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**The Tesseract: using the body's movement to  
shape my compositional practice.**

Susan Elizabeth Green-Mateu

A commentary accompanying the creative portfolio submitted to the University of Huddersfield in partial fulfilment of the requirements for the degree of Masters by Research.

January 2018

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## ABSTRACT

The aim of this research project is to challenge my practice as a popular music songwriter and producer. To achieve this, I have developed a theoretically informed dance/movement paradigm to shape sound and provoke alternative production methodologies within my compositional practice. My work questions how concepts from Modern Architecture, *The Bauhaus*, Laban Movement Theory, Dance Movement Therapy and the psychology of movement can be coherently integrated into my technologically-mediated creative practice.

Inspired by Laban Movement Theory, I have created *The Tesseract*. This is the culmination of research investigating how I can create a compositional system that enables the mapping of my body's movement to parametric control in custom audio effects and what are the performative and psychological implications I encounter arising from this system. *The Tesseract* allows me to integrate my intuitive physical movement and embodied cognition to create an interactive and dynamic means of sculpting sound in space. *The Tesseract* provides me with a compositional-kinaesthetic feedback tool that provides an auto-ethnographic reflection on my long established compositional methods and how these have changed as a result of this research. The tactility and physicality of controlling sound through movement offers a fundamentally different experience of working in a studio: one in which the perception of what is occurring sonically at any given moment can be immediately reconfigured through movement projection.

Ultimately, this research project facilitates the integration of *The Tesseract* as a theoretically informed way to shape sound through movement and a technologically mediated means for mindfulness. Through creating works in this way, I investigate connections between Dance Movement Therapy and psychotherapy as it relates to embodied cognition, memory, and trauma.

## LIST OF PORTFOLIO WORKS SUBMITTED

<i>I Remember</i>	(2017)	Audiovisual	8'20 mins
<i>Ghost Dance</i>	(2017)	Audiovisual	6'30 mins
<i>Here &amp; There</i>	(2017)	Audiovisual	4'15 mins
<i>Helix</i>	(2017)	Audio	4'30 mins
<i>Inter-Act</i>	(2017)	Installation	Open
<i>Memories of Filey</i>	(2017)	Audiovisual	9'15 mins

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This research project is dedicated to my daughter Aria, my “heart walking around outside my body”.

## INTRODUCTION

Simply put: Evolve or evaporate. That's how you stick around. Evolve or evaporate. You have to be very cognisant of what's going on around you. You can't be so bold and reluctant to be receptive to change that you don't allow yourself to grow. Because nobody really understands that music is always growing, a lot of it is reciprocal. (Usher in Jozzor, 2012)

As an auto-ethnographic study of creative practice, my inspirations, influences, experiences and explorations in compositional practice are an important part of the contextual understanding of this research project. The integration of Laban's movement theory, sound processing techniques and interactive technologies allow for personal reflection and evaluation to uncover the authentic structures of my creative practice. As a songwriter and producer, I continually challenge my creative process and actively seek to expand my artistic influences. Usher's words 'evolve or evaporate', from an interview coinciding with his seventh studio release *Looking 4 Myself* (2012) resonate strongly with me. As someone brought up within an interdisciplinary educational environment, I have always sought to assimilate new skills and then move beyond them by bringing them into fusion with ideas from different disciplines.

Raised in Miami, I attended a Magnet Arts School, an environment in which subjects like mathematics and science were taught synergistically through the lens of art and music. This teaching style allows for a freeing up and de-compartmentalisation of knowledge. Mathematics for example, became an exercise in fractal drawing, and physics was studied through stage and sound design. All were further intertwined as the years progressed from Musical Theatre and Songwriting to Production, Sound Engineering and Design. Thus, from an early age the mental acuity to express a concept from one discipline in a seemingly unrelated one was actively encouraged and developed.

I experience most things as homologous and analogous; patterns and shapes interrelate and are affiliated with everything. I see "abstract concepts, such as units



of time or mathematical operations, as shapes projected either internally or in the space around them.” (Carpenter, 2001) In my creative practice this is expressed in various ways: I feel music in movement and hear the angles and proportions of buildings as well as shapes in nature. I feel/taste internal and dermal temperature changes, from peppermint to vanilla, when I touch things. I have an eidetic memory and remember words and whole conversations like I do song lyrics, from the very first listen. Brad Blanton, author of *Practicing Radical Honesty* refers to this process as the *reactive mind*. Blanton considers that:

We are a recording device. We’ve been recording multi-sensory recordings of successive moments of now ... They are built into us; we have these records of things we experience ... they are proprioceptive recordings. (Blanton, 2014)

All of this produces profound emotional responses that are worked into my compositions, artwork and writing. Blanton expands on this in his talk *Radical Honesty*, explaining that emotional signatures are added as markers to these recordings, these compilations and layers of ‘nows’. (Blanton, 2014) These markers are like an unconscious filing system. They are like wormholes into a whole bank of information, content, and material with which to create art. Movement is an emotional signature that contains the expression of dynamics and a kinesthetic dialogue. Emotional signatures in my work are just as imperative as time and key signatures. Accepting that I organise my ‘unconscious filing system’ differently, I explain to people that my mind has ‘all-apps-open-all-the-time’. In order to communicate the complexities of my experience, I compose music, draw, and move. These forms of communication contain within them more than one mode of expression. The compilation of several elements at once helps to express an entire idea. For me:

The body becomes an instrument whereby the nonphysical becomes physical. It becomes a tool for learning more about the self through internal witnessing and awareness. (Vicario, 2017, p.6)

As such, the act of physical movement, or kinesthetic movement, suggested a means for me to challenge my creative compositional process. My initial research

questions were focused on how I could use movement to compose music and how this could influence my production flow. I was keen not to use on-the-body systems such as Imogen Heap's Mi.Mu gloves<sup>1</sup>, a development of earlier systems like the the Bodycoder by Mark Bokowiec in collaboration with Julie Wilson-Bokowiec (Wilson-Bokowiec & Bokowiec, 2006) and MIDI remote systems such as Michel Waiswicz's 'The Hands' (Waisvisz, 1985), but nevertheless wanted to harness the real-time content of movement expression.

Throughout, my research questions were continually refined as interactive technical and musical avenues were explored to examine the commonalities between movement and music. This resulted in *The Tesseract* – an interactive, wireless gesture-to-sound control system consisting of an Xbox Kinect Camera and custom effects racks in Ableton Live along with Max for Live (M4L) patches.

In my research words like movement, motion, physical movement, kinesthetics and dance are used. It is essential to understand that the use of these words here are interchangeable. Mónica E. Alarcón Dávila, in *Body Memory and Dance* explains how choreographer Merce Cunningham, “considers dance a physical-aesthetic manner of movement, and points out that every movement can be an instance of dancing.” (Dávila in Koch, 2012) This definition supports the interchangeability of the words like ‘dance’ and ‘movement’ throughout this research. Alarcón Dávila goes on to explain Merce Cunningham's practice as beginning with a question after which “he uses fortuity in his choreographies to find new movements.” (Dávila in Koch, p.104) The preliminary motivation of movement in my compositional practice is to use the emotional context generated by motion.

In the three chapters that follow, I contextualise *The Tesseract* both from a historical and a theoretical perspective. Chapter One contains a literature review of the historical use of the body as a unit of measure, detailing how the disciplines of art, dance and music interrelate through the work of various researchers, practitioners, and artists from both a practical and psychological perspective. This grounds the conceptual influences on my practice. Chapter Two details my early explorations

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<sup>1</sup> <https://mimugloves.com>

and initial test pieces created with what was to become *The Tesseract*. In Chapter Three I point to future work exploring how *The Tesseract* can be used as a tool in dance movement therapy and cognitive behavioural therapy that can sonically represent how our various inner mappings of memory/trauma affect our experiences.

# CHAPTER ONE

## 1.1 Mapping the Body

All art constantly aspires towards the condition of music. (Walter Pater in Jencks, 2013)

Music is liquid architecture; Architecture is frozen music. (Goethe, 1829)

The interrelatedness of all art is a core factor of why I began researching mapping movement and music. The interrelationship between architecture, music, the body and proportion has fascinated theorists and philosophers, from Pythagoras and Leonardo Da Vinci to Rudolph Laban, Le Corbusier and Lauren Sarah Hayes. In the Renaissance, it was thought that since man was created in the image of God, places of worship should reflect this. Unlike their Gothic predecessors, Renaissance architecture exhibited the architect's knowledge of geometry and arithmetic through proportion and symmetry. In his *De Architectura (Ten Books on Architecture)* Vitruvius states that proportion "is a correspondence among the measure of the members of an entire work, and of the whole to certain parts..." (Vitruvius, 1960, Bk. 3, Ch.1) The 'correspondence' of individual units within a building originated in the comparison of these to the human body (see Figure 1).<sup>2</sup>

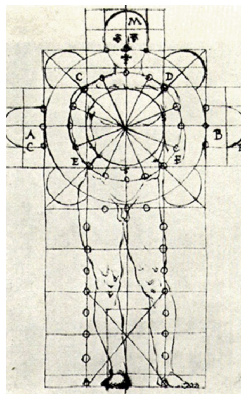


Fig.1: *Tratto di Architettura*: Church Plan by Francesco di Giorgio, 1490.

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<sup>2</sup> See <http://introtorenaissance.blogspot.co.uk/2012/11/the-perfect-churchcircular-geometry.html>

*The Vitruvian Man* (see Figure 2) by Leonardo Da Vinci was inspired by Vitruvius' text. Da Vinci's drawing includes a circle depicting a range of motion and a cube representing the space around the individual.

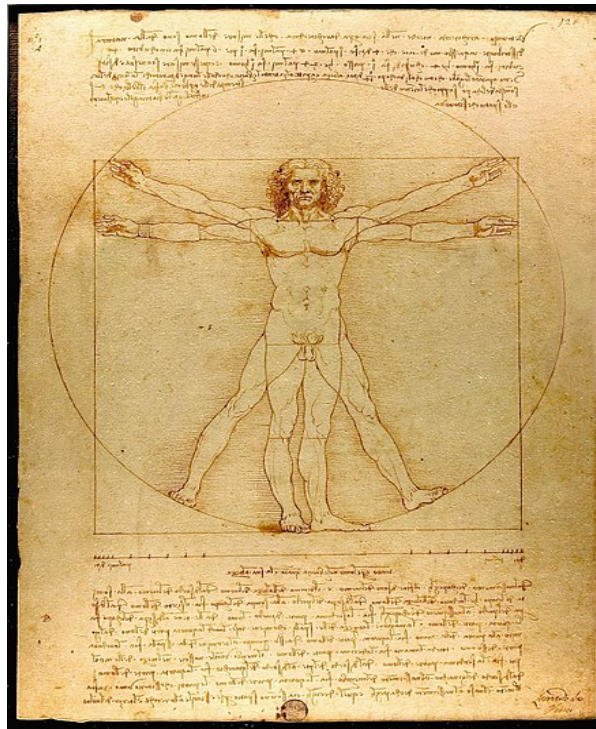


Fig.2: Leonardo Da Vinci - *The Vitruvian Man*.

Da Vinci's drawing incorporates Nicholas of Cusa's representation of God as the perfect geometric figure – the circle. Luke Strongman writes, "Renaissance semiologists have interpreted the basic geometry of Da Vinci's drawing in terms of two aspects: the 'material' existence symbolised by square, and 'spiritual quality' by the circle." (Strongman, 2010, p.220) There is a balancing of polarities here: the material-spiritual, the active-passive, and potential-kinetic. This dualism is significant to my research as it touches on the practical and conceptual applications of *The Tesseract*. The 'material' in *The Tesseract* is the result of investigation into the ways that human movement can be mapped to create a meaningful compositional framework, as well as the technology and software utilised to realise this. The 'polarities' in *The Tesseract* are drawn from Laban's movement theory. The cube is an essential factor in this, as it relates to the building of space as a container for human form. The cube is the most stable of structures. It is one of the platonic solids that represent the three dimensions of movement - also used by Laban.

These are also known as Cartesian coordinates: X=Left/Right, Y=Up/Down, Z=Forward/Backward. (Thompson, 2012, p.92). The 'spiritual quality', represented by the circle is what I term the 'conceptual mode' that deals with the analysis and personal insights in the explorations, tests, and works created through my work with space through the use of *The Tesseract*. The circle here illustrates the full range of the physical movement of a body. In *The Tesseract* I develop this further by drawing on Rudolph Laban's Kinesphere (see Figure 3).

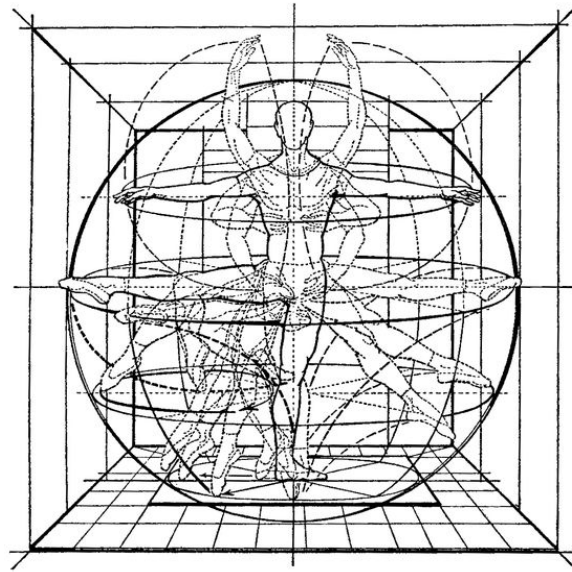


Fig.3: Space Modules of the Arms and Legs (Kirstein et al., 1953) after Rudolph Laban.

I extend Laban's Kinesphere, moving from a 3-dimensional representation of movement in space to the tesseract, which, once in motion, becomes a hypercube that creates a 4-dimensional extension of the cube. The hypercube can be seen in Dali's *Corpus Hypercubus* (see Figure 4). The cross seen in Dali's painting is an unfolded hypercube. The religious symbolism differentiating the spatial presentation of figures in Dali's work is integral to reading the work. However, what is more important to my work is the temporal aspect of the tesseract. Figure 5 shows the evolution of a 2-dimensional square to a 3-dimensional cube to a 4-dimensional hypercube.

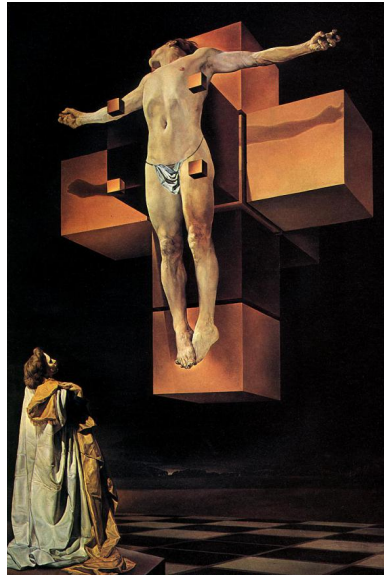


Fig.4: Salvador Dali, *Corpus Hypercubus*, 1945.

A hypercube includes height, width, depth and space-time. Space plus time in my research is articulated through movement. Movement is manifested sonically as the navigating of a fluid interaction through a multi-parametric space. Movement through a space over a given time is the 4th-dimensional quality of my compositional practice. This can be illustrated by observing a hypercube. When a hypercube is in motion the cubes rotate into and out of one another creating a toroidal flow.<sup>3</sup> If the movement alone is traced it forms a möbius strip.

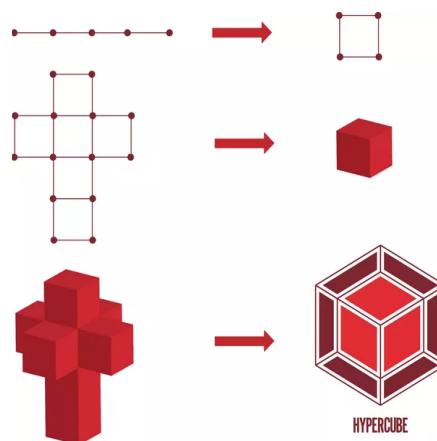


Fig.5: Illustration of 2D square/ line, 3D cube/cross and 4D tesseract/hypercube.

<sup>3</sup> A tesseract in motion can be viewed here: <https://en.wikipedia.org/wiki/Tesseract#/media/File:8-cell.gif>

In the same year that Dali painted *Corpus Hypercubus*, architect Le Corbusier developed his 'model of measure' based on the human form and called it *Modular Man*. Le Corbusier's view on 'Universeality' was a basis for the creation of the *Modular Man* (Jencks, 2013). Le Corbusier intended it to be a tool of measurement for design and architecture (see Figure 6) as a bridge between metric and imperial systems of measure.

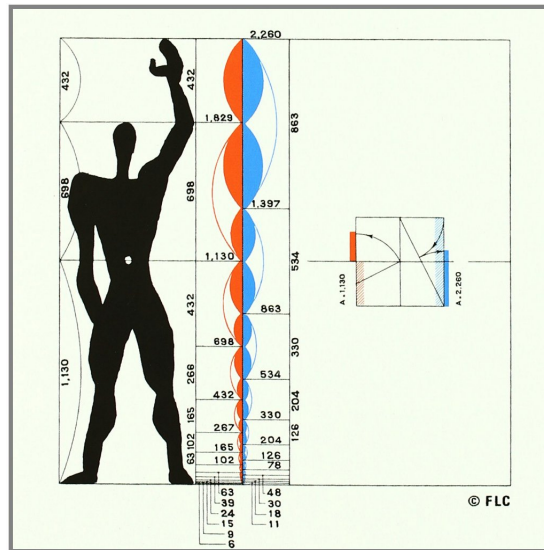


Fig.6: *Modular Man*, Le Corbusier, 1945.

Although Le Corbusier's work does not embrace the temporal, his use of the human form as a means of dissecting space into discrete units not only provides a direct link to Renaissance architectural thinking, but also highlights the continued importance of the corporeal in our perceptual understanding of the world around us. The ever-increasing technological mediation in today's society encourages virtual engagement with multiple data-streams. My work follows the work Vitruvius, Da Vinci, and Le Corbusier by placing the physical body at the centre of my compositional practice. It emphasises the physical engagement with interactive parametric controls in space on a *human* scale.

Rudolph Laban's theories on dance improvisation and movement offer a framework for considering human motion in physical space. His work demonstrates space as an area within reach of the body's extended limbs, which when projected in all directions from the bodily centre forms the Kinesphere. Laban considered this to be



the totality of a persons' movements or a sphere of movement carried with a person (Sutil, 2013). Laban used the five platonic solids to represent the various combinations of movement (see p.35). Laban referred to the connected movements as the dynamosphere, which is the emotion or character of the connected movements (Laban, 2011). In my work, what is communicated or expressed through the dynamosphere is achieved through a transformation of parameters controlling the manipulation and development of sonic events through timbral, spectral or temporal means. The underlying structure of my movement positions shapes the architectural framework for emotional expression in my work, while the movement from point to point (traceforms) shapes the formal structure of the piece much like Tony Cragg's *Vessel Forms Sketches* (see Figure 7a) and *Declination* (2004) (see Figure 7b).

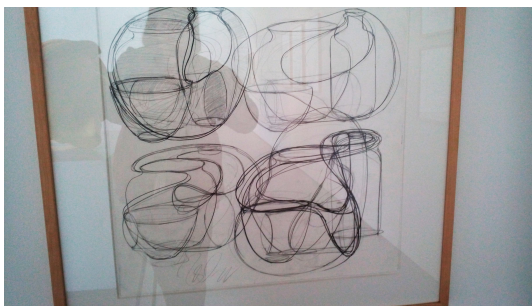


Fig.7a Tony Cragg – *Vessel Form Sketches*



Fig.7b: Tony Cragg - *Declination* from *Early Forms* series

In the sketches, Cragg has traced the forms of the vessels, interconnecting them to create one continuous form. Cragg's *Early Forms* is described by the Lisson Gallery, London as a series "in which vessels are turned into and around themselves to create delightful paradoxes of containment." (Sutcliffe, 2012). The foundations of Cragg's large twisted *Early Forms* sculptures (see Figure 8) lies in the interconnected sketches. These sculptures are physical manifestations of the shape of the sketch strokes that show the interrelation of the vessels. In my piece, *I Remember*<sup>4</sup> traceforms of my physical movements carry the emotional signature of the embodied experience of the work. The arcs of my bodily movement create overlapping trajectories that drive sonic development.

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<sup>4</sup> *I Remember* is discussed in detail on p. 46.



Fig.8: Tony Cragg, *Early Forms Series*.

Although my use of traceforms has a strong resonance with Cragg's developments in sculpture, it derives more from Laban's use of traceforms to represent the edges of each plane of the dynamosphere. In Laban's unpublished sketches, held at the University of Leeds, Laban refers to interlocking möbius forms as a '9-part knot' (see Figure 9).

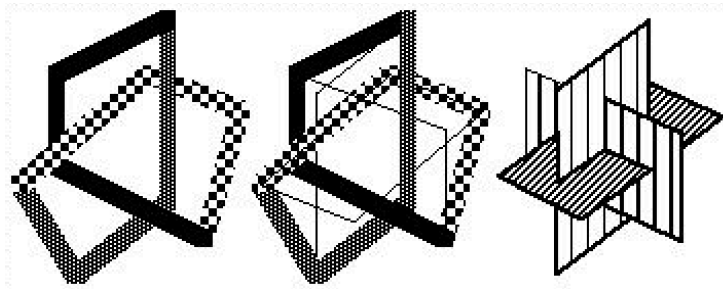


Fig.9: *9-part knot*, (möbius, Icosaheadral Planar sequence) from Laban Collection Archive, University Leeds.

In Laban's work, the möbius represents the shape of all possible movements between two or more bodies. In my piece *Ghost Dance*, the möbius is seen and heard as movements cycle between two different characters. It is also present when each character reverses their series of movements toward the middle of the piece.<sup>5</sup> Laban's developments took human proportion and movement from the planar presentation of Da Vinci's *Vitruvian Man* and Le Corbusier's *Modular Man* to a tetrahedral net: from a 2-dimensional representation to a 3-dimensional one. In *The Tesseract*, I extend this further into a 4-dimensional representation of human scale and movement.

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<sup>5</sup> A more in-depth analysis of *Ghost Dance* can be found on p. 44.

## 1.2 Interdisciplinary Thinking, Traceforms, and Movement

My work is more than audiovisual, it seeks to evoke a personal experience for the composer and other users of *The Tesseract*, beyond that of an audiovisual or purely audio experience by embracing the interaction of movement, sound, and video. The term ‘Gesamtkunstwerk’, often referred to in association with Richard Wagner’s operas, is the concept of the arts working in complete union. As such, it describes the core values of The Bauhaus. This 1930s Berlin-based Architecture/Art school combined architecture, fine arts, crafts, design, theatrical performance and music (Wolfman, 2016). In addition to the interdisciplinary thinking of the Bauhaus, it is the notions of embodiment, the psyche, and consciousness present in the work of Oskar Schlemmer that is of importance in my work as it moves my practice from being an integration of sensory physical elements to explore the psychological expression and intent in movement and sound. Matthew Wilson Smith, in his review of Melissa Trimingham’s *The Theatre of the Bauhaus: The Modern and Postmodern Stage of Oskar Schlemmer*, writes that:

Gestalt thought, a hardy German strain at least since Goethe, generally emphasised the whole as greater than the sum of its parts, explored identity as a pattern of organically linked relationships, and searched for essential forms beneath the shifting surface of reality. (Wilson Smith, 2012, p.163)

Oskar Schlemmer was the Master of Form in The Bauhaus theatre department. Wilson Smith writes that: “It was the Bauhaus theatre, in particular, with its necessary attention to embodiment, that was most suited to a tradition of Gestalt thinking as well as to the emergence of modern phenomenology.” (Wilson Smith, 2012 p.163) Schlemmer’s fascination with movement forms, states and objects of consciousness were central to his work. From his designs *Egocentric Space Lines* to his drawing from *Mensch und Kunstfigur* (see Figure 10) one can find traceforms and early mapping ideas using the human form as a unit of measure.

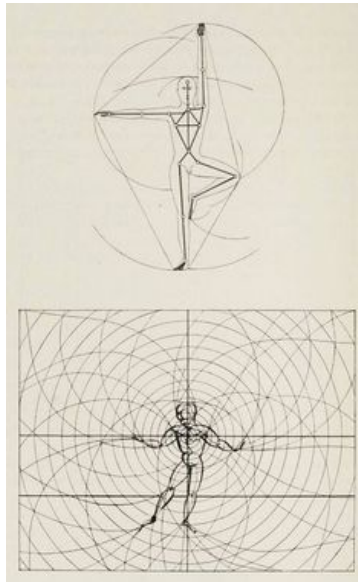


Fig.10: Oskar Schlemmer, *Egocentric Space Lines* (top) and *Mensch und Kunstfigur* (bottom) 1929.

Schlemmer's emphasis on states of consciousness in his work directly inspired the idea for my piece *I Remember* prompting research into Jung's ideas on individuation and integration by highlighting the significance of understanding what lies beneath our outward-facing selves or the shadow-side of our consciousness.

In line with the Bauhaus' integration of artistic disciplines is the work of Barbara Hepworth. Her work as an artist and sculptor, and her use of geometric proportions, strings, music and dance in her work has been an influence on my creative practice. Hepworth collaborated with choreographers and composers and often used terminology from other disciplines as titles for her pieces, such as her two-part sculptures *Contrapuntal Forms (Motet)* and *Forms in Movement, Pavan* (see Figure 11).

Hepworth's idea of motion and shape in space in her sculpture informs my notion of the overlap of two individuals' movements, particularly in *Ghost Dance*, as a representation of counterpoint. Helena Bonett discusses the role of movement in Hepworth's process in three ways that have been used in my research.



Fig.11: Barbara Hepworth, *Forms in Movement, Pavan*, 1967.

As Hepworth created sculptures she used “movement in terms of the changing shape of the sculpture as it is being made, and how the sculptor’s body navigates round the form.” (Bonett, 2013, p.2) Bonett also discusses Hepworth’s attention to the audiences’ interaction and movement around the sculpture and the sense of animation and undulation such movement created in the piece. In my work, I use movement to shape sound as well as move sound around the stereo field. I also work with mapping movements to the spatialisation of sound. As such, I am both the performer, as a bodily sculptural form, and audience. As I move within *The Tesseract* the sonic animation and ‘undulation’ or movement of parameters informs and shapes my subsequent movements. In Hepworth’s work, there is an ‘observed’ animation of static space whereas in my work there is a dynamic reciprocity of movement and sonic interaction.

This focus on dynamic movement is central to the work of the 19<sup>th</sup> century physiologist Étienne-Jules Marey. In his chronophotographic work Marey sought to abstract an understanding of movement from the mover (see Figure 12). Marey developed what he called ‘the graphic method’ whereby “movement is abstracted from the individual, [and] exists as an independent entity...” (Was, 2014). Understanding Marey’s desire to disaggregate movement from the individual prompted me to explore the recording of my physical movement as OSC (Open Sound Control) data that could then be used as a independent dataset to control multiple aspects within my compositional practice, from volume, spatial, and sound processing automation. This can be seen in my pieces *Ghost Dance* and *Here &*

There in which I recorded the dynamics of my movements first, without any music, only subsequently creating music that is shaped by this movement data.

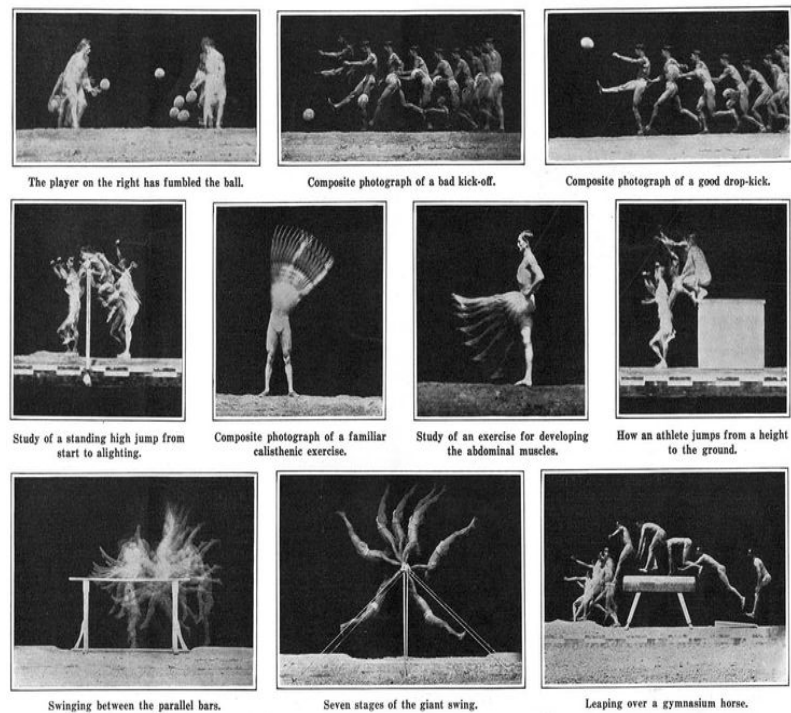


Fig.12: E.J. Marey, *The Human Body in Action*, 1914.

Two photographers that have extended Marey’s concept of movement as an entity independent of the object or person that moves, are Jean Johnson Jones (see Figure 13) and Shinichi Murayama. Jones, writing about her collection *Moving Models* states that: “Within my work, I invite the viewer to see differently, to ‘flip’ their usual visual thinking and to see movement itself.” (Jones, 2017)



Fig.13: Jean Johnson Jones, *Light into Matter*, 2017.

In his series *NUDE*, Shinichi Murayama explores the most explicit example of what Laban's traceforms look like. In the series, he tested several dancers' routines and chose the sequences that would work best visually. He then combined 10,000 photographs of the dancer per portrait (see Figure 14).



Fig.14: Shinichi Maruyama *Nude #4*, 2012.

In an interview with Slate magazine, Murayama says: “I had tried to capture single moments in my past works, but with *NUDE* I also considered the relationship between a moment and time.” (Murayama, 2012) The representation of Laban's traceforms in Murayama's work inspired the creation of my piece *I Remember*. Whereas Murayama's final work is a static photograph, *I Remember* presents movement as a representation of the notation of the piece itself creating changing sculptural shapes through traceforms in realtime.

In *Making sense through hands: Design and craft practice analysed as embodied cognition*, Camilla Groth explores the role of interacting with material to iterate concepts, and interpret physical experiences as emotional ones. In her doctoral thesis, she cites the work of ceramic artist Maarit Mäkelä and her contribution to vetting the “concept of thinking through making and argues for viewing artifacts as bearers of knowledge created in this process.” (Groth, 2017, p.16) Thus, the process of craft-like notation as the idea for the creation of “moving” sculpture as notation in *I Remember* helps me to make connections in my research and convey them in a tactile or haptic way to those interacting with the material. In addition to its

relevance to the creation of interactive processes in this research, the concept of embodied cognition is expounded upon as it relates to creatively processing ideas and emotions. Groth writes:

Even before the student starts the physical material exploration, while performing a dual space search between the composition and construction design spaces, an imaginary material exploration takes place, one that is based on previous bodily experience of the imagined materials. When imagination reaches its limits, the physical material exploration and the resulting prototype takes the concept to the next level. (Groth, 2017, p.191)

The notion of underlying body memory of previous experience begins to take root through the experience of making and moving through the motions of crafting.

### **1.3 Psychology of Movement**

In *Re-evaluating Rudolf Laban's Choreutics*, Jeffrey Longstaff researched the connection between Laban's *Choreutics* and various cognitive sciences to support it as a viable model and tool for the use of movement to enhance understanding in these areas. Longstaff argues that it can become a framework in experimental research by organising stimuli. The use of various measurement modes based the human form throughout history shows the progression and interconnection between the various modes across several disciplines. He concludes his research by writing:

The choreutic conception of the bodily production of spatial forms is given psychological validation from the finding that its major conceptual structures are closely similar to models of spatial learning and memory developed in motor control and cognitive science. These commonalities indicate that further critical reexaminations of 'choreutic laws' might be useful for suggesting conceptual models of spatial cognitive processes and in identifying attributes for movement analysis." (Longstaff, 2000, p.1)

In *Choreutics* (1966) Laban discusses traceforms from both a physical and experiential perspective. The motion of crafting space in the dynamosphere is also one of exploring the psychological space of a movement's intention:



The intention to move begins in what might be termed 'psychological space.' Laban called this psychological space the 'dynamosphere.' It is the 'inner world in which impulses surge and seek an outlet in doing, acting, and dancing,' the domain where movement from mood to mood occurs". (Moore, 2014)

I use movement by dancing in silence, walking or running, or even movement by transport (train, planes and automobiles) to access emotions and memories that then become material for my compositions. Due to this, I began to research DMT (Dance Movement Therapy) and behavioural therapy models. In the *Textbook of Psychotraumatology* memories are explained as metaphors:

Memories are a simplified, condensed, more pronounced and biased version of what was once reality, comparable to metaphors. These metaphors are subjective interpretations of the meaning of the traumatic event which influence subsequent life processes just as strongly, if not more so, than the factual reality of the event." (Fischer & Riedesser, 2003)

The use of movement to access memories as metaphors can be further seen in the field of Embodied Cognition since they are stored in the body. "The emotions and physical sensations experienced during the formation of a memory and those experienced during its recall play a major role in generating the version of an event produced in memory." (Koch, 2012 p.5) This memory recall and link to movement is also found in *Descartes' Error* by António Damásio, and Bessel van der Kolk's research in *Clinical implications of neuroscience research in PTSD*. The recollection of emotions, memories and metaphor through movement opens up a world of content to use as material for creative and healing purposes alike.

Through experimentation in the building and mapping of *The Tesseract*, musical and conceptual ideas began to arise associated with several Jungian concepts. Synchronicity, individuation and integration were of particular importance. In *Synchronicity: An Acausal Connecting Principle*, Jung described synchronicities as "temporally coincident occurrences of acausal events." (Jung, 1973, p.8) The presence of meaningful coincidence throughout my research has led to the creation of *The Tesseract*, the accompanying portfolio and insights derived from the works

created. Jung explains how the phenomena falls outside of causality in a realm of its own. "Therefore, it cannot be a question of cause and effect, but of a falling together in time, a kind of simultaneity." (Jung, 1973, p.8) The simultaneity of synchronicity can also be likened to synesthesia and quantum mechanics, in the way that events appear interfused leading to compounded and mutuality of meaning. Throughout the process of my research, the notion of awareness, specifically on the sound sources effected by my actions, steered me toward Jung's individuation process. Jung's interdisciplinary approach in psychology and his work on individuation "encompasses the philosophical, mystical, and spiritual areas of the human being." (Journal Psyche, 2012) Jung's individuation highlights the connection of an individual's actual movement through *The Tesseract* to the eventual awareness of inbuilt filters through which the sonic world is experienced. Koch reiterates this sentiment through the discipline of Dance Movement Therapy writing that: "Dancing involves being aware of one's own action while sensing oneself in all one's movements, which have a rhythm and a form." (Koch, 2012, p.109)

Physical movement as a form of self-awareness is also evident in the writings of Bessel van der Kolk. In *Clinical implications of neuroscience and PTSD*, van der Kolk writes,

... past experience is embodied in current physiological states and action tendencies and the trauma is reenacted in breath, gestures, sensory perceptions, movement, emotion and thought, therapy may be most effective if it facilitates self-awareness and self-regulation." (van der Kolk, 2006, p.13)

van der Kolk proposes the use of physical movement as a means of attaining self-awareness in order to heal. In my work, physical movement is used to uncover creative and emotive content to be incorporated in to the final creative output. In turn, the interaction of others with the resulting works might aid in their expression and healing through catharsis. Jung's idea of integration is a fitting next step as the synthesis of "the ego or consciousness with the personal and collective self." (Journal Psyche, 2010)

The importance of various movement therapies, as a process of individuation and integration, is seen again in *The Body Keeps Score* by van der Kolk, a psychoanalyst who works with trauma victims. He explains in the book that the use of various movement therapies has been found to be useful in healing modalities for uncovering hidden filters caused by past traumatic experiences that shape our world. Through movement, patients are safe to express repressed emotion in a way that does not cause repetitive trauma and Post Traumatic Stress Disorder (PTSD). Additionally, therapists can observe patient's movements, postures and body language to understand and help their clients intercept traumatic flashbacks and avoid dissociation. (van der Kolk, 2015) The relationship between movement and well-being has also been explored in Dance Movement Therapy. Sandra Koch and Diana Fischman in *Embodied Enactive Dance/Movement Therapy* (2011) state that: "The embodied 'enactive' approach becomes a unified scientific, philosophical, aesthetic, and potentially spiritual perspective with internal coherence." (Koch & Fischman, 2011, p.61)

Another DMT practice, *5Rhythms* created by Gabrielle Roth, conceptually aligns with the structure of *The Tesseract* and the underlying mapping of parameters. It also echoes my philosophy on why I compose and make art: "Turn your suffering into Art, your Art into Awareness, your Awareness into Action" (The Dancing Path, 2016) The *5Rhythms* are: *Flowing, Staccato, Chaos, Lyrical* and *Stillness*. (What are the 5Rhythms, 2016) An individual's internal memories, stories or emotions can be interpreted by themselves as they dance through the *5Rhythms* sequence with spontaneous and non-choreographed movement. This individual assessment helps them to "track perceptions and memories; seek out gestures and shapes; tune into instincts and intuitions. They reveal ways to creatively express aggressiveness and vulnerability, emotions and anxieties." (Why we dance them, 2016) The practice supports one's intuitive interpretation of embodied experiences and even trauma. It encourages individuals to understand the filters through which they see the world. This intuitive interpretation is the individuation process: "The movement is the medicine, the meditation and the metaphor ... peel back layers, lay masks down, and dance till we disappear ... Only to rediscover ourselves through it all." (Why we

dance them, 2016) This practice has adopted Laban's dynamosphere or the 'mood' of movement.

In my work and practice, 'intuitive embodied experiences' are synesthetic reactions to internal and external stimuli. In *What do the mirror system, embodied cognition, and synesthesia have to do with each other?* Margaret Wilson explains synesthesia in this way:

... the extreme end of a continuum which encompasses a more general human tendency to create mappings across domains ... universal or near-universal phenomena of cross-modal equivalences ... including phonological symbolism, pitch-height, -brightness, and -size correspondences, and spatial synesthesia such as the spatial-numerical association of response codes effect. (Wilson, 2013, p.1)

Wilson goes on further stating that: "These phenomena - which have so much in common with synesthesia - also have so much in common with embodied cognition." (Wilson, 2013) The suggestion that the full range of synesthetic presentation links to embodied cognition lead to further research as it relates to movement and memory. In *Memory, metaphor, and mirroring in movement therapy with trauma patients*, Marianne Eberhard-Kaechele discusses movement therapy and how: "Body psychotherapies such as dance/movement therapy draw on constructed experiential metaphors as a form of intervention, involving the physical realization of abstract ideas such as emotional processes or mental states." (in Koch, 2012, p.270)

Throughout my research, there have been several realisations of abstract concepts while experimenting with *The Tesseract* as they relate to internal filters and interacting with other individuals and their own filters. My work with *The Tesseract* reflects Koch's writings that: "Tactile, kinesthetic, bodily self-reference is not just an ever-changing *now*, but rather the experience of self-continuity in the midst of change." (Koch, 2012, p.109) Thus, movement and memory along with Blanton's "reactive mind" (Blanton, 2000) and its process of building an inner timeline of memories attached to heightened emotional experience hold the key to embodied resources for creative expression. Through movement we are able to access deeply

entrenched memories as material for works. Through the creative process we may get to know our inner filters and become better able to individuate. “Enaction and embodiment emphasise the roles that body motion and sensorimotor experience play in the formation of concepts and abstract thinking.” (Koch, 2011, p.57)

In the context of this research, *The Tesseract* represents synergistic reality beyond one individual’s personal individuation experience. This is explored in my piece *Helix*. It can also be seen and heard in *Ghost Dance* where two characters’ movements through their respective tesseracts are overlaid. The work explores two individuals’ intertwined movements. It is an embodied experience of the concept for integration, interpersonal, understanding, and healing. Much as a tesseract cycles both about and within itself, a cube within a cube, the piece becomes a conceptual model and sonic representation of two individual experiences merged to create a separate experience or 4th dimensional collective experience. (Landrum, 2005)

#### **1.4 Mapping Motion**

Many composers and movement practitioners have developed technological systems to map gesture to sound, from Max Matthews, Richard Boulanger, Wayne Siegel, Lauren Sarah Hayes and Imogen Heap. Sensor systems enable mapping of proximity, pressure, angle, and force, and can be worn on the body or off-body hardware sensors such as the Kinect or Leap Motion. The data collected from these systems is usually interpreted by software as MIDI data that can be mapped as the user desires.

One of the most significant early examples of gesture controlling sound was John Cage’s *Variations V* (1965). Cage worked with Merce Cunningham, Gordon Mumma and David Tudor to create a novel approach to dance and music which, though independent of one another, were part of the same space/time experience. Todd Winkler writes that:

The system was developed to derive sounds from the movements of dancers, who produced music based on their proximity to several electronic sensors placed on stage. Thus, the entire floor was transformed into a musical instrument responsive to movement throughout the space. (Winkler, 1995)

Though the technology chosen for *The Tesseract* does not include physical sensors, as in *Variations V*, the concept of using movement to effect music inspired the possibility of recording and capturing ephemeral movement by technology was influential.

In 1971, Erkki Kurenniemi created the DIMI-O or ‘Optical Organ’ (see Figure 15). It was an optical video synthesiser which made music based on a digitised image. It consisted of a video interface that contained organ sounds, memory and video circuitry that allowed for notes that were played through a keyboard synthesiser to be displayed visually on a small television screen. The graphical notation resembled modern-day MIDI and was saved in the interface’s memory to be played back or manipulated by various controllers. The DIMI-O was used as an interactive instrument in Kurenniemi’s *DIMI Ballet* where a dancer is shown creating sound through her movements. A video camera was connected to the interface to capture video. Once the dancer’s image interacted with the graphical notation on the screen, these notes would be sounded. (Camile, 2008) While researching ways in which movement could be useful as a way to compose music the DIMI-O was an inspirational early success in creating music without on-the-body sensors or wires using only video capture, an interface and movement.

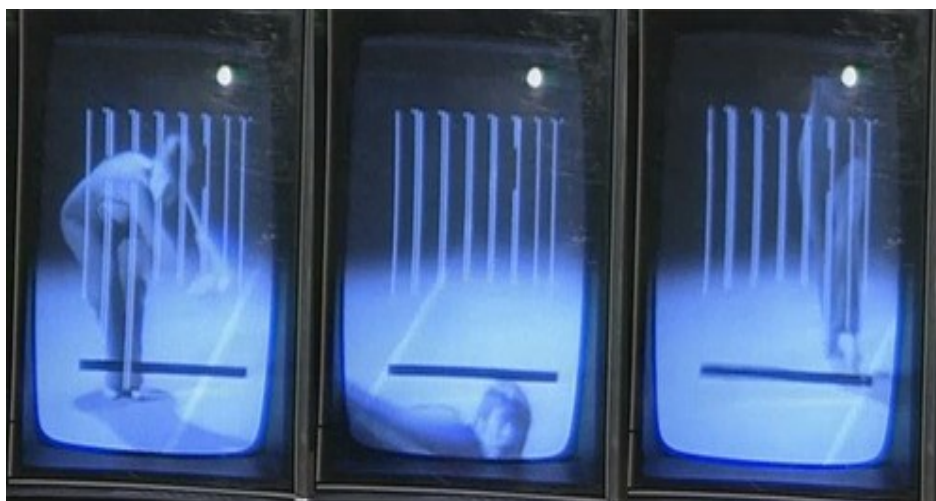


Fig.15: Erkki Kurenniemi Dimi Ballet (stills), 1971.

Wireless systems such as Kurenniemi’s and more recently Kia Ng’s *Movement via Motion* (MvM) that uses a video camera to process real-time movement and maps

movements to “Musical controls, and basic filtering include scale type (tonality), note filters, and pitch and volume ranges.” (Ng, 2004, p.647) have inspired my own work particularly. However, there are important conceptual elements that I have drawn on in my research from wired sensor-based systems. Michel Waisvisz’s work sought to use gestures through a multi-sensor controller to create electronic music and led him to the creation of *The Hands* (see Figure 16), one of the first gesture sensor controllers. Information generated by the performer’s finger pressure and hand position changes, was sent to an analogue-to-MIDI converter and then to a MIDI sound device. Waisvisz’s intention was to find a means to integrate the micro expressions of physical gesture into electronic music. (Waisvisz, 1985)

In an interview with Interactions Magazine called *Michel Waisvisz: The Man and the Hands*, Waisvisz speaks to Elizabeth Dykstra-Erickson and Jonathan Arnowitz about musical interaction:

“Musicians deal with processes that have a life of their own—a string is a pretty wild thing, and it takes a while to come to grips with it; you learn to engage with it. A real player knows that it will never be fully under control, and the art is somewhere in the middle...in between is the art...I like the word interaction, engagement; it’s more emotional.” (Dykstra-Erickson & Arnowitz, 2005, p.64)

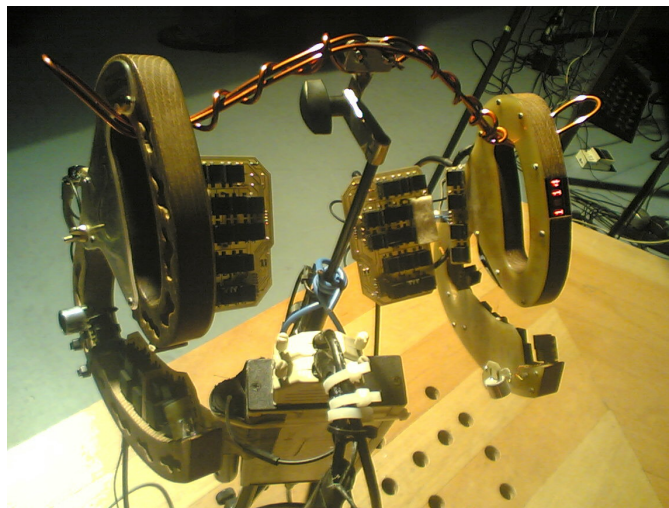


Fig.16: Michel Waisvisz, *The Hands*, 1985.

The significance of accepting that there will be outcomes that are present and out of my control through the use of my interactive setup gave me a different perspective

and freedom in my compositional works. Waisvisz's value of the importance of using gesture to control electronic music mirrored my own desire to get out from behind a desk, controller or computer to express emotion through movement and have these translate directly into my compositional practice.

A more intricate on-the-body wired system than Waisvisz's is the Bodycoder system developed by Mark Bokowiec in collaboration with Julie Wilson-Bokowiec, that comprises a wearable sensor suit linked to MAX software for sound playback and real-time sound manipulation. The system allows the performer to make in-the-moment decisions during the performance, controlling what is played, processed live, and when. Brian Knoth, in discussing the kinesthetic experiences arising from performances using the Bodycoder system writes that:

Since the perceptual events we most often encounter on a daily basis come and go via unconscious processes, such works that offer new conscious experiences of sensory reconfiguration are meaningful to our understanding of perceptual experiences. One might even argue that such events could heighten experiences of the perceptual act in general." (Knoth, 2012, p.287)

The description of the interventional qualities of the Bodycoder system as a "tool and as a prosthesis" (Wilson-Bokowiec & Bokowiec, 2006, p.57) caused me to assess *The Tesseract* as a conceptual prosthetic communication device between body and mind as it relates to the individuation and integration processes.

Imogen Heap's work on interactive performance systems with MIT was also examined. The vest and gloves that she has developed since 2010 to trigger and control audio in Ableton Live is similar to Wilson-Bokowiec & Bokowiec's Bodycoder system. Heap and the research team working with her are "quick to point out the idea isn't particularly new - gestural music devices have been around for decades." (Shapiro, 2015) Heap's Mi.Mu Gloves are described as "wireless, sensor-enabled gloves for creating and performing music through movement and gesture." (mimugloves.com, 2014) The gloves are fitted with sensors and wireless technology for two-way communication to a computer. The system includes software that works with Ableton Live, Logic Pro X and MAX. The gloves have integrated



finger flex sensors, buttons, and accelerometers to detect movement and gesture while also providing feedback to the user through LED light and vibration motors. The gloves are customisable in that gestures are mappable to MIDI or OSC through the software provided. Though the gloves are quite diverse, I was looking to use the whole body's movements to affect sound through invisible means, without wires or sensors. Heap spoke to CNN about her impetus to create and use this technology stating that: "Movement for me is key ... I have a body, and I have a mind, and in my mind, I have music. And it's a very shapely, sculptural thing that's going on." (Shapiro, 2015, p.3) This notion of sculpting sound with movement links, in my thinking, directly back to the sculptural artwork of Cragg and Hepworth discussed above.

J. P. Bellona created a stand-alone application called *Kinect-via-Synapse Max Interface* (see Figure 17), which "routes and displays user-tracking data from the Xbox Kinect via OSC messages inside Max/MSP. The interface handles fifteen joint messages for a single user, three different tracking modes, and six different joint event messages with a real-time configuration of external routing options" (Cycling 74). This application was useful in understanding the various ways in which a body might be mapped to sound parameters and became a launching point for the way in which I organised the technical aspects of what became *The Tesseract*.

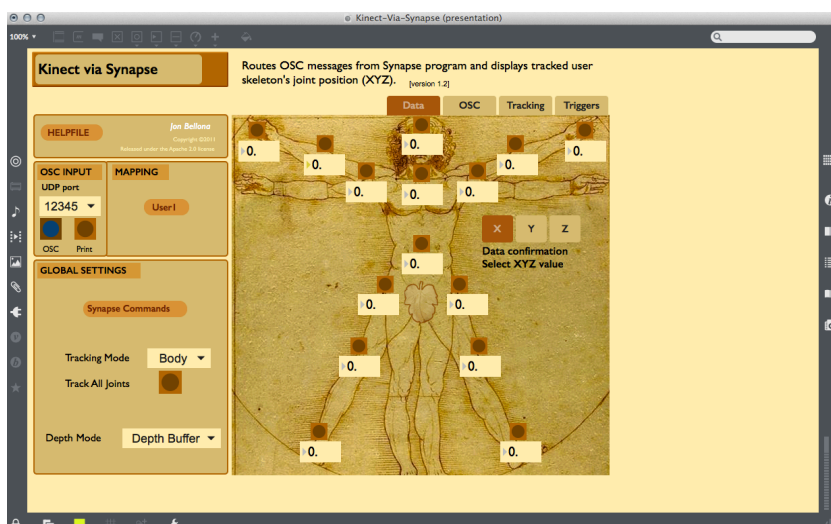


Fig.17: J.P. Bellona's Kinect-Via-Synapse Max Interface, 2017.

## CHAPTER TWO

### **2.1 *The Tesseract***

In this chapter I will discuss the creation and development of *The Tesseract* through a series of explorative test pieces and portfolio of works. Through the process of exploring sound and movement with *The Tesseract* the research questions I had originally posed were refined to:

- How can Laban Movement Theory provide a framework for enabling me to shape sound through corporeal movement through space?
- In what way does the psychology of movement shape my thinking as a creative practitioner and affect my creative output?
- How can I capture movement as an abstracted 'entity' to shape compositional parameters and how does this process affect the emotive content of my work?
- How can I use *The Tesseract* as a means of enhancing self-awareness as an artist?

I will demonstrate how I have integrated Laban Movement Theory while fine tuning the calibration of it to a body-in-motion concept for sound control and improvisation. In Laban's *Theory of Space Harmony* there must exist three dimensions:

- 1) Movement - body/physical form;
- 2) Effort - dynamic energy;
- 3) Traceforms- the connected movement's path.

The resulting mapping and set-up of *The Tesseract* has applied Laban's three dimensions to control sound processing parameters through movement. *The Tesseract* is virtually made up of a cube within a cube and uses movement to create a separate dimensional experience, shaping any sound source passed through it. My compositions are the result of a process of exploring the potential use in audiovisual composition, leading to a range of personal insights about process and the development of this system. *The Tesseract* can be used in a practical compositional capacity. Eventually, possible future uses for it as a tool in Dance

Movement Therapy (DMT)/psychological healing modalities will be explored. (see Conclusions and Future Directions, p. 54.)

Rudolph Laban's *Movement Analysis*, and in particular, his *Space Harmony* practice, depicts the space in which certain movements occur as having specific geometric shapes. Laban's background as a classically trained artist gave him an eye for dimension and framed his perception through geometric shapes, lines and planes. He became so adept at observing these that his research into developing his theories, as Hodgeson writes in *Mastering Movement*, "tended to be in picture or narrative in form ... when he was thinking abstractly, and theoretically his thought was in shape and pattern." (Hodgeson, 2001, p.27) Laban utilised the platonic solids as a training space for his students. For example, a giant icosahedron made of interconnected pipes (see Figure 18) was regularly set up outside of his school and students would move within that space practising the "movement scales" (Konie, 2011, p.5).

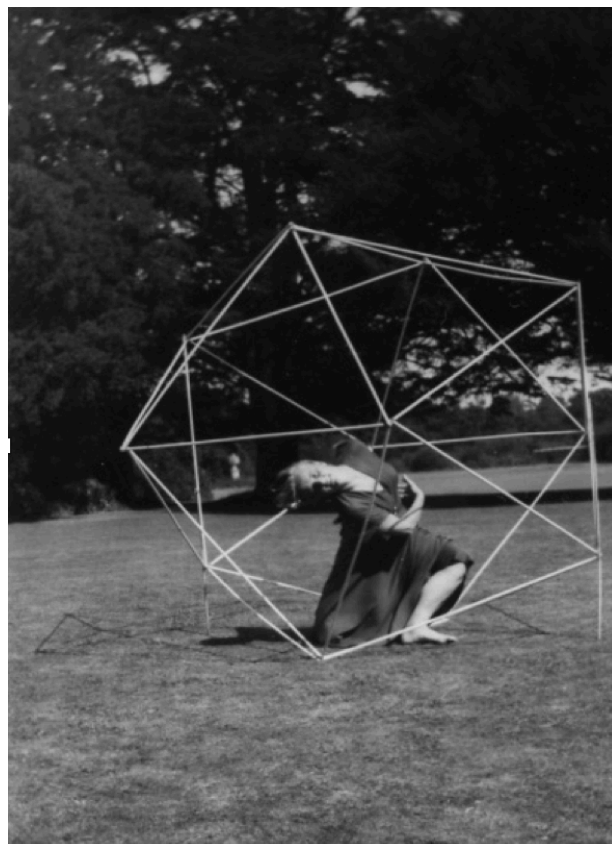


Fig.18: Photo of Laban student in the icosahedron, June Petit. 1942.

Movement scales were a series of motions which students cycled through to balance all possible combinations and polarities of movement. For example, it is common for a person to have a stronger leg or side. These movement scales, much like musical scales for a musician, help dancers to balance their strengths and weaknesses as they transition from movement to movement or polarity to polarity.

The platonic solids in Laban’s practice were considered a scaffolding that held within them various movement potential. Each one contained a different set but, all movement and expression, according to Laban was held within the icosahedron. Laban’s conceptual synesthesia was of great help in his work in developing a coherent Movement Theory. The following platonic solids (see Table 1) were a physical structure that represented potential motion in space viewed as such:






	Tetrahedron: Basic form Up/Down, Left/Right
	Cube: Diagonal, Extremes, up/right- down/left
	Octahedron: Represents stability
	Dodecahedron: 3 cardinal planes.
	Icosahedron: Contains all solids, has the appropriate volume & angles to match the possibilities of the movement of the human body within regular polyhedral space. Proportions related to the Golden Ratio.

Table 1: Five Platonic solids used by Rudolph Laban.

In composing with *The Tesseract*, I found that the use of physical movement in my practice also served as a way to memorise steps or musical movements through emotions or ideas. It is akin to internally recording an embodied sequence of Blanton’s “nows” (Blanton, 2000). The body and movement become an organic step

programmer and sequencer. This sequence is then used to write out each part of a composition. Emotion is stirred up by movement, much like the churning of stagnant waters. Movement lifts and softens concentrated embodied emotional material to shape a composition as a potter, sculptor or designer might. The resulting work or piece of music then becomes the means by which I process personal experiences and, an offering to the listener or participant as a safe way to access their empathy and illicit a cathartic response to connect with their indwelling feelings and memories.

Beginning with the expression of emotion, movement is captured, and sent as Open Sound Control (OSC) data that is converted to MIDI data that is mapped to audio effects racks in Ableton Live that are applied to a dry sound source. This incoming movement data causes dynamic shifts and changes the sound source. The dynamics created are audible emotional content, a sonification of my embodied emotion. These emotions can then be further analysed as memories or experiences. This continual cycling between expression, evaluation and analysis exists at every level of my research and creative practice.

In *Integral Theory in Action*, Sean Esbjörn-Hargens writes, “Everything has an interior and an exterior as well as an individual and a collective perspective.” (Esbjörn-Hargens, 2010) The interior and exterior perspective in my research relates to the conceptual representation of *The Tesseract* as well as the way it has been mapped. The exterior cube represents the filters created by embodied experiences from our history and even trauma in our lives, and is mapped to audio effects racks that apply filters which correspond to Laban Movement Theory and Laban’s notion of ‘effort’. The interior cube represents a still place within that is free of filters and untouched by trauma. It is mapped as a bypass between effects on the effects racks in *The Tesseract*. Between polarities, this central section allows for a smooth transition from one end of the spectrum to the other on each axis or plane of movement. This creates a ‘centre’ cube where the sound source is not affected. Only when one moves from the centre position or neutral gesture will the sound source be changed by the various combinations of filters and effects that are on the exterior cube. The individual and collective

perspective relate to the interaction of two tesseracts as can be seen in my portfolio.

For *The Tesseract*, I use an Xbox Kinect 1414, chosen for its wireless capability, its ease of use for experimentation, as well as for its ability to capture spatial and body location through infrared imaging using three cameras in the one device. As an infrared capture device, the Kinect uses time-series data along with its three lenses to capture 3D movement. I use *Synapse* by Ryan Challinor to capture movement data as OSC. Challinor has made this software specifically for the use of the Kinect. He has also created a collection of M4L for Kinect plugins available online. The technical flow in *The Tesseract* is:

1. XBox Kinect 1414 as Movement Input;
2. Synapse as OSC translation;
3. M4L Plugins to map data from OSC to Audio Effects Racks;
4. Ableton Live as tracks to be affected and sound output.

Movement is captured by the Kinect, and this movement is then interpreted as OSC by Synapse. Synapse superimposes a skeleton onto the image of the body using mappable X, Y and Z points at the head, neck, shoulders, elbows, hands, torso, hips, knees and feet, and allows the user to view the body in motion. This provides 45 mappable points which can be fine-tuned by using M4L for Kinect plugins. This tuning is measured in millimetres in three relative ways:

1. *World Relative*: The body's relation to proximity to the Kinect;
2. *Screen Relative*: The body's relation to proximity to the Synapse screen on the monitor;
3. *Body Relative*: The body's relation to the individual's centre or more specifically their torso.

Laban Movement Theory is the model for my mapping strategy of the customised effects racks in Ableton Live. (see Figure 19) Laban's efforts or characteristics are attributed to each cartesian coordinate: "X= flexible/direct, Y= strong/light, Z= quick/

sustained... and are associated with Time, Space and Weight.” (Laban, 1947) These characteristics have been translated into mixing parameters. For example:

Y-axis

- Up = High pass filter
- Down = Low pass filter

Z- axis

- Forward = sharp filtering and eq
- Backward = reverb and or delay

X-axis <sup>6</sup>

- In = Closer to the centre of the cube and a more dry or pure signal of the original sound material. This inner/centred space is also mapped as a bypass along the chain between audio effects in Ableton Live mapped to all three axis.

- Out = Chorus effect or Doubling.

or

- Right/Left = This allows the positioning of the whole body to pan sound in the stereo field.

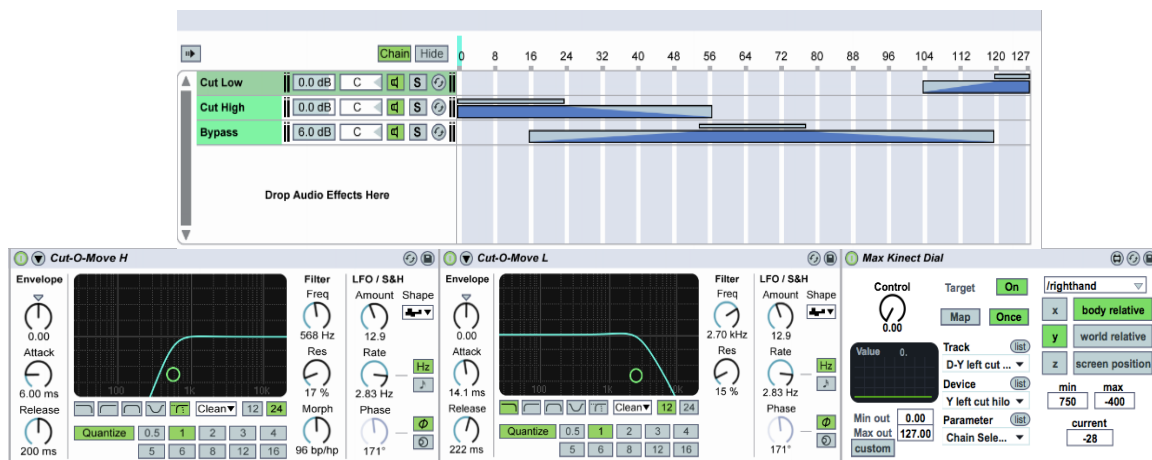


Fig.19: Example of one of *The Tesseract's* customised effects rack mapped to a M4L Kinect plugin to control the Y-Axis by the right hand relative to the body in Ableton Live, 2017.

The above are examples of some of the combinations of audio effects that match Laban Movement Theory ‘efforts’ mapped to movement in *The Tesseract*. However,

<sup>6</sup> The X-axis can be used for ‘out’ and ‘in’ gestures or right and left stereo panning depending on the body part being mapped. For instance, the torso uses the X-axis as right/left in screen or world relative due to the nature of how this part of the body moves. It is impossible to map the torso to move right or left of itself since this is a physical limitation. The out/in mapping of hands, elbows, feet and knees can be mapped relative to the body, since these body parts have the kinesthetic ability or physical capacity to move in this way.

it can be mapped with any effect that matches the 'effort' described in Laban Movement Theory. I chose to map chained polarities across each axis' continuum bridged by a bypass or 'centre' where a sound source would not be effected and come through in its pure original form. (see Figure 20) This is demonstrated in *Traceforms*, a short five minute video that encapsulates the key elements of my research. There are several different versions of each of the axis' that can be used together to create different tesseracts thus creating the possibility of several combinations of X, Y, Z polarities. This was deliberate in order to create a modular way to represent different emotional combinations. More conceptually, it symbolises the varied ways individuals embody experiences, memories and/or trauma and represents their unique filters of perception.

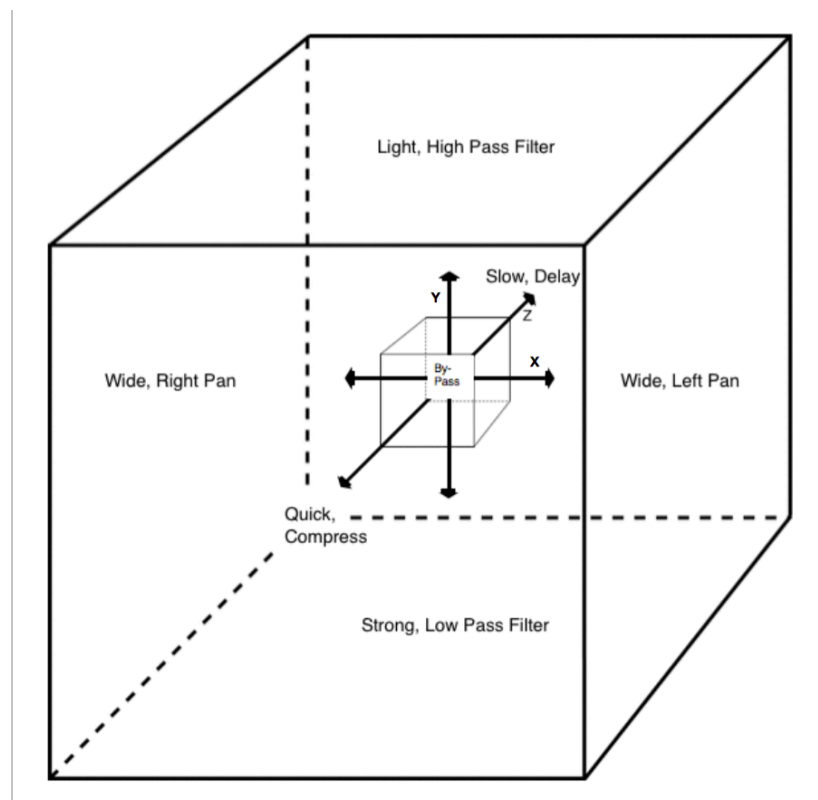


Fig.20: Example of one version of the virtual architecture of *The Tesseract's* chained polarities and centre bypass, 2017.

## 2.2 Initial Explorations

My initial explorations with what was to become *The Tesseract* included *Simple Arm Drums*, *Marionette Test*, *Fun with Filters*, and *Dolby Atmos*. In *Simple Arm Drums* I mapped Ableton to Synapse and the Kinect, using Kinectar to trigger a kick and



snare drum from Ableton by means of simple hand gestures. I found Kinectar unreliable, in addition, the software did not allow for previous mapping parameters to be saved for later use. In *Marionette Test (Playing a solo bass line, On/Off and Double Gesture plugin)*, I investigated how Synapse (see Figure 20) and the Max for Live Kinect (M4L-K) plug-ins by Ryan Challinor could be combined to play through various instruments efficiently across several tracks in Ableton Live using movement data. I linked Synapse and the Kinect directly to a bass sound on a track in Ableton Live through M4L-K plug-ins. I tested a combination of movements to find a way to play a three-note bass line consisting by moving my right arm up and down along the Y-axis.

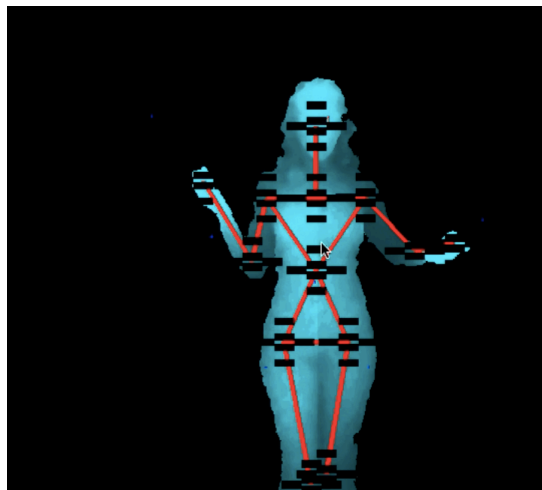


Fig.20: Susan Green, *Marionette Test* with Synapse, 2017.

The left arm was mapped along the Y-axis to turn the bass sound on and off to play bass notes without having to play through the chromatic series, and also vary the length of the bass notes being played. In addition, I mapped a double gesture using both right and left arms moving outward away from the body along the X-axis to turn off the bass track along with all the plug-ins mapped to it. I rejected this because the gestures were similar to those encouraged by many other systems and not exactly the kinds of larger more flowing dance movements that I use in my creative process. I quickly realised that my work requires a fluidity in movement trajectory to achieve the emotional content I desire.

*Fun with Filters* linked Synapse and the Kinect directly to Ableton Live through M4L Plugins and incorporated pre-signal and post-signal flow tests through to the

master output. For pre-signal the dry sound was audible, and arm movements turned up or down the effects sends changing the sound. For the post-signal feed, the sounds were only audible when the arms moved and turned up and down the effects sends. As a result of these tests, the use of movement to design sound, the variety of sounds produced between pre- and post-signal fader and the conceptual notion of embodiment emerged as a key areas for future investigation and the application of *The Tesseract* in my work.

The most extensive of these early tests was *Dolby Atmos* (see Figure 21) in which *The Tesseract* was tested on the Dolby Atmos system in London, UK.

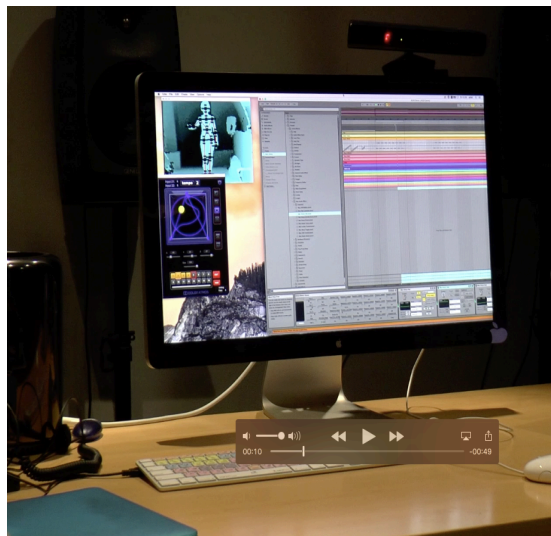


Fig.21: Dolby Atmos test, London 2017.

Dolby Atmos is a spatialisation tool that works seamlessly with Ableton Live, though it is still in the developmental stages. I worked closely with Jake Fields, Dolby field application and mix engineer. I connected *The Tesseract* directly to the Atmos interface to map body movement as its controller. Every parameter was mappable which allowed for multiple M4L patches to be chained together. This also allowed for a wider range of motion. A surprising feature of diffusing stereo sound in 3D placement was the ability for my body to turn around 360 and the sound followed my movements. I attribute this to the fact that Dolby Atmos is designed to default its stereo image by mirroring the right channel.

Performing live sound diffusion on a brightly lit stage has and will continue to be difficult with the Kinect due to light and heat limiting the Ultra Violet sensors. A

different capture system will need to be used if standard stage lighting is used. It can however, be used in a dimly lit venue which might be suitable for clubs such as the Ministry of Sound in London where Dolby has installed their complete live Atmos speaker system.

### **2.3 Early Test Works**

Four early works were created that moved beyond my compositional language away from notions of 'bassline' 'drum' and 'note' into a sound-based world, including recorded found sound as well as synthesised materials. I regard these four pieces as successful in terms of composition and interaction, but not a fully fledged implementation of *The Tesseract*. In *Vocalage* I tweaked and fine-tuned *The Tesseract* audio effects racks and the mapping of it to my body. As a professional vocalist, I naturally used my instrument as the first sound source. So, I designed the sound palette using a raw vocal sample looped in Ableton Live as I danced and moved in front of the Kinect mapped to customised audio effects racks based on my implementation of Laban's Effort Theory captured through Synapse and M4L plugins. Using the system in this way, I was able to record mapped gestures as automation of the effects over the live vocal loop. The setup facilitated a particularly sensitive multi-dimensional control of sounds which allowed me to shape material for real-time performances. As I was able to record the automation of filters through free movement improvisation on an empty track, this allowed me to drop a sound source into the track after the fact. The idea of 'mixing' or 'automating' first then 'composing' the music became an intriguing methodology.

A second early work, *Chaos* uses the session of a song I wrote earlier in the year called *Codex*. On day one of a two-day session, I was testing the parameters by mapping someone else's bodily proportions to the customised audio effects racks based specifically on Laban's Effort Theory. The significance of this session was the use of the system by a different person, of a different stature, in a different environment than the above early work. I also needed to understand how the various relativities of mapping worked as they related to proximity to the Kinect and the virtual space created within Synapse. I did not record automation of their movements as it was just a test session to understand the difference between

'Word Relative' mapping and 'Screen Relative' mapping in the Max for Live plugins. On day two, I opened up the session to further test the relativities on myself. I did not anticipate hearing any of the filters from *The Tesseract*, as I did not record any automation of movement the previous day nor were the Kinect or Synapse open or mapped to a body yet. However, the dials on the audio effects racks were left on, and all of the filters were recalled based on the day before. So, when I pressed play the original content was overly distorted and very loud.

On a conceptual level, a revelation occurred concerning memory, trauma and the effects of such on the present moment. This stimulated further research into Dance Movement Therapy modes. It was during this experiment/accident where my research became "me-search". I began to look into embodied cognition and movement. I also began to ponder how our mental filters, perhaps built up by past trauma as buffers or protection against future trauma, might affect our perception of the world and interaction with one another, and the result this has on creative process.

Once I completed the assembly of the various audio effects racks and combinations of x, y and z axis polarities, I realised that the virtual architecture of *The Tesseract* needed to be outlined and demonstrated. *Traceforms* became a short video in which I explain *The Tesseract* and demonstrate how movement through it affects a sound source.

## **2.4 Portfolio Pieces**

The following pieces and works are included in my portfolio. This section deconstructs each piece and explains the process by which they were made. The works are also discussed in context of the influences and research that exist in the foundations of their creation. Links to theories and concepts, insights and interpretations are explained below.

A sense of time, space, and gravity are explored in my portfolio through the use of *The Tesseract*. Some of my pieces were recorded in an empty modern architecture style building and pool in Miami, Florida. The building "implies a past that is caught

up in the present and anticipates the future". (Walton, pg. 227) I captured several takes of movement throughout a space and overlaid these performances to display the superimposition of the past and present, as seen in *Ghost Dance* and overlap of time and timezones as seen in *Here & There*. In *Memories of Filey* the pool was used as a container and additional filter to process memories of one place in a seemingly opposite space and the reconciliation of the past and present. The pieces explore and reveal the creation of a separate dimension, independent of any one performer or sound source, respectively. This separate dimension is a version of an anticipated future.

#### 2.4.1 *Ghost Dance* (Audio/Video)

In this piece, I filmed myself and also recorded movement in *The Tesseract* as I danced through a room in two separate instances. I used the dimensions of the large room as a container for the movement and of a memory. This is representative of Laban's' dynamosphere as well as the circle and square drawn around the *Vitruvian Man*. I performed a series of improvised movements in the space as two different characters. One character, the ghost, represents a traumatic energetic signature frozen in the somatic memory. (Talwar, 2007, pg. 26) The second character, the girl, as a person entering the memory the first time. The two performances were overlaid upon one another visually and sonically. The synchronicity of the improvised movements and editing was left to chance. (Cunningham, 2017) The music was composed partly by sonifying the recorded automation of the captured movement affecting the audio of a simple sine tone then converting it into rhythmic midi in Ableton Live. This resulted in the glitch patterns and pulse of the piece. The use of a single sound palate dropped into the movement automation was of importance in order to preserve the identity of the characters while also highlighting the blending, shaping and texturising the sounds. The title of this piece alludes to Jung's attempt to describe the paranormal as 'synchronicities' and the spiritualist movement of his day. This was an experimental piece using *The Tesseract* squared concept where two tesseracts would be engaged simultaneously. The resulting projection of one image upon another is representative of a PTSD episode where a person has a "decreased ability to associate new information to existing experience, but, instead, to hyper-associate

current sensations to past pain.” (Van Der Kolk, 2002, pg.78) The feeling of being haunted or trapped in the tyranny of the past can be heard as both present and past are projected upon one another.

#### 2.4.2 *Here & There* (Audio/Video and Ableton Session)

*Here & There* technically explores body relative mapping parameters, and screen and world mapping relativities as they relate to two different size bodies. It also plays with the concept of a fourth dimension as an abstraction of entanglement and long-distance connection<sup>7</sup>. The first performer, my daughter Aria recorded automation of every iteration of *The Tesseract* at once through improvised dance movements. Each and every version of the X, Y and Z axis’ were armed and active as she moved to her favourite piece, *Für Elise* by Beethoven. Prior to recording, *The Tesseract* body parameters were scaled to her bodily proportions within the frame of three camera angles. As the second performer, I kept the body mapping parameters as they were and filmed myself sorting through some of my research notes while sitting on the floor in the same frame that was used to record Aria dancing. My movements were recorded as automation of just one version of *The Tesseract* consisting of one of each of the x, y and z coordinate audio effects racks. The music was composed with two vocal takes of Aria singing and two tracks of a piano recording of *Für Elise*. These tracks were dropped into the recorded automation of the captured movement and event. The video edit was used as a template to ride the volume of the various tracks as they matched the visuals. This very personal piece about my year of research away from my home and my daughter in Miami, Florida, depicts the entwined nature of chance, choice and connection as a fourth dimensional experience.



Fig.22: Aria Mateu in *Here & There*, 2017.

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<sup>7</sup> Entanglement: Gravity’s long-distance connection, Science News, <https://www.sciencenews.org/article/entanglement-gravitys-long-distance-connection>

### 2.4.3 *I Remember* (Audio/Video)

A performance of my movement alone was captured by two video cameras and a Kinect. Both video and automation of *The Tesseract* effects racks were recorded. I wore a black morph suit in a black box theatre in complete darkness with LED lights strapped to my wrists and ankles. The video was edited together and the LED's were processed in Adobe After Effects to create light trails as traceforms. The composition and arrangement process was a significant change in the order of work flow that I had always used as I was able to realise sound from visuals in a way that I had not done before. As seen in *Ghost Dance* and *Here & There*, I dropped sound sources into the previously recorded automation but also incorporated my previous composition processes in the programming of some of the percussion, drums, and bass parts. This became an integration process both compositionally and psychologically. "Dance and drama work directly with the body through movement, activating the right hemisphere and limbic material, while art and music activate non-verbal material through kinesthetic and sensory pathways." (Talwar, 2007, pg. 26).

### 2.4.4 *Helix* (Audio)

This piece uses a blend of my previous compositional process with the use of *The Tesseract* to aurally elucidate the toroidal movement of a tesseract, specifically the centre portion which looks like a helix. Audio of a voice free-flowing and processing-out-loud while I paced a room as if sleep walking<sup>8</sup> was recorded captured by the Kinect affected and automation captured by my pacing and hand gestures at the time. The words that came to me spoke of individuals swirling, combining and separating revealing countless simultaneous experiences all at once while describing the tesseract as a healing modality for individuals, groups and eventually the collective consciousness. This piece uses four basic sound palates: human vocalisations, rhythm section, a piano motif, and swelling synth themes each mapped to their respective Tesseracts with distinctive filters. These are

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<sup>8</sup> Lucid dreaming practices are creative processes that have been used by Jung's spiritualist contemporaries, to mystics, to artist to access wisdom, truth or inspiration beyond our waking hours. <https://documents.mx/documents/edgar-cayce-roberto-assagioli-jung-and-psychoanalysis.html>

representative of the 4 dimensions<sup>9</sup> swirling around one another. I exploited the bypass and centre positions of the audio effects racks by using intermittent movements from my various sleeping positions and movements. This was made possible by propensity for sleeping on my stomach, twisting in a helix-type motion occasionally over a period of a sleep cycle.

#### 2.4.5 *Inter-Act* (installation)

*Inter-Act* is an interactive audio/visual installation (see Figure 23) first performed at The University of Huddersfield's Heritage Quay as part of International Women's Day, 2017. The work was projected on and interacted with via a large immersive concave screen. Audio and video were played through Ableton Live and projected by two projectors in Heritage Quay. Movements were captured through the Kinect mapped to audio effects in *The Tesseract* which affected the sound sources running through the system. To control video interaction, frequencies were marked as triggers for video effects through *RokVid*, a M4L plugin by Adam Rokshar. This caused specific distortions, filters and scene changes visually in response to movements affecting and shaping the sound. Festival participants and attendees were encouraged to use the system and experiment with *The Tesseract*.

As one moves, this piece reflects the way in which we move through life and how we experience it through our internal filters. Our responsibility for the resulting projection of/onto our external reality become apparent. Our inner thoughts not only affect our interpretation of a situation, but it also catalyses a further distortion of it by projecting it into our outer reality. (van der Kolk, 2015) This becomes a feedback loop in which we continue to process experience through our internal filters and create an affected outer reality, transporting us to a whole new dimension where we are both the cause and the effect. As such, the work was a particularly important in

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<sup>9</sup> These are connected to Rossi & Rossi's proposal regarding 4D quantum theory and creative consciousness are linked. "research on these four major dimensions of *The Classical Psychosocial Epigenome: Mind, Mirror Neurons, Genes* and the *Brain/Body* could be generalized with Penrose's 4-dimensional quantum theory integrating cosmos and consciousness...Current research in psychosocial genomics is reviewed to underpin a new evolutionary RNA/DNA epigenomic theory of the quantum transformations of consciousness and creative cognition." (Rossi, 2015)



understanding the psychology of my movement in performance rather than merely the physical mapping of parameters. The work of Carl Jung, Sandra Koch, Diana Fischman and Bessel van der Kolk became fundamental in my understanding of *The Tesseract* as a means of expressing embodied cognition and increasing self-awareness.



Fig.23: Susie Green, *Inter-Act*, at Heritage Quay celebrating International Women's Day, 2017.

#### 2.4.6 *Memories of Filey* (Audio/Video)

This piece portrays the experience of sound-inside-sound, and the interaction of two simultaneous embodied experiences expressed through the way that the piece was made. I took field recordings from a visit to Filey, UK and played them through an underwater speaker in a pool in Miami, FL, USA. I placed a contact mic and hydrophone into the water to record the sounds of Filey through the pool in Miami. (I called this the 'Filey inside Miami' track.) I also recorded myself singing underwater in the pool and found it quite difficult to use my voice in the foreign environment. It reminded me of the clipped, and alien sounding vocals heard in "The Suicided Voice" (Bokowiec, 2003) A video of my movements underwater was taken by a GoPro. My gestures were run through *The Tesseract* and recorded as automation used to affect the vocal track. All of this was recorded into Ableton Live. In the studio, I took the 'Filey inside Miami' track and extracted rhythm and various phrases. The piece is structured as a palindrome in that it begins with the raw Filey sounds and progresses into the 'Filey inside Miami' filter. From there it slowly morphs into a standard structured pop formula after which it slowly thaws back through the 'Filey inside Miami' filter until it melts back into the original Filey field recording. After the music was composed, arranged and mixed a video was edited using camera phone pictures and videos taken during the field recording session in Filey and the GoPro footage Miami pool. This piece represents the embodiment of the entire experience containing the two soundscapes and the memory of one

processing into the other and back again. The cycling of these two is also a virtual tesseract in motion creating a separate dimension of experience altogether. The making of this piece coincided with an avalanche of disruptive events, personally. Thus, to record and complete it became an exercise in being in the moment. From the battling of haunting memories to the immediate pulls on my time and resources, it was a challenge to stay the course. As David Foster Wallace said in his 2005 commencement speech at Kenyon College, “simple awareness; awareness of what is so real and essential, so hidden in plain sight all around us, all the time, that we have to keep reminding ourselves over and over: ‘This is water. This is water.’” It was in this water-within-water where two very different experiences were finally reconciled, and the inoculation against PTSD was administered.



Fig.24: Susie Green, Memories of Filey, 2017

## CHAPTER THREE

This short chapter reflects on *The Tesseract* as a way of understanding how experiences and memories shape perception and movement. My initial intention was to create a compositional system in an objective manner to explore and develop my creative practice. As the research progressed and the psychology of movement theory opened up avenues in movement therapy and psychoanalysis became a surprising but enriching element I fully embraced and integrated. Movement in my practice begins with a simple question - 'How do I feel?' This is not usually a voluntary or conscious occurrence. It is a private expressive reaction at times when I cannot write, sing or sketch out my emotional state. The series of motions, by chance, create a composition in layers that can be later referred to as I write out the piece as music, lyrics or even a drawing or piece of art. Alarcón Dávila explains it in this way: "It is not just the sequence of the steps that count, but also the moment of transition between one step and the other, the moment in which one step is ending and the next is coming into being." (Dávila in Koch, 2012, p.108) As such, this chapter examines the potential of *The Tesseract* as a tool in cognitive behavioural therapy and dance movement therapy and is framed by concepts in current models in this area that I have found influential.

*The Tesseract* can be thought of as an inner structure complete with defences and filters built around our pure centre. Many of these filters distort reality when we go further from our centre. This is why the closer to the centre of the three mapping relativities in the three dimensions of mapping potentialities (X, Y, Z) one gets in *The Tesseract*, the more pure and true the sound source becomes. There is a figurative bypass programmed when we find our centre. As we smooth and connect with the edges of what lies underneath, and continue to come back to our centre the shape of our experience in the world can also be more peaceful and smooth.

Echoing Esbjörn-Hargens statement, "Everything has ... an individual and a collective perspective", for me, an individual's movement through *The Tesseract* is a Jungian individuation process. In this conceptual model, the sound source of the practical model is anything we experience from the outside world. We can call this

experience with the outside world 'reality' and define it as anything we might process through our senses. Rodolfo Llinás writes that:

In order to make its way in the world any actively moving creature must be able to predict what is to come and find away to where it needs to go. Prediction occurs by the formation of a sensorimotor image, based on hearing, vision, or touch. This contextualises the external world and compares it with the existing internal map. (Llinás, 2001)

As discussed earlier, through the practice of centring and movement to and from the centre of *The Tesseract*, one is potentially able to understand their own mapping of filters and bypasses as they move through the world. As van der Kolk puts it, an individual must “become aware of their sensations and action tendencies ... discovering new ways of orienting themselves to their surroundings and exploring novel ways of engaging with potential sources of mastery and pleasure.” (van Der Kolk, 2006, p.13) However, an individual cannot avoid the inevitable interface with others' tesseract's, as it were. This compounds the individuation process and can cause further distortion of reality if the individuals are not aware of their own mapping. Not only does one need to be aware of their own internal mapping, but they must also be able to distinguish between theirs and the others. This dance between two tesseracts can produce a separate interpretation of reality that combines the two individual ones. From the outside, an inevitable synergy results in its own dimension. This can be experienced in my piece *Ghost Dance* where two tesseracts interact sonifying movement as empathy in the form of attunement, mirroring and resonance. In *Therapeutic Relationships and Kinesthetic Empathy*, Diane Fischman reflects on ways in which dance movement therapy (DMT) helps people to understand one another past their own filters. Fischman writes:

Through movement and dance, perception, understanding and intervening, dance therapists can relate to both inner and outer worlds. They understand that empathy enables intimacy and human closeness. The process involves elements that are common in the experiences of both individuals so that recognition of differences is therefore tolerable. (Fischman, 2011, p.11)

Dance movement therapists physically mirror the movements of clients to invoke a sense of empathy to understand the client. A DMT practitioner uses mirroring techniques with clients to help understand and guide them toward healing. These DMT practitioners are trained in Laban Movement Analysis and attune themselves to their client to embody understanding, also known as Kinesthetic Empathy. (Lauffenburger, 2010) However, there are concerns regarding the accuracy of interpretation of movement and dependability of a practitioner who may also be working through their own bias. “It is not clear [if this] could be reliably achieved anew by every unbiased learner, given its importance in human interaction.” (Wilson, 2013, p.1) On a practical level *The Tesseract* has the potential to be a viable tool of measure for use in DMT once it is mapped to an individual’s body. It can mirror and play back the results in real-time as a person moves through the filters as a sound source is effected. The technology stands in for another individual who might be operating off of their own biases creating a distortion of feedback. Perhaps it can overcome a human being’s limitations regarding “the sheer complexity of the mapping that must be achieved when one’s own body schema, encompassing a complex, multi-jointed set of effectors, is linked to another’s body.” (Wilson, 2013, p.1)

*The Tesseract*, as a theoretically guided (Laban/Human Measurement Module) and technologically mediated (motion capture/Ableton Live) vehicle for mindfulness, is a virtual double cube that surrounds an individual. When in use through Ableton Live, the evidence of it is heard through the affected sound source. It is representative of the theoretical idea that individuals carry their personal *Tesseract* consisting of life induced customised filters. Through varied postures and movement through day to day experiences balanced by centring in stillness, the understanding of our own affected perceptions and projections can bring about more mindfulness. As we interact with others, who move through life within their own tesseracts, the distortion of the experience can be compounded. Mindfulness as a practice encourages one to understand their own centre and the filters that have been built up around that centre. If we begin to understand our own mapping through individuation, we are then able to know the difference between our own filters and others’ and perhaps take in the complete interactive experience. If both parties are

privy to this process, empathy and mirroring can take place and filters can be bypassed through mutual centring. Thus bringing peace and balance back into the equation.

## CONCLUSION & FUTURE DIRECTIONS

The creation of *The Tesseract* has successfully achieved both the artistic and research questions I set out to explore. Arriving at the University of Huddersfield as a professional producer, songwriter and singer, I have through *The Tesseract* been able to interrogate my creative practice from formal, sonic and production perspectives. Whilst it could still be said that there is a pop sensibility about my work, there is for me a symbiotic relationship between my previous work and this new work as an interdisciplinary sound artist. There are however, many areas that I wish to explore further that have not been possible within the confines of this Masters degree.

Currently, underway is the creation of an interactive sculpture based on the audiovisual piece *I Remember*. The video is being interpreted in Adobe After Effects where wrists and ankles of the performer were tracked, and blended movements have created connected traceforms. A 3D image will be sculpted into a frozen representation of the overall shape of the piece. The sculpture will be fitted with an internal speaker and a mini port to plug in a sound source. The edges of the sculpture will be coated in conductive material in order for an individual to finger-dance with the video as they trace with their finger across the piece. As they move around the edges of the traceform sculpture, the sound source is affected as if they were dancing using *The Tesseract*. This leads back to Hepworth's thoughts on movement between a piece and an observer as interaction with her sculptures. It also is significant as a means to freeze the emotional signature of the piece into a haptic 3D object that can be interacted with not unlike the concept of *The Toy Symphony*. (Ng, 2004, p.645) It is meant as an accompaniment to the original piece where the viewer/listener can experience instant feedback on their movement and choices as the sounds created weave in and out of the original piece.

As a technical next step in the use of movement in my compositional practice, I would like to explore kinematic variables such as velocity and acceleration (Thompson, 2012, p.137) to fine tune movement mapping. I am looking into the use of accelerometers to map Arduinos in MAX or Pure Data wirelessly as seen in the works of the Uilirha Duo. Inspecting the possibilities of using electronic textiles (e-

textiles) with machine learning programs like Wekinator as seen in Becky Stewart's work with e-textiles and "signal processing to build interactive, body-centric wearable computing systems" (Stewart, 2016) will help in lighter wearable sensors. The conductive thread can be woven into lighter items to support freedom of movement while OSC is being tracked and recorded. This can minimise the time it takes to calibrate the system for each individual. Leah Buechley's *Lilypad Arduino* (2010) is another example of e-textiles in action. In addition to fabric, I am looking into *Beauty Tech* (2013), Katia Vega's work which uses mappable beauty products, wearable computers and muscle based interfaces.

The use of a dedicated motion capture system as seen at the University of Oslo's RITMO - Centre for Interdisciplinary Studies of Rhythm, Time and Motion, (formerly called fourMs - Music, Mind, Motion, Machines) would be ideal. The state of the art facility, shared by three research groups uses the Qualisys motion capture system and an array of sensors including EMG and a Xsens MVN full-body, mobile motion capture system. I would also like to visit University of Leeds' Interdisciplinary Centre for Scientific Research in Music labs, home of Dr Ng's MvM system and other research that use their motion capture system, scanners, dedicated labs and studios.

Since video and motion pictures are actually a series of still frames, these slices of time have helped me to understand the process of recording movement and has reframed the process in a more technical way prompting understanding of video capture patches in MAX. This is something I would like to expand on in order to build bespoke programs. In the future, I would like to use a more finely tuned motion capture system that can better detect the speed of the movements to represent this dimension of Laban's theory of efforts and exemplify a more wholly realised aural version of Laban's theory's on space harmony.

Additionally, there is interest in the use of *The Tesseract* or a similar set up by Dr Mireil Diaz of the Psychology Group Of South Miami in DMT, with foundations in the *5Rhythms* model. Diaz is interested in the possibility of removing reverse transference in therapist/client interactions through the use of technology to produce less biased interpretations and treatment. I would like to write one long-



form composition per 'rhythm' (five in total) then have participants dance or move through these while being tracked and automation is recorded by the system. After the client moves through the *5Rhythms* series, they will be able to listen back to the affect their movements caused on each piece. This will give them a new dimension to process with individually, which will be followed by the joint examination with a therapist. Experiments in comparing and contrasting the original *5Rhythms* model with the addition of *The Tesseract* or similar set up are also of interest.

I will continue to develop my compositional, creative, production and performance practices further in the quest to humbly contribute to my sliver of the world by challenging myself through my creative practices. This will hopefully cause a ripple effect of inspiration and healing within others and eventually between people and groups. As Le Corbusier described in his 1957 letter to Albert Camus- "I'm taken with the idea of a 'box of miracles' ... as the name indicates, it is a rectangle box made of concrete. It doesn't have any of the traditional theatrical tricks, but the possibility, as its name suggests, to make miracles." In this way *The Tesseract* is a virtual box within a box with no apparent bells and whistles or flashy code or external gears or lights. However, the possibility of its use as a tool for evolution from self-awareness to team or group-awareness could add another dimension to lives and make more than sound, but perhaps make miracles grow from me-search to we-search.

As a result of my journey through this research, my interest in using music and movement as a healing influence through my work has grown. I have already begun interviewing sound and colour/light practitioners and composer/performers such as Vanessa Cicneros, Angel Mae Collins and Timo Preece. These individuals have combined sound, colour and light into their practices as a healing modality for clients and audiences alike. In addition to artists and those who have an active sound healing practice, I have begun looking into academic researchers and groups that are exploring this area. Their interests and application of sound-healing covers the spectrum from inducing relaxation, helping ease individuals with psychosomatic disorders, and investigating cures for cancer. These researchers are testing the validity of various sound-healing practices and healing outcomes. Projects span the

examination of various tuning methods, observing ancient instruments like the Monolina and the resonances that they produce, and the use of light and sound frequencies to heal at the cellular level in controlled experiments. Such research is being conducted at Goldsmiths University of London, Freie Universität Berlin, International Psychoanalytic University Berlin, University of Heidelberg, University of Glasgow, and UC Berkley. I would like to explore these healing modalities further and incorporate some of the concepts to my compositional, creative production and performance practices. My journey and research continues.

## APPENDIX 1

### **Traceforms Script**

The Tesseract is a virtual cube within a cube that we we carry with us everywhere we go and process our world through. The outer cube contains filters, buffers build out of our experience and memories. They exist to protect us from undergoing future trauma, yet as we move through the wold they can also act to distort our perception. We each have our own unique combination of lenses mapped to it. The inner cube is pure and filter free. This can be accessed through mindfulness. As we hold every thought captive while remain completely invested in each moment we have access to this pure center and are able to discern what is before us in a more unbiased way. But how does this relate to music?

I've used movement theories Rudolf Labans' Movement Theory as inspiration for my mapping strategy of movement to customized effects racks in Ableton Live. So, movement in a 3D space is broken down into cartesian coordinates -

x is right and left or in and out,

y is up and down

and z is forward and backwards

Along each axis there is a continuum and in each opposite direction there is an equal and opposite polarity.

According to Laban, movement contains with in it the concept of time, space and weight or gravity.

The x axis is associated with space, communicates flexible or direct motion as it moves toward and away from the center or along the right and left plane.

The y axis is weight or gravity and encompasses strong or light movement at it's highest and lowest point

and finally

The z axis is linked to time where quick or sustained movements occur across the forwarded and backward continuum.

I've translated these characteristics and positions into movement mapping and mixing parameters. For example:

Along the Y-axis, Up and down I've created an effects chain that pans between a high pass filter when the hand is up and a low pass filter when the hand is down. Between the two filters I've sent up a bypass where there is no filter. These have been calibrated to my body's proportions and range of motion.

Along the Z-axis, I've created an effects rack that chains a very compressed filter at the front, a bypass at the center and a thick delay toward the back of the spectrum. In the demonstration I've mapped my hand to front and back and the sound being processed is affected in a fluid manner across the polarity.

Along the X Axis I've created an effects rack that pans sound smoothly across right, center and left. [This axis can also be interpreted as inner and outer or open and close. If I chose to use this axis in that way, for instance, I would map both hands to a bypass of filters toward the center and a chorus or doubling effect building in intensity the further my hands moved away from the center which the system recognizes as my torso. So, the X-axis can be used for 'out' and 'in' gestures or right and left depending on the body part being mapped. If I choose to map to the torso, it impossible for it to use the out and in parameter, due to the nature of how this part of the body moves...in this plane of existence, I still cannot get my torso to move away or toward itself. The out and in range can be mapped to hands, elbows, feet and knees since these body parts have the physical capacity to move in this way relative to the center of the body.]

There are several different effects racks mapped to corresponding movements along the three dimensions with unaffected bypasses at the center or each chain, which creates a center bypass cube). Multiple versions were created deliberately as a modular way to represent different emotional combinations and to be combined into individualized Tesseract. A Tesseract needs 3-dimensions (time, space and gravity or x, y and z) and movement (or time space). As a sound source is played and a person moves through this virtual architecture of filters, they mix and shape the sound into something other than it's original form, a 4th dimensional experience. Through movement and focus we might get to know which combination of movements create specific textures, contours and patterns of the affected sound source. By holding a neutral gesture in stillness at the mapped bypass cube, we can perceive the difference between the source and the distortion of it.

Which is not unlike when we move through life and mindfully pay attention to the difference between the distortions of our early or past-built filters, prejudices or buffers and a centered more clear source. The Tesseract sonifies unique filters of perception and represents the varied ways individuals embody and perceive their movement through events or life. Perhaps we might not shed these ingrained filters that shape the way we assess events and interactions but, we can mindfully route our awareness to the peace within and attune to this stillness of source and project some peace into the shape of our lives.

## APPENDIX 2

### **Memories of Filey Prose**

we glided toward the horizon, hand in hand.

eyes fixed on the moon sipping on saline, lungs wide open, I don't think I've ever breathed this deeply before now...

the breeze coaxed open our ribcages and everything escaped us.

we never watched our feet when we were together.

they seemed to never touch the ground...until now...

a kiss under our soles.

that's all it took for us to notice that we were standing in the middle of the North sea,

in the middle of the night, in the middle of everything.

The waves were frozen under our feet, so solid,

tiny rivers flowed in between the peaks

and we just had to reach down to touch them to cure our disbelief.

we spun ourselves around.

unable to tell the stars from the lights of the board walk, we were surrounded.

by constellations, by winks and blinks from a distant past just now making their way...to us? Like a message sent full throttle...forget about the bottle we spoke... about time.

and space, and place...I don't think I had ever noticed your face...until now.

The ocean swallowed itself back exposing its depths, giving us foundations to dive deeply while still breathing.

We thought we were so special when this was just part of the schedule.

bracing itself for the next rendezvous with the shore.

And while we weren't looking, with each breath that we took in the tides mapped themselves down to our core.

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