive" and even "virtual reality" appear in the literature when making reference to a variety of phenomena that in some occasions differs in qualities, This vagueness sometimes makes it difficult to explore the still scarce literature on the subject. For example, the term "immersion" is used to refer to the experience of feeling transported into a different environment than the real lived one. It is often applied in the context of media delivered through an external visualization method, such as a video display or projection, but it is also applied when making reference to the qualitatively different experience that emerges in HMD delivered virtual reality. In this last one, there is immersion, but this term sometimes is applied to a particularly different type of immersion that this medium affords and that can be better defined as "presence".

Mel Slater defines *presence* as the sensation of being in a real place that is produced by the use of VR systems consisting mainly of a stereo vision delivery system (e.g. HMD, Cave), a tracking system, directional audio and possibly a haptic interface (2009). This feeling of "being there" produced by a VR system capable of recreating the sensorimotor contingencies (perception of the environment through the natural use of the body), is referred by him as *place illusion* (PI). "It is the strong illusion of being in a place in spite of the sure knowledge that you are not there" (p. 3551). The capability of producing PI

is not necessarily part of the experience of immersion or virtual reality, for example the virtual reality

that is produced when playing a video game being seen through a computer display, where there is no

reproduction or correlation with the sensorimotor contingencies (p. 3553).

> In the 1930s, Walter Benjamin, writing on the revolutionary potential of cinema to penetrate, like a
> surgeon's hand, deep into our optical unconscious, noted that a critic hostile to film complained, "I
> can no longer think what I want to think. My thoughts have been replaced by moving images.". In
> virtual reality, this sensation of technology remodelling consciousness is amplified. (Tuer, 2006)

An example of audiovisual artwork that is characterized by the experience of immersion or vir-

tual reality, without PI, is the work done in the Second Life platform by the Avatar Orchestra Metaverse.

By creating visuals in a tridimensional space that are combined with sound synthesis, an international

group of artists convene in this virtual space to perform telematic improvisations that can be witnessed

by anyone in Second Life. "With a focus on sound, Avatar Orchestra Metaverse explores nuances of

identity, culture, and communication, uncovered through telematic connection within a virtual environ-
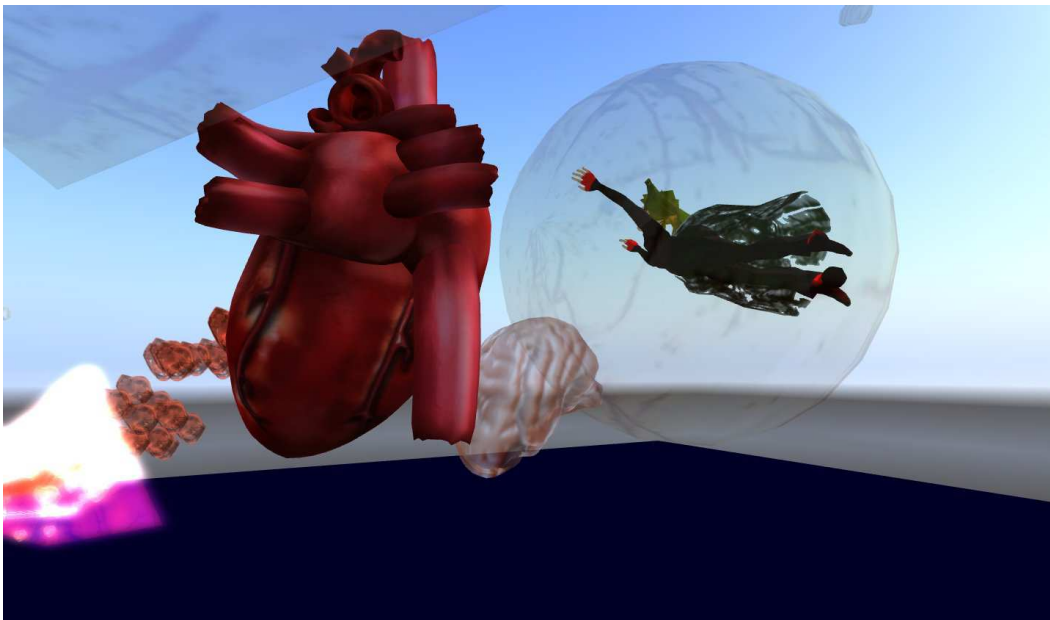
ment" (Pearson, 2010).

FIGURE 2.5: *ROTATING BRAINS / BEATING HEART* created by Stelarc, Pyewacket Kazyanenko, Franziska Schroeder, Pauline Oliveros, Tina Pearson and the Avatar Orchestra Metaverse (2010)

It is the emergence of PI within the virtual space that separates VR from other image technologies. The fact that the engagement of the sensorimotor contingencies is required for the sense of presence to emerge makes VR a kind of medium that is embodied rather than remain external to the viewer.

> whereas photography and cinema present analog or materially inscribed images for subsequent perception by the spectator's simulational consciousness, in VR the image is literally created in the process of "perception" (simulation). From this follows a fundamental shift in the relation of the image and (human) simulation: rather than being mediated by the distance constitutive of perception ... this "relation" has been folded in on itself—the image simply is the mental simulation. (p. 169 Hansen, 2004)

This embodiment, or emergence of the virtual place from within the body-mind of the spectator, has a great potential to be used as an artistic revealing of the nature of our relationships with the real inhabited places. This kind of artistic use of VR is a core value in the work of Charlotte Davis, in particular in the case of her VR installations *Osmose* (1995) and *Ephémère* (1998), that use a tracked HMD, spatial audio and interactivity.

Talking about Osmose, Davis states that "[the] themes in OSMOSE [are the] archetypal aspects of Nature, and the desire to dissolve boundaries between interior and exterior within the context of enveloping luminous spaces" (1998). In her work she explicitly tries to depart from representing Cartesian spaces in VR. Through the use of transparency she mixes images representative of nature, such as leafs, trees, water, terrain, to create poetically abstracted worlds that lie between figuration and abstraction. These environments are navigated through the use of breathing movements detected by a worn harness that allows the viewer to slowly float from environment to environment.

Davis' work often raises the question about her intentions of replacing an experience of nature with technology. But in her view, technology is being used as a filtering of nature through the artist's vision that allows for an artistic revealing or poiesis to happen in the viewer. These virtual spaces can then potentially give rise to a fresh and re-sensitized sense of natural wonder. "Embedded in the question is an assumption of an opposition between culture and nature, yet the urge to copy nature—that

is to create a second nature through mimesis—is central to an understanding of our existence and the world we live in" (Tuer, 2006).

Reading about her work, it is interesting to note how Davis handled what Hansen identified as the tendency of VR to *reterritorialize the body onto the face* (p. 161 2004). This concept refers to the fact that the emergence of presence happens mostly through vision via the head mounted display. When immersed into a VR space we don't take our body with us and at the most what can be done is a crude representation of it via 3D body models that could include hand tracking. For Davis, this type of body representation serves only to bring back the Cartesian space she is trying to avoid and the use of 3D representations objectifies the body. "In comparison, I am attempting to approach the participant's body as a subjectively "lived-body" or "I-body" Inhabiting virtual space" (p. 263 C. A. Davies, 2005). She seeks to increase the viewer's sense of immateriality.
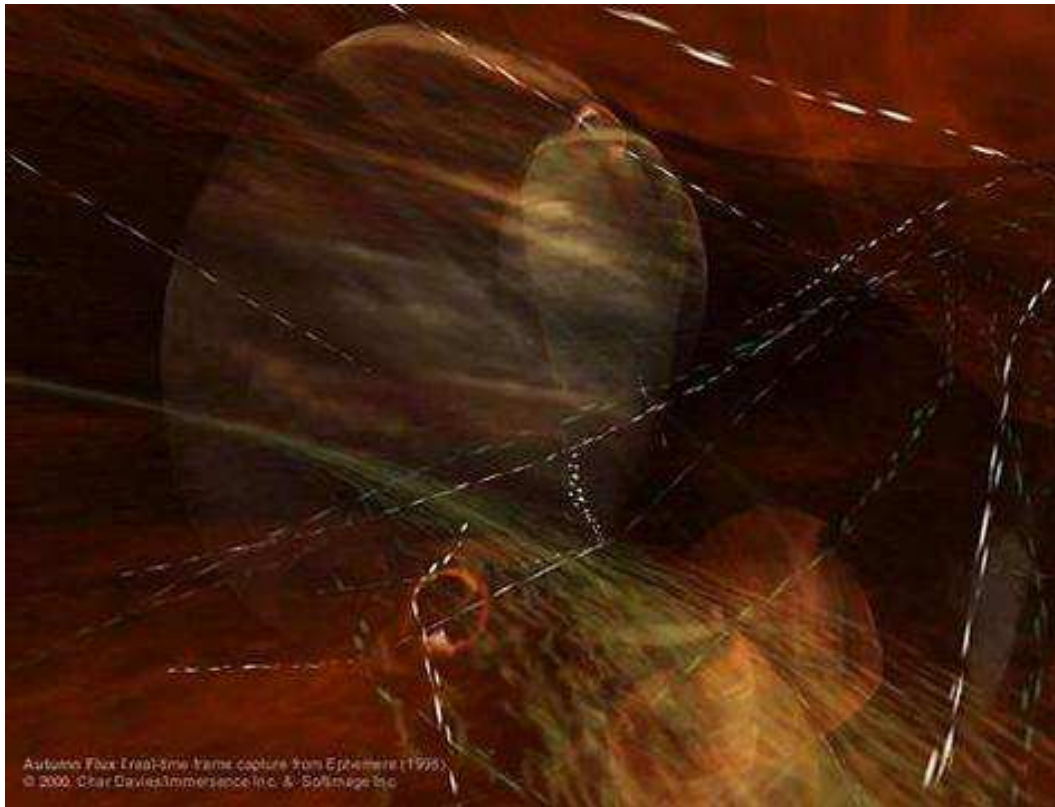
FIGURE 2.6: Charlotte Davies, Autumn Flux I from *Éphémère* (1998)

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3. Process

3.1   Method

Sitting under a highway is a research and creation project that relies heavily on digital technology. This fact might seem initially contradictory, particularly since the theory formulated by its creation process, as presented in the Context chapter, addresses the theory of the standing-reserves and criticizes the tendency to reduce everything to a means to an end. Certainly this theory was formulated by Heidegger in association with his reflections on the essence of technology, but he also distinguished the enframing-revealing of technology from the *poietic*-revealing of art in that the later brings forth the Being of a thing, rather than occluding it by transforming it into a standing-reserve, just waiting to be used (Bolt, 2011),

> Poiesis, like enframing, is a mode of being's coming to presence. However, Heidegger clearly differentiates between the two modes. While enframing concerns an ordering and mastery over what-is, poiesis involves openness before what-is. (2011, p. 80)

It is this openness before what-is that this research project aimed for. This was sought by a combination of artistic creation practices and theoretical research motivated by the *praxical* knowledge acquired during the creation process. This knowledge then fed back into the creative process giving place to a feedback loop where practice and research informed each other. As stated by Heidegger, we don't get to understand our being-in-the-world by theoretically contemplating it, it is by getting into

direct connection and experiencing it, the praxical nature of being in the world, that its nature is revealed

to us (2011, p, 87-88)

> Since creative arts research is often motivated by emotional, personal and subjective concerns,
> it operates not only on the basis of explicit and exact knowledge, but also on that of tacit knowl-
> edge. An innovative dimension of this subjective approach to research lies in its capacity to bring
> into view, particularities that reflect new social and other realities either marginalised or not yet
> recognised in established social practices and discourses." (E. Barrett & Bolt, 2007, p. 4)

3.1.1 Research-Creation

Without addressing in detail the justification difficulties that an artistic creation based research

project faces within academia, the best way to define the research nature of this thesis project is by

making reference to the definition of Research-Creation, and its categories, as formulated by Chap-

man and Sawchuk (2012). This definition seems current and relevant because in its formulation takes

into consideration previous work related to the definition of the research-creation process, such as that

by E. Barrett and Bolt (2007). At the same time, it intends to encourage a fresh conceptualization of

research-creation, without simply trying to justify its validity by making it fit into already accepted sci-

entific academic research values and processes.

> Research-creation "theses" or projects typically integrate a creative process, experimental aes-
> thetic component, or an artistic work as an integral part of the study. Topics are selected and
> investigated that could not be addressed without engaging in some form of creative practice,
> such as the production of a video, performance, film, sound work, blog, or multimedia text. (2012,
> p. 6)

Chapman and Sawchuk further divides research-creation into four categories: research-for-creation,

research-from-creation, creative presentations of research and creation-as-research. Considering that

the use of these categories does not mean that "... [they] are mutually exclusive categories, only that

they stand as useful terms for elaborating discussions around different approaches to research-creation"

(2012, p. 15). Three of these four suggested categories are relevant to this thesis project: research-for-

creation, research-from-creation and creation-as-research.

The research-for-creation category refers to the initial work done in preparation for the creative production. This included an exploration of the initial ideas and a scan of the literature related to them, research and prototyping of the technologies to be used, and artistic audiovisual material exploration. The products of this research are then intended to support and elicit the creative process. The knowledge gathered through research-for-creation informs the aesthetic, ethical or technical choices that are subsequently done through the production process.

> ... the gathering of materials, practices, technologies, collaborators, narratives, and theoretical frames that characterizes initial stages of creative work and occurs iteratively throughout a project. (Sawchuk & Chapman, 2015)

The research-from-creation category refers to the research and findings that are triggered by the creative process. It is within this category that the previously mentioned feedback loop can be defined. Iterative and circular cycles of creation and research that are sustained along the production process. "The use of such research information does not simply come at the end of the process to "evaluate" the effectiveness of the work; instead, the work itself can be used to generate information ... to help build the project in question, as well as future initiatives." (2012, p. 16).

> ... the extrapolation of theoretical, methodological, ethnographic, or other insights from creative processes, which are then looped back into the project that generated them. (Sawchuk & Chapman, 2015)

The Creation-as-research category is for those research-creation projects that use a combination of the four categories, were research originates and depends on the execution of a creative process. It is through creation that new findings emerge, This is quite relevant to this thesis since it is the creative and intuitive effort performed in the first place that revealed the concept and theories of the environmental disconnect central to this project. It is where the poietic nature of art plays an important role as generator of research and knowledge.

> It is about investigating the relationship between technology, gathering and revealing through creation (following Franklin, 1992, and Heidegger, 1977, where "technology" connotes a mind-set and practice of crafting as much as it does "equipment"), while also seeking to extract knowledge from the process. (Chapman & Sawchuk, 2012)

In the following sections I will then explain in detail the activities performed for the creation of *Sitting under a highway*, without isolating its components into each one of the mentioned categories but rather presenting them in a thematic or organic way that better communicates the nature of the different processes.

3.2   Under a highway

Artworks that are centred on exploring the qualities of a specific geographical location have the potential of creating an intimate connection, awareness and a reflective process between those locations and the works' audiences. My incursion into sound art practices connected to specific locations, such as sound-mapping and soundscape composition, helped me become aware of this potential. These practices also helped me realize the rich creative possibilities of utilizing location captured audio and visual materials, together with the phenomenological insights acquired through the mindful exploration of those locations.

During the span of several years, I have physically traversed different geographical areas accessible to me, with aural and visual awareness and collecting materials in the form of sound recordings, photography and video. Some of those materials have ended being used as part of my own art work or just kept for personal enjoyment. As part of this process I have come across particular locations with specific characteristics that, in some way or another, have left a strong and permanent imprint on me.

The area framed by the Don river, lake Ontario and the intersection of the D.V.P. and Gardiner highways is one of those influential locations and one that I keep returning to for continuing exploration. It appears to me as a living metaphor of the essential qualities that arise from the encounter between the natural and the human made, where both coexist in state in which one seems to be about to take over the other: the natural is being penetrated, polluted and contained by the human technological, while at the same time the human structures are gradually eroded, crumbled and penetrated by the

natural. The metaphorical nature of this location also extends as a metaphor of human oblivion to the consequences of such encounter. A metaphor of that to what humanity has turned their backs against, while looking in another direction to be completely distracted and immersed in our own human constructs and utilitarian purposes. Such absence is also physically manifest in the contrast between the thousands of human beings that traverse the area every day while driving at high speed on the elevated highways, passing by with minimal engagement, and the almost complete absence of human presence and emergence of *place* happening at ground level.

FIGURE 3.1: The mouth of the Don Valley River at Lake Ontario, by Hector Centeno (2009)

3.3   Mindful exploration

As explained earlier, in *Sitting under a highway* I'm attempting to elicit the same kind of artistic revealing that soundscape composition produces but expanding it through the use of an immersive audiovisual virtual space. During this research-creation process it became clear to me that it would make sense to attempt a translation of the characteristics of the aural poietic revealing about the landscape, that soundscape composition performs. into the visual immersive space. This visual creative process then began in the same way as a soundscape process, by capturing bidimensional and tridimensional visual elements from the landscape being explored to later be digitally transformed. It would also be essential to perform this visual material collection with the same mindful qualities of soundscape listening and recording.

Different techniques or approaches for mindfully exploring a location's soundscape have been already described by sound artists and acoustic ecologists, some of them referenced in the previous chapter. Parallel to this, I believe that the cultivation of mindfulness through the frequent and sustained practice of meditation techniques can be of great help in sustaining the kind of quality of mind needed to establish a deep connection with the places. The way I physically arrive to the location seems also to have certain degree of influence. The gradual approach of walking or cycling to the location rather than driving a car seems to grant a gradual immersion and a better experiencing of the qualities of interconnectedness manifested in the transitions between the different places leading to it.

After exploring the area, I decided to limit the material collection to the particular section of the highway shown in Figure 3.2 and around the river area shown in Figure 3.1. Both locations gave me two different perspectives with a variety of visual and acoustic qualities representative of the area. In the following two sections I will discuss the techniques and equipments used for audio and visual material collection while further details on how these materials where used will be discussed in section 3.4.

FIGURE 3.2: Highway overpass location

3.3.1   Visual acquisition techniques

The techniques used for capturing visual materials were: photogrammetry, to create 3D models and textures from scans of small and large scale elements, and stereoscopic video recordings, to be used for texturing. I chose to use photogrammetry due to being affordable by requiring only a standard photographic camera and accessible software, both commercial and open source. This technique has been gaining popularity in film and video game productions due to the advancements in computer vision techniques and available computing power that allows for a highly precise tridimensional scanning of small to large objects and structures with results that also include high quality photorealistic texturing. It will also very likely become a significant tool for the media productions presented through the newly available consumer VR equipments.

Using photogrammetry for scanning large structures, such as the highway overpass used for
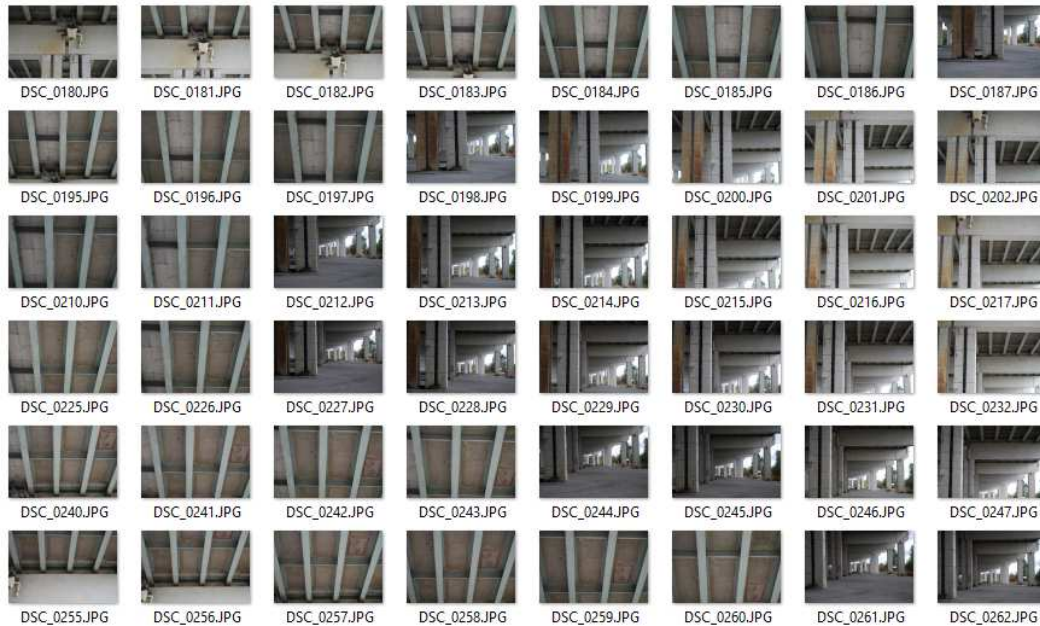
FIGURE 3.3: Highway photogrammetry: sample of the photo set

this project, represents a significant task that requires hundreds of overlapping photographies from all angles and several hours or up to a full day to process on a recent desktop computer. This image capturing is often performed using flying drones with attached cameras but for the sake of maintaining a simpler, less distracting and hands-on equipment usage process, I purposely limited myself to what I could achieve using a DSLR hand-held camera. I also decided to limit the perspective to a single point of view that would also give me a sense of depth thanks to the continuation of the highway being visible while extending toward the vanishing point. The final 3D mesh and texture are shown in Figure 3.4.

Since the capturing was done form a single perspective, the resulting mesh presents a significant degree of degradation in those sections where no visual information is available to the processing software. These sections are only visible when navigating the model toward the vanishing point (see Figure 3.5). For certain applications, this could be undesirable but for artistic purposes I find that the qualities of these artifacts are an interesting outcome that I intended to explore in future iterations of this project.

FIGURE 3.4: Highway photogrammetry 3D model displayed in Unreal Engine

Virtual reality presented through an HMD is a fundamentally stereoscopic medium that can be paired with other stereoscopic image capturing techniques including stereo video and photography. There are currently several ongoing efforts, some of them performed by large corporations such as Google ("Google Jump," n.d.), to improve the capture and visualization techniques of spherical stereoscopic video (360-3D video). This is a technique I was interested in exploring from the beginning of the development of this project, and again for the sake of unobtrusive simplicity and affordability, I opted to use a pair of consumer grade action video cameras (GoPro branded) mounted on a 3D enclosure accessory also commercially available. With these, I captured closeup and far views of rocks, plants, wall textures and other visual elements that I intuitively decided to focus on while exploring the location.
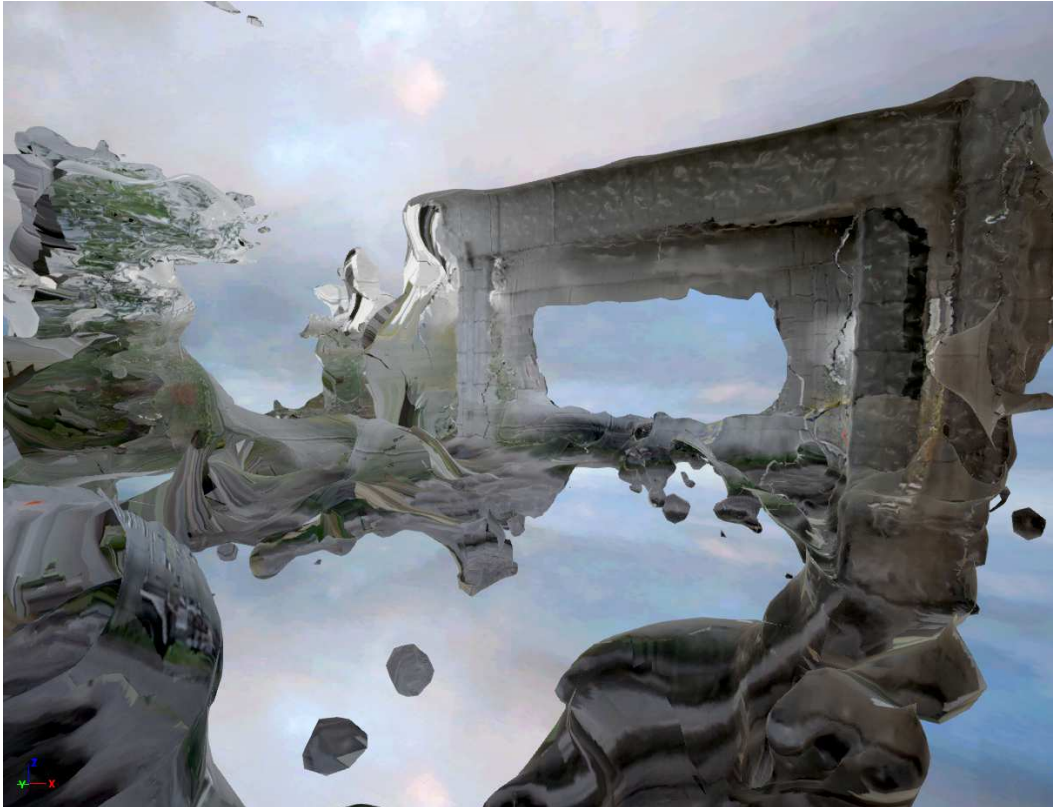
FIGURE 3.5: Photogrammetry artifacts produced by missing visual information

3.3.2   Sound acquisition techniques

The sound capture of the soundscapes present in the location was performed following techniques that would allow me to preserve their spatial qualities. Over the past years, and as part of my sound art work, I've been performing research and testing of different recording techniques in order to better fulfil that preservation purpose, including custom designed binaural microphones, baffled stereo devices and particularly ambisonic recording and reproduction techniques. In the case of ambisonics, in the past three years I have developed a custom designed native B-Format microphone that can be built using 3D printed metallic and plastic parts and affordable, high fidelity and low noise, electret microphone capsules. This project was inspired by similar ones such as the A-Format microphone

designed by Indian sound recordist Umashankar Manthravadi ("Umashankar Manthravadi in Ars Electronica," n.d.). As opposed to commercially available A-Format (tetrahedron arrangement) ambisonic microphones, native B-Format does not require complicated calibration and transcoding processes (for more details on the ambisonic system, please see [David G. Malham and Myatt, 1995]). This microphone was connected to a customized 4 channel portable recorder using 3D printed parts designed by Manthravadi. Both microphone and recorder are shown in Figure 3.6.

FIGURE 3.6: Custom designed Ambisonic B-Format microphone with 3D printed frame and customized portable 4-channel sound recorder

3.4 Soundscape and Landscape virtual counterpoints

It might initially seem contradictory that for this project I am asking an individual to wear an HMD and completely disconnect from their surroundings in order to experience artwork that is actually trying to elicit connection with reality. As mentioned earlier in this chapter, I believe that the geographical location I explored serves as a metaphor of the human oblivion that happens while we only engage with our own built forms of standing reserves and their use for work or entertainment. At the same time,

almost any other art form asks their audiences to be momentarily immersed in it and to disconnect from what's around the artwork. In exchange, we emerge enriched by the experience and, in some instances, transformed in a way that allows us to perceive the rest of reality in a different or improved way.

In the case of HMD virtual reality, the immersion is enhanced by the emergence of the place illusion effect. From this perspective, projects such as *Sitting under a highway* have the potential of becoming a point of entry into a space of reflection and artistic revealing that more clearly connects with the experiences of the physical spaces we inhabit. A door that upon being initially approached might appear to lead to just another experience of continued disconnect, but instead the users slip through it to find themselves immersed into a strange place of mystical and contemplative nature.

It is interesting to note, and as pointed out by Dixon, 2006, that many of the significant artworks that have been produced in the short lifetime of HMD technology have had a tendency toward an exploration of the primordial, the natural or the ancient. This is also evident in the works of Charlotte Davis and it is interesting to me that I did not become aware of both this kind of artistic VR subjects and Davis' work until I was already developing this project, and then realizing I was also using the technology for similar purposes.

As mentioned earlier, the conceptual approach that I followed to design the presented virtual space has also been influenced by my previous sound art work. I followed an approach in constructing the sound layer so that in itself it could almost stand as a pure soundscape composition piece. Then, I treated the construction or composition of the visual layer with a similar approach in order to create a "landscape" composition that would serve as a counterpoint to the soundscape. As in any layered temporal aesthetic counterpoint, at different moments both seemingly independent layers will either perfectly coincide or take their own independent directions. This landscape-soundscape counterpoint concept might not seem evident to the spectator and it is not the purpose of this work to demonstrate

such technique. It is rather a conceptual creative technique that I intend to further explore and develop in future iterations of this and other audiovisual VR projects.

Through the use of immersion and the presence effect, ultimately this landscape-soundscape composition intends to manifest itself as a temporarily inhabited place, product of the aesthetically composed acoustic and visual textures, and the spatial qualities extracted from a real place. In order to explore the potential of this creative approach, I initially built a virtual playground or exploratory environment (see Figure 3.7) to fulfil the purposes of better understanding: (a) the general expressive potential of the place illusion effect; (b) the phenomenology of sound and visual event synchronization within the VR space; (c) the phenomenology and techniques of texturing, photogrammetry acquired 3D models, lighting, 3D mesh animation and stereoscopic videos; (d) the phenomenology of the presence of uman and non-human figures and the effects of departing from their understood, real behaviour and appearance to an unnatural, surreal state; and (d) the initial design of the computational system to render both the visual and acoustic layers in realtime.

FIGURE 3.7: Virtual space for the phenomenological and technical exploration of place illusion

3.4.1 System design and physical manifestation

Because most of the creative 3D audiovisual digital technology has been developed to serve the needs of gaming interactive media, it is not surprising that these software environments are the ones to first support the creation of content to be delivered through recent HMD technology, which also is mainly targeting the video game industry. Considering this in the context of *Sitting under a highway*, the use of tools to create artistic, reflective and mindful content constitutes a significant departure from the dynamics and intentions of their planned purpose as digital gaming standing reserves. This act in itself could constitute a metaphor of the core that this project is intending to reference: artistic creation as an intuitive and subjective reflection, seeking the breakdown of the reified conceptual constructs that create a disconnect between humans and their inhabited places.

To be able to satisfy the computational demands required by a good quality audiovisual experience using stereoscopic visual rendering, spatial audio and sensor interactivity, a two computer system was designed where one computer is dedicated to the HMD realtime visual rendering and the second to the EEG data processing and realtime sound rendering. Both computers are networked via an ethernet cable for event synchronization and data exchange using the OSC protocol.

Between the available software alternatives, I chose to use Epic Games' Unreal Engine 4 (UE4) due to its sophisticated shader capabilities with rich illumination, texturing and virtual material design tools that produce photorealistic tridimensional scenes (it is for these same reasons that UE4 is favoured as a tool by architecture visualization producers). The engine also offers a good environment for designing both interactive processes and scripted narratives, with mesh, texture and post-processing effect animation.

The sound rendering system was built using Cycling '74 Max (previously known as Max/MSP) with the addition of the HOALibrary ambisonic processing externals, developed at the Centre de recherche

Informatique et Création Musicale (CICM) ("HOALibrary for Max and Pure Data," n.d.), and the convolution and spectral visualization externals from the HISSTools library, developed at the University of Huddersfield, UK ("The HISSTools Impulse Response Toolbox," n.d.).

The physical presentation of the installation was designed with the purpose of inviting the audiences to a state of calmness, concentration and simplicity, when approaching it and while being inside the installation space. One individual at a time enters the space under dimmed light where a clean and simple setup is found in the middle, consisting of: one low wooden bench where the HMD (with attached hand sensor), headphones and EEG sensor band rest ready to be worn; a wooden box behind the seat containing the computer system; and a display monitor on top of the box so any external observer can see what is being seen through the HMD. The space is enclosed by at least 3 curtains or walls in order to create an intimate place, and for the same reasons that in a Zen monastery a mediator sits facing the wall or an empty space, in the installation the individual also seats facing the walls or curtains. This is all done with the intention of inviting to move away from distraction and toward concentration. Figure 3.8 and Figure 3.9 are both computer renditions of this layout that were created to better understand the design. The bench shown there could also be replaced by a wooden block or beam of similar dimensions. The dimmed light is necessary not only for eliciting calmness but also to avoid any light leakage into the HMD that could make the viewer aware of the outside, contributing to breaking the place illusion effect.

FIGURE 3.8: Prototype computer rendered visualization of the installation layout

FIGURE 3.9: Prototype computer rendered visualization of the installation layout, far view

3.4.2   Audiovisual aesthetic treatment and techniques

In her VR work, Charlotte Davis seeks to move away from the Cartesian representation of space and volume, This is a critical design decision she makes in order to avoid perpetrating the conventional values that main stream computer graphics technology has favoured, including objective realism, linear perspective and Cartesian space. For Davis, all of these characteristics contribute to emphasizing the dualistic, scientific and mechanistic worldview of the western world.

> For me [Davis] the challenge of working with this technology involves subverting its conventions and the ideology behind them in order to make images that can act as antidotes, reaffirming our organic participation in, other than our separation from, the world. (McRobert, 2007, p. 51)

I could say that in the case of *Sitting under a highway*, and as mentioned earlier, there is a degree of technological subversion by utilizing technology heavily associated with video gaming for the purpose of creating a meditative, non-competitive experience. On the other hand, and opposite to Davis, I decided to use a photorealistic visual aesthetic with tridimensional objects that initially appear solidly placed on a Cartesian space, even though, like her, I am also trying to address the disconnect that dualistic thinking can produce. I understand the use of the Cartesian space as an opportunity for aesthetically connecting the virtual place to the visual and sonic spatial configurations present in the location from where all the audiovisual materials derive; whereas in the case of her VR work, Davis is trying to create an abstracted space without direct connection to a real location.

It is true that the term "virtual reality" has been historically used to emphasize the idea that by creating computer graphics delivered through an HMD, we should be aiming to create a virtual world that is indistinguishable from the real one (Coyne, 1994). I opted to use photorealistic textures and tridimensional volumes replicated from reality not to emphasize an objectification that produces separation between self and external reality, but rather to place an emphasis on the fact that mindfulness happens in our reality: it is an invitation to contemplate and connect with the beauty of the textural, morphological and acoustic properties of our real inhabited places.
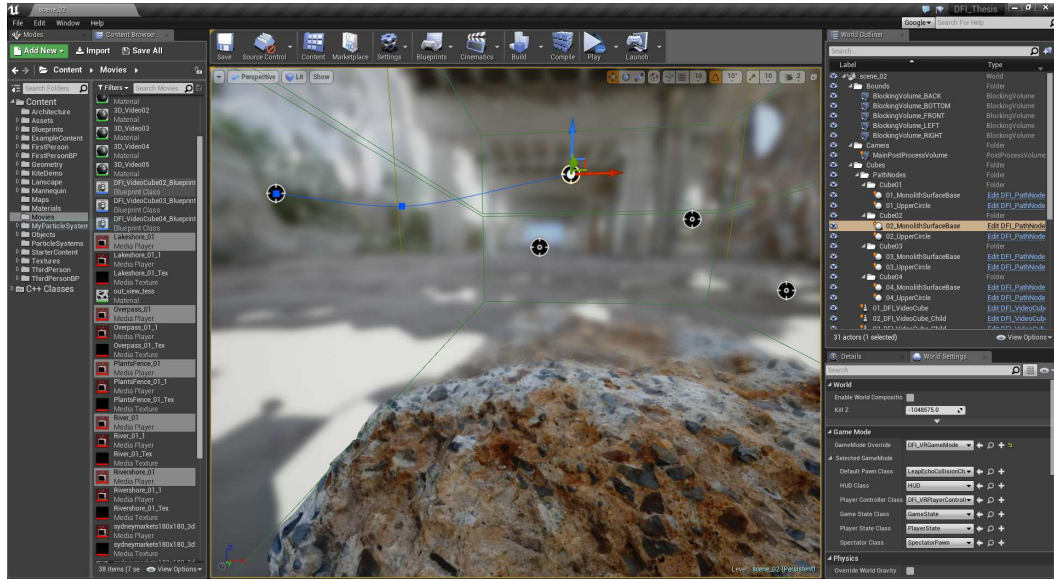
FIGURE 3.10: Main view of the UE4 project

The accuracy of the Cartesian space is also in some ways subverted by the presence of floating geometrical objects, textured with stereoscopic videos of natural elements shot at the location. These objects display ambiguous physics behaviours, such as being able either to pass through solid objects or bounce on them, and either float or fall toward the ground. Simultaneously, the stereoscopic video textures visible on them break the Cartesian rules by exhibiting tridimensional depth without parallax effect. Over the whole scene, a narrow depth-of-field effect is also applied to create an unnatural visual characteristic (as compared to human vision) that functions both as an interactive exploratory element and a visual metaphor of focused concentration.

The iteration of *Sitting under a highway* presented together with this document represents a stand-alone version of a project that I will continue researching and developing beyond the work done for this thesis. It currently consists of two stages that are summarized as follows:

- Stage 1: This is the opening stage where all the spectators begin. They emerge under the highway overpass through a fade in from a completely white space where only the soundscape is fully present (see Figure 3.11). They appear as sitting at ground level, at the same hight they are

sitting in reality. The appearance of the landscape is blurred due to the narrow depth-of-field and nothing other than the immediate floor underneath and the virtual hands can be seen in focus. In the background, at a medium distance, a luminous human figure can be seen mindfully and slowly walking back and forth, in and out the scene. The soundscape consists of the unaltered one recorded at the location. The spectators remain at this stage for some time and until it is determined that they have sustained a minimum degree of mental calmness and concentration (further details are discussed in subsection 3.4.3).

- Stage 2: The transition from the previous scene to the second scene is again done through a fade to white. Now the spectators are placed in an abstract open space of infinite horizon under a cloudy sky (see Figure 3.12). In front of them, as some sort of mystical monolith, stands now a reproduction of a large piece of eroded concrete, wood and natural detritus that was captured from under the highway. Four geometrical sound emitting bodies, which I call *Elements*, slowly move and emerge from inside the monolith. Each one of these is textured with stereoscopic video of natural elements taken from the location. They glow, change shape or rotate in coordination with their sound. What happnes next is determined by the EEG sensor data: the Elements hover, move at varying speeds and change sound characteristics in patterns determined by the raw frequency data and the concentration/relaxation indexes. They also eventually return to their initial position over the monolith and drop under the influence of gravity to rest on its surface. At this point the spectators can "grab" the Elements to examine them closely thanks to the hand positioning sensor. They can also be thrown into the air or to the ground, to then resume their independent flight. The soundscape in this stage changes from the previous untouched field recording and is now composed of layered, generatively processed sound samples taken from the same recording. In the background, the human figure continues the slow and mindful walking that was present since the first stage. Sustained mindfulness also eventually brings the spectators close to the walker.

Technically, all the visual components consist of custom programmed behaviours and textures

FIGURE 3.11: First stage scene with the highway appearing blurred due to an applied depth of field effect

that use the standard frameworks that Unreal Engine 4 (UE4) provides. The particulars of some of the technical procedures that I believe could be useful to the reader are documented in Appendix A where I included screen captures of Blueprint diagrams and Max patches. The flow of events was staged using the Matinee functionalities of UE4, and the movement of the Elements was programmed using procedural animation of spline paths. For the human figure walking in the background, a 3D model was created using the open source software Makehuman ("Makehuman open source tool for making 3D characters," n.d.) and animated using Blender ("Blender Project," n.d.) with data from the freely available motion capture database produced by Carnegie Mellon University ("CMU Graphics Lab Motion Capture Database," n.d.).

Throughout the design process a balance between visual quality and performance had to be maintained since current VR technology requires a substantial amount of GPU power. Each frame has to be rendered by the engine twice (once per eye) at a higher than required resolution in order to preserve quality after applying distortion corrections. Currently it is not yet possible to use more than one GPU in parallel and VR optimizations are still being worked out into all the main stream software engines.
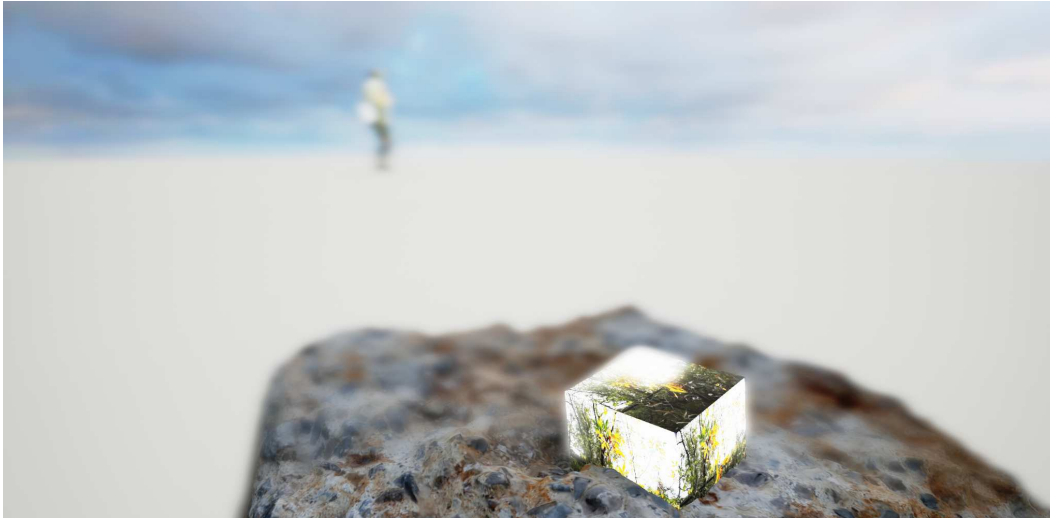
FIGURE 3.12: Second stage scene with video cube or *Element* emerging from the concrete monolith

As in many soundscape composition sound art pieces, the sound design was done using only the ambisonic recordings performed at the location as a source of material. As mentioned in the Context chapter, this is important in order to create objective and subjective references—depending on the degree of sound processing done—to the location that is being used as a source.

Ambisonics constitutes, in many ways, an ideal spatial audio recording and reproduction system for virtual reality HMD media. The technique allows not only to record or synthesize 360 degrees of spatial sound (full periphony soundfields) but also to perform rotations along any of the soundfield's three spatial axis. As it is being done by the visual rendering engine, the orientation reported by the HMD can also be used to compensate for the head movements of the individual wearing it to create the illusion of sounds remaining in their spatial location, enhancing the emergence of the place illusion effect.

The ambisonic system is also very flexible for spatial audio reproduction. Multichannel loudspeaker setups of almost any number and spatial configuration can be used to recreate varying degrees of acoustic spatial fidelity. This includes being able to combine ambisonics with binaural HRTF
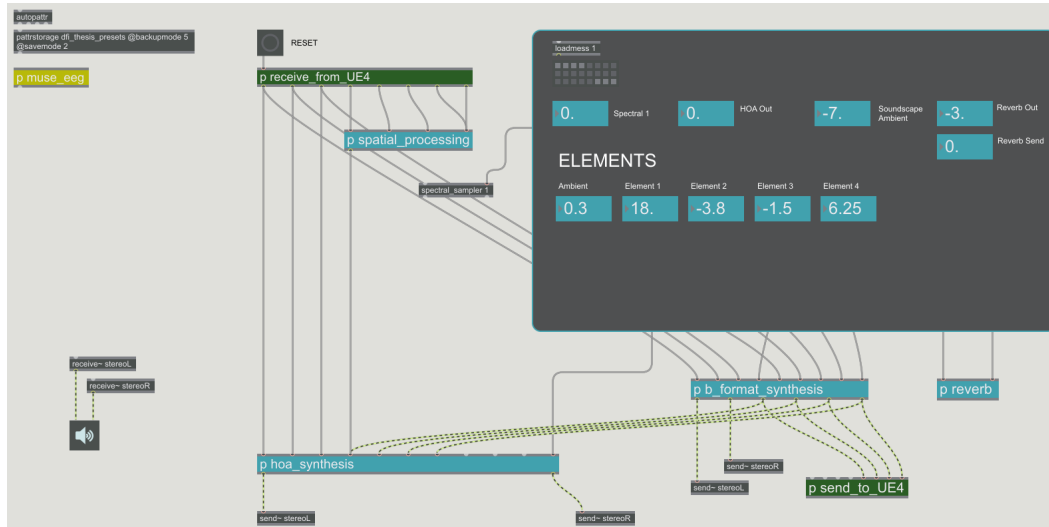
FIGURE 3.13: Main view of the Max patch

techniques in order to reproduce spatial audio through headphones, by placing the ambisonic decoded

speaker feeds as virtual speakers binaurally panned using convolution (for a discussion of the tech-

nique, see Noisternig, Sontacchi, Musil, and Holdrich, 2003). In the case of the sound system designed

for *Sitting under a highway*, this ambisonic to binaural technique is utilized for both the reproduction of

the untouched ambisonic soundscape recordings and the synthetically generated and ambisonically

panned sounds. As part of my research, I discovered that the use of the HRTF impulse response files

(or kernels) included in the Ambisonic Toolkit, developed by Lossius and Anderson (2014), were the

most effective in reproducing a nearly spatially accurate binaural image of the soundscape.

The ambisonic system also makes it possible to extract spatially localized portions of the sound-

field using a technique known as *virtual microphones*. This produces results equivalent to having placed

a real microphone of a specific polar pattern in the same location, aimed at a specific azimuth and ele-

vation. The polar pattern and orientation of the virtual microphones can be specified in order to focus

on either particular sounds or wider areas of the soundscape (the algorithm used in this project to

accomplish this is documented in Appendix A).

The audio processing and synthesis techniques performed in Max can be summarized as follows:

- The location and orientation (rotation) of the HMD in the virtual scene is constantly transmitted from UE4 to Max via OSC. The location data is then scaled to match the spatial dimensions of the ambisonic `[hoa.3d.map]` object used in Max to place sound sources in the tridimensional soundfield space. Specific objects inside the UE4 scene (i.e. the Elements) also can report their location via OSC so their corresponding assigned sounds can be placed in the 3D spatialization map. The orientation angular data is used at the end of the processing chain, before the binaural encoding, by a third-order ambisonic plug-in ("Blue Ripple TOA Core Plugins," n.d.) and a b-format algorithm in order to rotate both the synthesized soundfield generated by the `[hoa.3d.map]` object and the untouched ambisonic field recordings.

- Four virtual microphones are used in Max to extract specific sounds from the field recordings that where then filtered to isolate specific frequency ranges, These are the audio signals associated with the Elements in the virtual scene. Simultaneously, the untouched ambisonic field recordings were either presented in their natural form or processed (using filtering and time domain segment scrambling) to create the base ambient component over which the sounds of the Elements where placed.

- The absolute peak amplitude of the Element audio signals is measured over short periods of time, scaled and sent to UE4 via OSC messages. This values are used to perform animation of texture parameters (e.g. light emission of the mesh) and creating a link between sound qualities and visual transformations of the geometrical shapes (e.g. rotational movements).

3.4.3   Presence and interactivity

Interactivity in HMD delivered VR is an important element that contributes to the emergence of presence. As stated by Slater and Sanchez-Vives (2014), resent studies have found that beyond the place illusion effect, to be able to perceive the physical events occurring in that virtual space as believable is also an important factor of presence. This is what Slater calls *plausibility illusion* (Psi),

PI relies heavily on head (ideally eye) tracking because it enables head-based sensorimotor contingencies—in other words, perception of the environment through use of the body in a natural way: bending down, looking around, looking past, listening by turning the head toward the source, and so on. Psi is the extent to which the participant perceives events in the virtual environment as actually happening. It seems to be a function of the extent to which events in the environment refer specifically to the participant, the extent to which events respond to that person's actions (for example, the participant smiles at a virtual human that smiles back), and the overall credibility of the environment compared to expectations. (p. 25)

As further discussed by Slater, Psi can also appear through actions performed via virtual embodiment or body ownership illusion. This is possible due to the brain's flexibility in being able to perceive virtual or fake body parts as replacement or extension of the real ones. By using tracking devices to mimic the position and movements of a body part with a virtual one, the users can quickly believe that they have acquired a bodily presence in the virtual world. Distorted or augmented physical qualities, such as unreal or elongated limbs are also quickly assimilated and used as own.

The modelling of causal perception, as understood by cognitive psychology, manifested in the interaction between VR objects (Cavazza et al., 2005) can also contribute to Psi. In reality, throwing a stone on a glass window produces the perceived causality of the glass breaking due to this action. In VR new causality connections can be created by consistently associating certain events to a reaction. This new causality does not have to necessarily mimic what happens in reality but it contributes to creating a sense of presence in a virtual world.

In the case of *Sitting under a highway*, the creation of Psi was attempted with embodiment and causality via a hand tracking sensor (Leap Motion) that allows the audiences to experience hand presence in the virtual world and to physically manipulate virtual objects. The affects and perceptual effects emerging from the appropriation of augmented virtual body parts were explored by applying tridimensional ground textures, captured at the location, to replace the skin of the hands (see Figure 3.14 and figure 3.15).

This type of embodiment seemed to me to trigger an interesting and complex series of emotions

that could lead the audiences to reflect and experience a stronger connection with the essence of the location. Once the illusion of bodily presence is achieved, by seeing a hand shape that very closely mimics the movements and spatial position of the real hand, the replacement of the skin with a tridimensional texture composed of soil, branches, plants, snail shells and bird bones can cause a strong emotional reaction of being simultaneously taken over by an external entity but also of embodying that same entity. This seemed to me an interesting visual and physical perceptual metaphor of the interdependence between our body-mind composite and the surrounding inhabited places.

FIGURE 3.14: 3D ground textures applied to virtual hands

The second interactivity interface involved in *Sitting under a highway* was an EEG sensor band utilized to take an approximate measurement of the audiences' level of mindfulness. This was computed as a composite of the level of their mental relaxation and concentration as reflected by analyzing specific brain wave frequencies. The correspondence between this measurement and the impact on the virtual world are less obvious and direct when compared to the virtual hands interaction. It seemed to me that this correspondence could very likely be not understood by the audiences unless they are
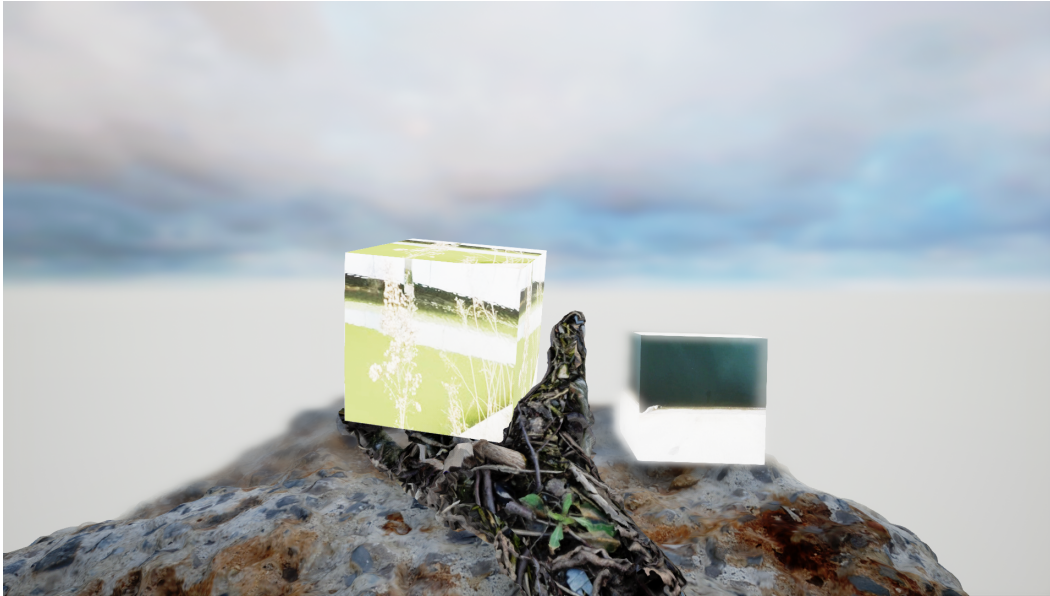
FIGURE 3.15: Lifting an Element with one virtual hand

informed, prior to starting the experience, that their level of concentration and calmness will be measured.

In general, it is very difficult to use EEG data to measure specific mental states from the wide spectrum of electrical oscillations emitted by the brain. This is particularly difficult if the measurements are not calibrated to the electrical qualities of a specific individual. The use of EEG in audiovisual art has solved this problem by either targeting interactive or performative systems to be used by a single individual or by simply taking the EEG data and mapping it to a broader range of visualization and sonification parameters. The latter will produce results that will vary depending on the user but also provide an opportunity for intuitive biofeedback to happen, where a direct perceptual representation of raw data is used instead of a qualitative analysis of the brainwaves (see Christopher, Kapur, Carnegie, & Grimshaw, 2014, for a further discussion and references of EEG based audiovisual artwork).

It would have been ideal to use the EEG data to measure the presence of brain frequencies associated with states of meditation. Different meditation traditions display increase or decrease in brain activity at different frequency bands due to their difference in focus. In the case of Zen meditation,

which is focused on concentration and awareness, diverse studies have shown that the mix of brain-wave types and levels varies between novice and experienced practitioners (Cahn & Polich, 2006). To perform this measurement on random participants in order to obtain usable and precise parametrized data would have been close to impossible.

Taking into consideration the aforementioned difficulties and for the sake of simplicity and ease of wearability (placed under the HMD headset), a consumer grade, *Muse* branded EEG sensor band was used. The Muse is an easy to wear 4 sensor band with an SDK containing proprietary analysis algorithms that provide, among other, an approximate measure of mental concentration and relaxation (named concentration and mellow in the SDK used at the time of development of this project) and a measurement of the relative power of each brainwave band.

The interactivity layer of the system in *Sitting under a highway* uses the concentration and mellow parameters; the relative brainwave measurements of specific frequency bands; hands tracking; and the detection of head rotation. Its functionality is summarized as follows:

- The EEG data is received via Bluetooth and sent as OSC messages by the muse-io application. The OSC messages are received by the Max patch where the values are analyzed and sent to UE4.

- The mellow and concentration parameters are scored over medium periods of time (10 to 30 seconds) to grant some flexibility and to compensate for inaccuracy due to lack of individual specific EEG calibration. The algorithm keeps track of the number of seconds that the individual displayed concentration and calmness within the period of time and accumulates a score. This score is then sent to UE4 where it is used to determine if changes in the virtual scene should be performed, including the transition between stages and the movement state of the Elements.

- The relative values of the theta, alpha, beta and gamma EEG bands are also sent to UE4 to be used in determining the movement patterns of the Elements when in flight state. This is also

done in order to provide a spatial audiovisual representation of the audiences' general state of mind that could also function as intuitive biofeedback.

- When the concentration/mellow score falls within a low range, the Elements stop flying and return to their initial positions above the monolith to then drop under the influence of gravity (simulated by the UE4 engine). At this point and using the virtual hands, the users can interact with the Elements. If the concentration/mellow score goes back up, the Elements either resume flight by themselves or when they are thrown or released by the user's virtual hands.

- The movement of the spectator's head is monitored and analyzed using the raw gyroscope data generated by the HMD's built-in sensor. To encourage concentration and calmness throughout the two scenes, when excessive movement during a short period of time happens, the whole scene fades out to white to remain there until the movement has slowed down. The analysis algorithm of the angular velocity of the 3 accelerometer axis was designed to not trigger the fadeout after short, sudden changes of perspective but only after continued, restless movement.

FIGURE 3.16: View of the four Elements hovering over the monolith

4. Conclusions and Future Directions

This research-creation project emerged from the insights I've acquired through my artistic sound art work and the discovery of the immersive and presential capabilities of newly accessible consumer VR technology. My artistic process has been centred in the application of mindfulness and meditation practices, as performed in the Zen Buddhist tradition, within the artistic exploration of the relationships with our environments. The first objective of this project was to discover and develop processes, and their theories, for the creation of new audiovisual work involving the presential nature of VR. The parallel second objective was the discovery of theory and philosophy that would expand my understanding of our relationships with our inhabited places, theory that would then feedback into the creative process.

The exploration of existing literature revealed to me that a combination of the relatively new geophilosophy theories and the traditional existential phenomenology, such as the one proposed by Heidegger, can lead to a better understanding of the social, ecological and political dynamics between humans and their environments. It also became evident that within these theories, and the location aware artistic practices and disciplines such as soundscape composition and Acoustic Ecology, exist conceptual threads that deeply resonate with the documented and experienced insights of meditation based spiritual traditions. From their own contexts, all are clear and conceptually similar when pointing out the fundamental nature of the dynamics existing between our perception and the world. I am particularly interested in continuing the exploration of these connections in order to deepen my understanding.

New media technologies, such as VR, also open up the opportunity for breaking with the design trends that have prevailed in the creation of content for TV, cinema and video gaming. For decades, the main objective of mass media content design has been to elicit behaviours in the audience that lead to an increase of profit for the producers and/or sponsors. This has lead to excessively omnipresent, formulaic, culturally and socially thinned-out glocalized media content that weighs against society's well being. The need to apply critical design principles to new media is urgent. Motivated by its introduction into the consumer mainstream, there is currently an ongoing discussion among media designers regarding the need for discovering the specific narrative processes native to VR, Being a new, or renewed medium, there is a still substantial work to be done in further understanding the phenomenology of the presence effect (PI and Psi), and its different roles and nuances depending on the media genera, including the purely artistic.

I believe that for the creation of *Sitting under a highway* I have barely began to discover the new artistic possibilities that emerge from this technology. The increased accuracy levels of visual and bodily presence possible now in a virtual world open up new and interesting aesthetic experiential channels. I will continue exploring them through future iterations of this and future projects. Upcoming technological developments will also allow me to widen the exploration, such as the potential of spatial interactivity that room-size tracking technology will offer.

Creating virtual reality worlds is a highly demanding creative and technical task due to the complexity of the systems involved in its production, Many of the VR creative workflows are still technically being discovered and developed. Throughout the process of this project, several technical and creative hurdles had to be cleared that consumed a significant amount of time and energy. This was particularly the case due to my chosen artistic process, requiring me to be in mindful contact with every single aspect of the project as much as possible, hence having to realize the whole technological and artistic production process only by myself. It was a great learning opportunity that encouraged me to learn new technologies and creative techniques, including, among other: new software tools for visual design and EEG analysis; 3D modelling and texturing techniques; animation techniques using motion

captured data; photogrammetry workflows to translate real life objects into usable photorealistic VR assets; lighting and post-processing rendering effects; spatial audio synchronization between a game engine and an external audio synthesis environment; and VR game engine performance optimizations.

A better understanding of the phenomenological qualities and the audiovisual artistic potential of VR presence was also a valuable outcome of this project. Some of them could be summarized as follows:

- The value of photorealism in creating a sense of connection with a geographical location, and the subtle alteration of hyperrealism via surreal elements to trigger uncanny affects. This phenomenon is similar to the embodied "digital any-space-whatever" that Hansen elaborated based on Deleuze's theory (see Hansen, 2004, p. 196-231, for a discussion on this). This affect triggered embodiment is also made interestingly more complex through the virtual space embodiment already experienced in VR through the PI and Psi factors.

- The aesthetic value of 3D imaging techniques now affordable in VR. Particularly those that are possible with recent GPU processing capabilities, as compared to the limitations of previous systems used for VR rendering. The techniques related to the medium itself such as photorealistic textural parameter animation, realistic lighting (dynamic intensity, coverage and shadow generation) and dynamic depth-of-field and eye adaptation effects are just an initial list of possibilities explored in this project, with many more to be explored in future ones.

- The possibilities of the audiovisual medium in VR. Combining different levels of abstraction in the sound and visual components represents a rich opportunity for artistic exploration. Instead of using photorealistic visuals, the abstract use of shapes, particle generators and textures would generate a different artistic discourse with implications in VR that I am interested in further exploring.

- The effects on presence of virtual physical layouts. For example, object proximity, where closer, near field objects elicit stronger presence than those in the far field. This could be due to the

stereoscopic limitations of the medium itself. Considering the documented mechanisms of human vision, the exact placement of the limit between this near-far field could also change depending on the interocular distance (IPD) of each user.

- The aftereffects of prolonged VR use. This is a relatively new research area that is currently experiencing an increased attention due also to the upcoming mass consumer commercial availability of new VR equipment (Davis, 2016). Personally, I did not experience some of the already identified effects such as nausea or vertigo but in a few occasions I did experience some strange perceptual disassociation effects that might be anecdotal but worth considering and looking into. The hand manipulation of virtual objects greatly increases the level of the place illusion, nevertheless this physical action contains a strange paradox in the fact that I could feel truly present but at the same time experience total absence of tactile sensations such as the weight and texture of the objects I truly believe I am holding. Over extended periods of time, I was able to adapt to this disassociation and still experience the virtual manipulations as believable. This experience unexpectedly reappeared in real life, a few minutes after removing the HMD, when I instantly and intuitively expected to not feel anything when reaching and about to grasp a bottle of water.

Many other insights that came out of this project are intuitive in nature and will require longer time to rationalize and put into words, if possible or if actually necessary. I am sure that many of these will also manifest in clear or hidden ways in future projects. I feel that having conceptualized and theorized an artistic process that before this project had remained exclusively as intuitive in nature, will not hinder its core values. The intuitive qualities will remain but now enriched by the further connections and doors that the rational analysis has created.

The currently planned future developments of this project will include expanding the number of stages so the users are placed within more than two environments. This could include exploring changes in the depth-of-field effect to allow the users to perceive the far field areas of the highway, and particularly placing them in those areas where the lack of visual data produced interesting degraded

photogrammetry results. I also have a number of objects that were captured from the location requiring still extended re-topology or post-processing work to make them usable in the game engine (see Figure 4.1 and Figure 4.2), These objects could then be displayed in front of the users, in the same way as it was done with the concrete monolith. Each one of these could then release different types of geometrical Elements, utilizing 3D video textures and sounds emphasizing other aspects of the location. The behaviour of the Elements when being held by the user could also be elaborated to include changes in shape, sound or texture.

The interactivity mechanisms are also an area I'm interested in exploring further. The use of EEG data could be improved by designing a calibration procedure that is not intrusive to the artistic discourse. This could be done in the form of a preamble scene where the user is in some way encouraged to perform the required mental actions, in order to collect the data that could be used as baseline for the calibration. The use of hand tracking proved to be very effective but I am also interested in discovering the interactivity possibilities of the upcoming technology that includes spatially tracked hand controllers.

FIGURE 4.1: Raw photogrammetry scan of highway detail

FIGURE 4.2: Raw photogrammetry scan of another highway detail

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Appendix A Key system components

This Appendix contains sample snippets of the UE4 Blueprints and Max patches used in the audiovisual system of *Sitting under a highway* that perform specific visual and audio processing functions. A complete documentation of the architecture of the whole system is out of the scope of this document due to page number constraints.

A.1   Unreal Engine Blueprint Snippets

A.1.1   Stereo video texture

This is the Blueprint used for applying the stereo videos as textures. When rendering to a stereo HMD, the screen-space in UE4 is divided in two vertically: the first half corresponding to the left eye and the second to the right. Depending on the eye being rendered, the first or second half of the stereo side-by-side video is rendered on the texture.
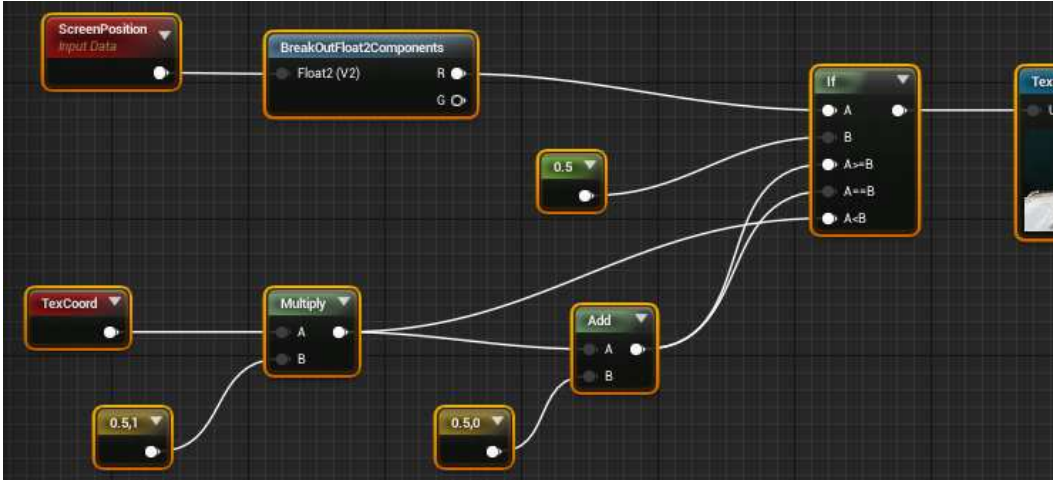
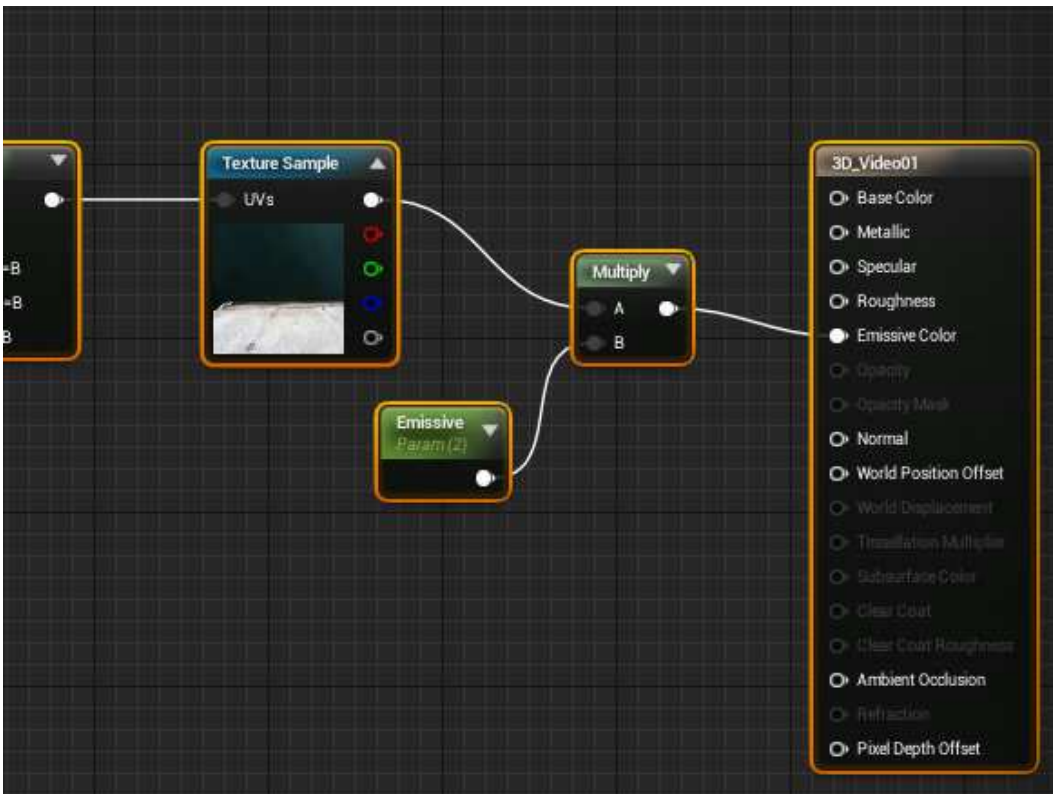FIGURE A.1: Stereo video texture for HMD visualization, part 1

FIGURE A.2: Stereo video texture for HMD visualization, part 2

A.2   Max Patches Snippets

A.2.1   Virtual Microphones

This is the Max Gen patch used to extract the virtual microphone signals from the ambisonic B-Format recordings. It takes three parameters: azimuth and elevation in degrees; and directionality (polar pattern) as a float value in the 0-1 range, where 0 is omni-directional, 0.5 is cardioid and 1 bipolar.
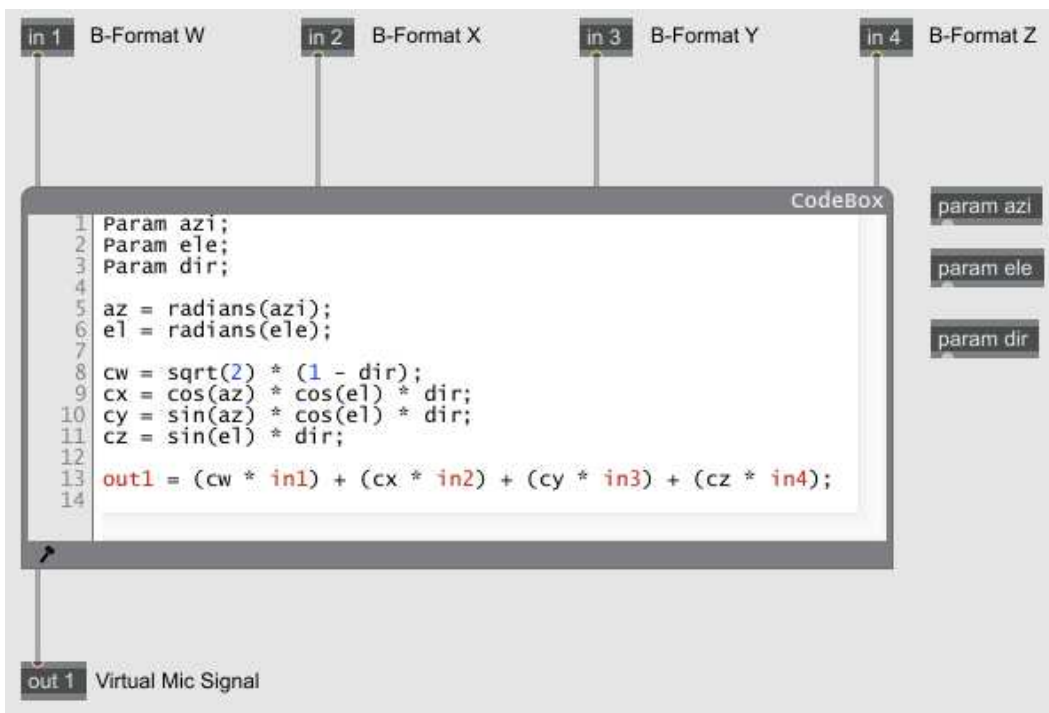


```
1  Param azi;
2  Param ele;
3  Param dir;
4
5  az = radians(azi);
6  el = radians(ele);
7
8  cw = sqrt(2) * (1 - dir);
9  cx = cos(az) * cos(el) * dir;
10 cy = sin(az) * cos(el) * dir;
11 cz = sin(el) * dir;
12
13 out1 = (cw * in1) + (cx * in2) + (cy * in3) + (cz * in4);
14
```

FIGURE A.3: Virtual microphone Max (Gen) patch

A.2.2   B-Format Rotation

This is the Max Gen patch used to rotate the B-Format soundfield. It takes three parameters: yaw, pitch and roll angles in radians. The rotations are performed in that same order.
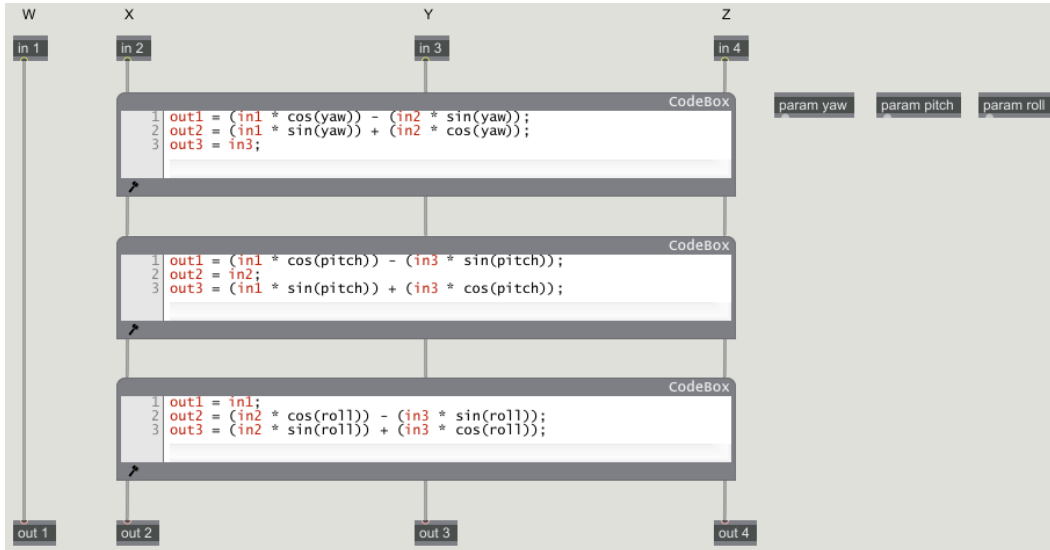
W	X	Y	Z
in 1	in 2	in 3	in 4

```
CodeBox
1 out1 = (in1 * cos(yaw)) - (in2 * sin(yaw));
2 out2 = (in1 * sin(yaw)) + (in2 * cos(yaw));
3 out3 = in3;
```

param yaw   param pitch   param roll

```
CodeBox
1 out1 = (in1 * cos(pitch)) - (in3 * sin(pitch));
2 out2 = in2;
3 out3 = (in1 * sin(pitch)) + (in3 * cos(pitch));
```

```
CodeBox
1 out1 = in1;
2 out2 = (in2 * cos(roll)) - (in3 * sin(roll));
3 out3 = (in2 * sin(roll)) + (in3 * cos(roll));
```

out 1	out 2	out 3	out 4

FIGURE A.4: B-Format rotation Max (Gen) patch

A.2.3 3rd Order Rotation and decoding

This is the section of the Max system that applies the rotation to the 3rd order ambisonic spatial-ization. Since the HOA library uses it's own channel ordering, the signal requires to be converted from HOA to B-Format before is sent to the TOA panner plugin. The angles in degrees arriving from UE4 are converted to unity range (0-1) also to be used by the panner.
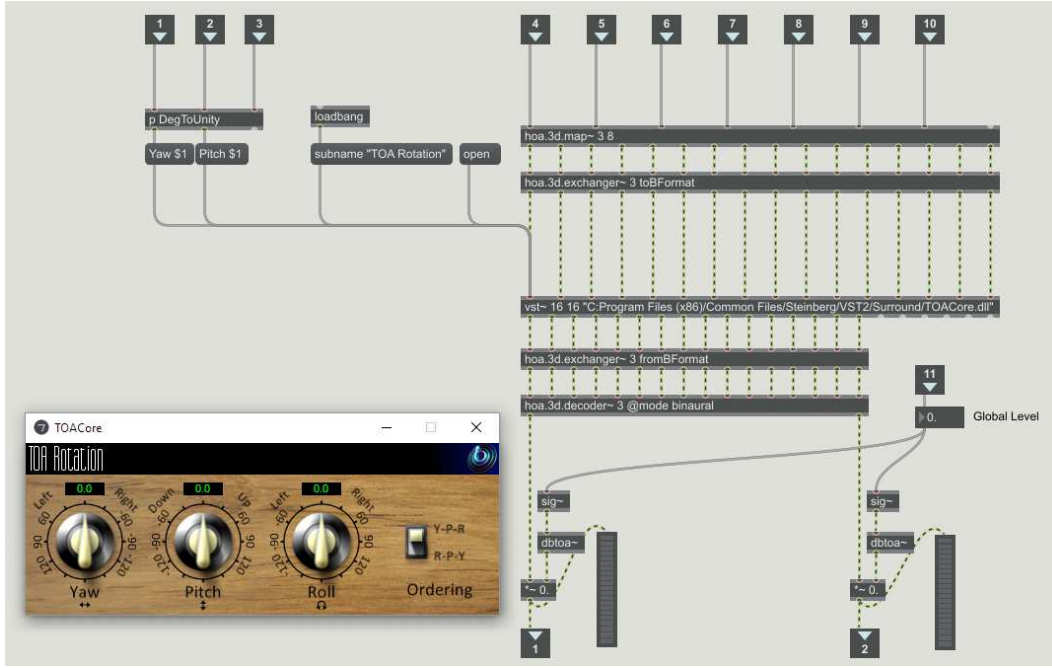
FIGURE A.5: 3rd order ambisonic rotation and decoding

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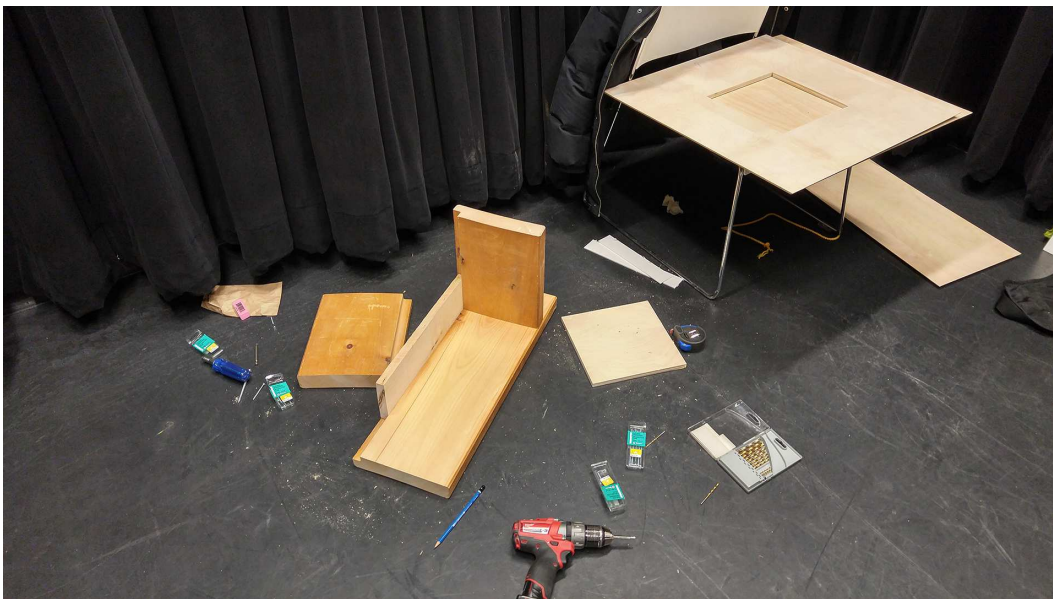# Appendix B Exhibition visual documentation

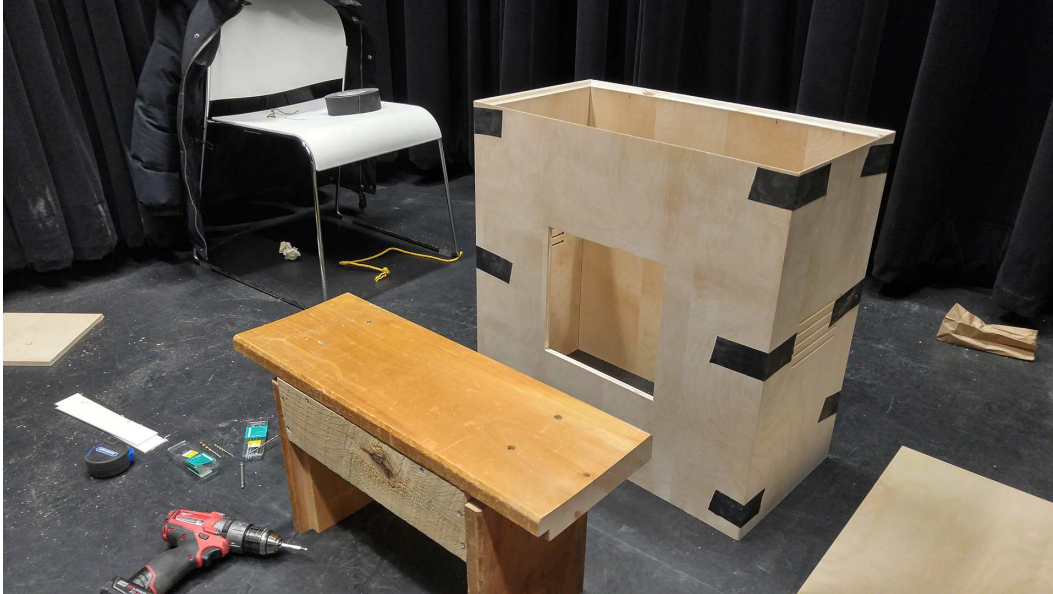FIGURE B.1: Custom made computer box and bench being assembled.

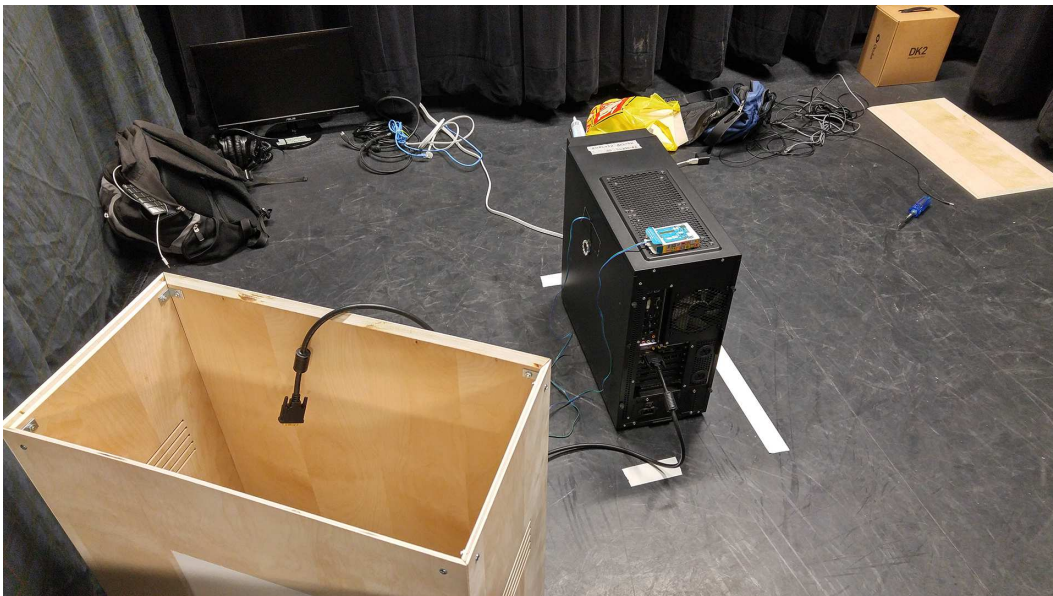FIGURE B.2: Custom made computer box and bench being assembled.

FIGURE B.3: PC computer running UE4. Arduino and LED ring for visual effect mounted on cabinet.

FIGURE B.4: Computer box brackets for easy reassembling and transportation.
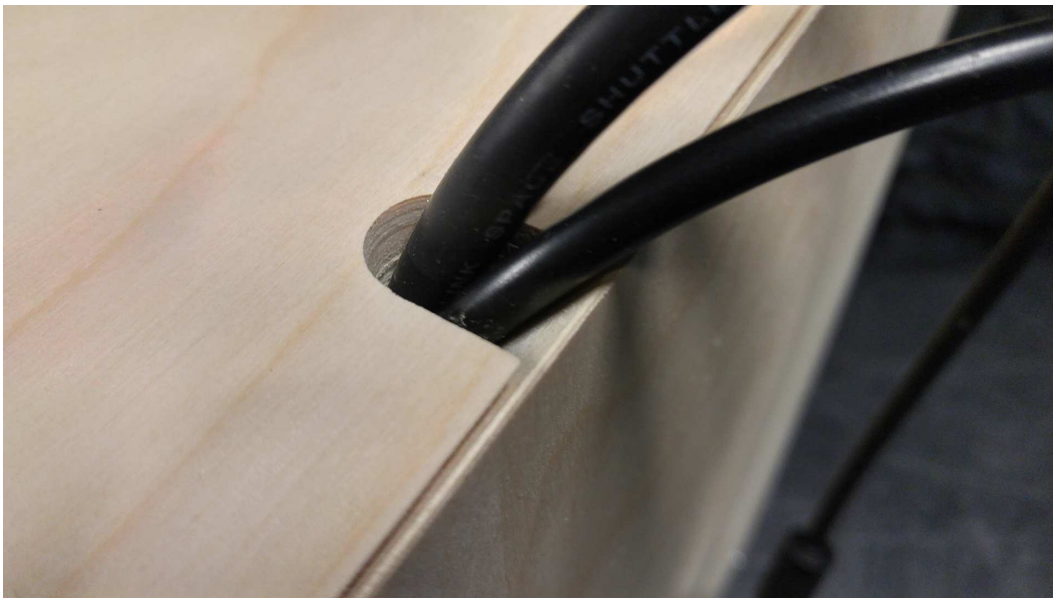

FIGURE B.5: Power and video cable outlet for the LCD monitor.

FIGURE B.6: Bench and box assembled on user's side.

FIGURE B.7: Front view. Acrylic window on computer box for lighting effect.

FIGURE B.8: System running and ready to be used under dim lighting.
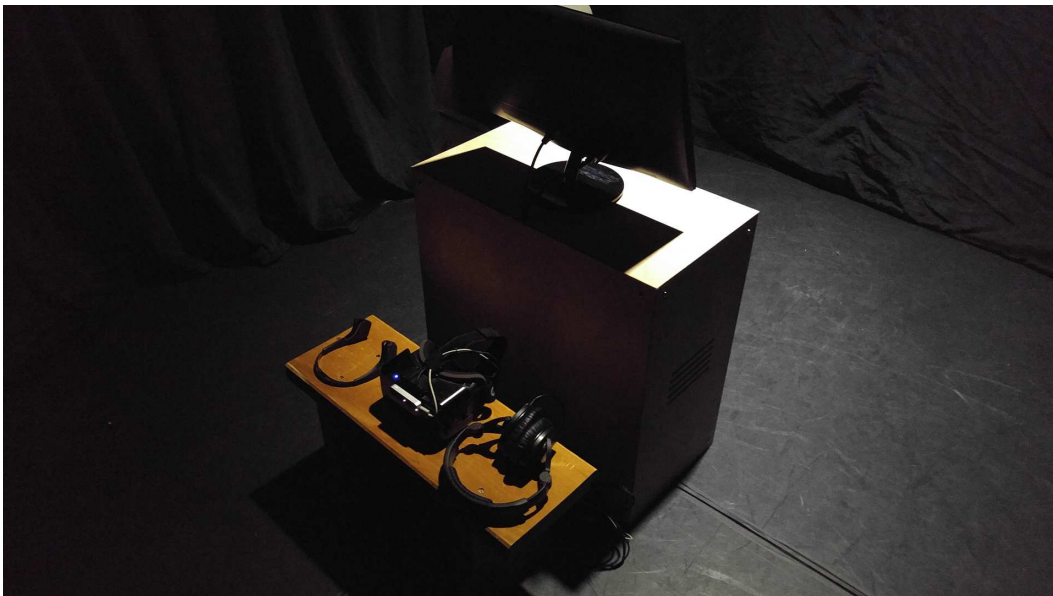

FIGURE B.9: Headphones, HMD and EEG sensor band ready to be worn.

FIGURE B.10: Immersed user in action.