# Composing visual music: human traces, from an animator’s perspective

**JULIE WATKINS**

A thesis submitted in partial fulfilment of the
requirements of the University of Greenwich
for the Degree of Doctor of Philosophy

February 2019

# DECLARATION

I certify that the work contained in this thesis, or any part of it, has not been accepted in substance for any previous degree awarded to me, and is not concurrently being submitted for any degree other than that of Doctor of Philosophy being studied at the University of Greenwich. I also declare that this work is the result of my own investigations, except where otherwise identified by references and that the contents are not the outcome of any form of research misconduct.

# ACKNOWLEDGEMENTS

I am deeply grateful to my supervisors, Professor Stephen Kennedy and Dr Andrew Hill for their insightful guidance and understanding. My sincere thanks also to Dr Mary Kiernan for having initiated my research. Many thanks to the singers, Martin Nelson, Clare McCaldin and Alison Cross, who enthusiastically carried out my requests to sing in a manner completely new to them. They sang immaculately and were extremely generous with their expertise and time. Special thanks to my family and friends, whose support and encouragement I greatly value.

# ABSTRACT

This research sought to create one possible framework for a relationship between phenomenological experiences and visual music. Composers of visual music have long sought to create a new artform in which the visible and audible are utterly synthesised. Our different perceptions of the visual and the audible, combined with the lack of a ubiquitous, uniform synaesthesia, pose many challenges. Indeed, visual music in the 20th century, as described by William Moritz, was 'virtually suppressed'. The modernist formalist principles that were espoused by Fischinger, Ruttmann and Richter, which are often seen as the starting point of visual music, are a result of the practitioners' interests and the processes available at that time. This gives visual music a technical foundation, which pervades creative thinking; visual music becomes about how the sound is synchronised with the picture and conceptual links between image and sound. Traditional concepts of visual music that are predicated on responding to music were expanded to a definition that encompasses placing visuals on an equal footing to audio. This was then further expanded to a concept of visual and expanded visual music that starts from the premise of expression and aims to evoke embodied visceral affect. Affect, via the sublime, light and the human gestural, was investigated using a philosophical framework that was informed by Burke, Kant, Merleau-Ponty and Deleuze. Light and human traces were combined in order to affect the beholder. The approach was Practice as Research. Bringing wider artistic practices and forms of expression: animation, photography, light-based artworks and painting, into the field helped to re-frame visual music in terms of how it was perceived, created and displayed. Basing the tempo of visual music on the human gestural, 'animation-tempo', rather than on musical tempo was key to composing from an animator's perspective. Taking visual music off the fixed-screen into three-dimensional installations helped to turn spectators into participants, which increased the affect of the visual music. The research culminated in the development of a framework: an open-ended tool for composition and evaluation of visual music.

# CONTENTS

# FIGURES

**Appendix B**

**Appendix C**

# 1 Introduction

## 1.1 Overview

The area under research is composing visual music, an artform that seeks to go beyond the duality of eye and ear to create a new artform, even to highlight emerging modes of perception. As Murray Schafer, the musician, composer and communication theorist, states: ‘The function of art is to reveal new modes of perception’ (Schafer, 1993, 20). Visual music is a creative practice that is, as Friedmann Dahn asserts: ‘an equal and meaningful synthesis of the visible and audible. And is therefore ultimately its own art form’ (Lund & Lund, 2009, 149). The director of the Center for Visual Music, Cindy Keefer, and visual music artist and historian Jack Ox define visual music as interpreting specific pieces of music visually, or using a musical structure, or converting images to sound, for example by placing images into a film’s soundtrack and simultaneously showing these images (Ox & Keefer, 2008)[1]. This research starts with a traditional definition of visual music, in which visual music composition is predicated on responding to music, which is re-viewed from an animator's perspective, resulting in a definition in which methods of composition starting from visuals mirror those starting from audio. This mirrored definition is further developed and eventually, through Practice as Research, arrives at an expanded concept of visual music and a framework for composing.

The ‘pioneers’ of visual music in the 1920s approached visual music composition using modernist formalist principles; this gave visual music a technical foundation that emphasised conceptual links between the visual and the audible and continues to inspire visual musicians. However, although the possibilities for creating linkages has exponentially increased over the last hundred years, especially with the affordances of digital and algorithmic tools

[1] For their full definition see Appendix E

and techniques, there is no general consensus on how to create compositions with an indivisible synthesis of the visual and the audible. Indeed, in the 20th century, non-objective animation, including visual music, was, as the renowned visual music historian William Moritz stated: ‘virtually suppressed’ (Moritz, 1988, Center for Visual Music website).

This research seeks insights into a broad range of conceptual audio and visual linkages by looking to the traditional canon of visual music and beyond to wider artistic traditions in painting, photography, light art and animation. In this research artistic traditions comprise: seminal practitioners whose approaches resonate down the generations, exemplified by J.M.W. Turner and Norman McLaren, movements: modernist photography’s new vision and found abstraction, and seminal theories and teaching from practitioners such as Laszlo Moholy-Nagy and Paul Klee. This approach widens opportunities for creating a synthesis of the visual and the audible. Nevertheless, the methodology of conceptually linking the two is still limited by the differences in how we perceive the visual and the audible. Therefore a second methodology is also employed; composing visual music from the desired result: a ‘metaphorical synaesthesia’ – an emerging mode of perception that transcends the duality of eye and ear. This second methodology starts from the premise of expression, using human traces of visible gestures and vocal expression, in order to create visual music that is beyond the duality of eye and ear, because it affects the beholder, changing their pre-reflective state.

Exploring the creation of a framework for composing visual music using these two diametrically opposite methodologies in combination with widening the underlying artistic references allows the investigation of a significant gap within composing visual music. Theories of visual, audio-visual and audio perception, philosophy of the sublime and phenomenology underpin the research. In this Practice as Research, concepts and methodologies are rigorously tested through composing visual music works, for both fixed-screen and installations.

# 1.2 Aim, context, contribution and outcomes

## 1.2.1 Aim

This project aims to expand the concept of visual music by contextualising visual music within wider artistic traditions, drawing on ideas and approaches from outside the traditional visual music canon and thereby inform creative practice, and to question and define what contemporary visual music practice might be in the 21st century.

## 1.2.2 Re-contextualising visual music practice

This thesis acknowledges the role of the canon of visual music in exploring modernist approaches and re-contextualises visual music practice within artistic traditions in painting, photography, light-based artworks and animation. The philosophical framework of this research, informed by Edmund Burke, Immanuel Kant, Maurice Merleau-Ponty and Gilles Deleuze, underpins the links made between Turner, the sublime, metaphorical synaesthesia, light as an artform, embodiment, phenomenology and affect. Affect is used in its philosophical sense, to emphasise embodied experience. Affect indicates a change in the experience of a body and a change in being-able-to. It is pre-reflective. As the philosopher Brian Massumi writes:

> *L'affect* (Spinoza's *affectus*) is an ability to affect and be affected. It is a prepersonal intensity corresponding to the passage from one experiential state of the body to another and implying an augmentation or diminution in that body's capacity to act.
> (Massumi, cited in Deleuze & Guattari, 2004, xvii)

Inspired by the artist Paul Klee's opposite modes of constructive-geometrical and a metaphysical openness, two diametrically opposite methodologies are developed. The first methodology is composing visual music based on conceptual links between images and sound. The modernist formalist approaches of the traditional pioneers of visual music, Léopold Survage, Hans Richter, Viking Eggeling, Oskar Fischinger and Walter Ruttmann are examined. More diverse compositional approaches are then explored by looking at practices within and beyond the traditional canon of visual music. Klee exemplifies the composer as conduit of experiences. The animator Norman McLaren epitomises creating stylistic cohesion through concentrating on one technique per composition and pushing the technique to its limits. Composing using montage is discussed with reference to McLaren and Sergei Eisenstein. John Whitney, Golan Levin and Guy Sherwin exemplify varied approaches to composing using mathematical models. Rudolf Pfenninger, Oskar Fischinger, Boris Yankovsky, Arseny Avraamov and McLaren are discussed in relation to pioneering graphical sound. Michel Rouzic's software *PhotoSounder* highlights the opportunities and challenges of current algorithmic mapping. Sven Ingo Koch, Bret Battey and Rajmil Fichman exemplify composers who mix different types of mapping including recognisable, local mapping and a broader approach that uses their interpretation and intuition as composers. Diego Garro's *objets audiovisuelle* are discussed in relation to linking sound shapes with geometrical shapes. Sound-shape symbolism is explored via Wolfgang Köhler's 'Bouba-Kiki' effect, which Christine Cuskley developed by looking at phonaesthesia. Mary Pietrowicz and Karrie Karahalios' study of voice visualisations demonstrates further possibilities for sound-shape symbolism. This is contrasted with Trevor Wishart's focus on the textural and Joseph Hyde's works in '*video concrète*'. Methods of composition are contextualised through a discussion of the perception of sound, visuals, audio-visuals, rhythm and audio-visual synchronisation.

The second methodology is inspired by Klee's metaphysical openness and starts from the premise of expressivity – creating visual music based on the affect of light and 'human traces'. In this research 'human traces' are records of gestures including vocal expression, or anthropomorphic information: 'animacy' and 'perception of causality'. 'Animacy' is a form of anthropomorphism perceived in abstract animation; the shapes appear to be animate, motivated or expressing emotion. 'Perception of causality' is the perception that one event causes another event. For example, when one object strikes another and the second object moves, most observers perceive that the first object caused the second to move. The affective, pre-reflexive and ubiquitous nature of mimicry of human gesture is discussed.

The sonic element of this research is human non-verbal vocalisation because of its power to create embodied visceral affect. We have, as Marianne Latinus and Pascal Belin discovered, specialised cerebral processing for vocal expression that is separate to language. How we identify with singers in an embodied way is explained with reference to Kenneth Bozeman and Arnie Cox. The human voice is rich in timbre, vital for conveying affect, as Aniruddh Patel found. The special affordances of vocal expression and non-verbal vocalisation are discussed with reference to Trevor Wishart and Mary Pietrowicz. These affordances are augmented with the powerful, omniscient position of the '*acousmêtre*' as defined according to Michel Chion:

> [An] acousmatic character whose relationship to the screen involves a specific kind of ambiguity and oscillation… We may define it as neither inside nor outside the image. It is not inside, because the image of the voice's source – the body, the mouth – is not included. Nor is it outside, since it is not clearly positioned offscreen.
> (Chion, et al, 1994, 129)

Light as an affective artform is central. Light is traced from painting to photogram to film to installation through: Turner, Christian Schad, Man Ray, Laszlo Moholy-Nagy, Thomas Wilfred, Anthony McCall, United Visual Artists and James Turrell. The research integrates concepts and approaches from installation and immersive artworks. Turrell's and McCall's artworks in light underpin the research into visual music beyond the fixed-screen that uses the powerful and fundamental experience of light. This research is focused on the nexus between the 'cinematic', 'all art that foregrounds time, or movement, or both' (McCall in Walley, 2004, 67), the 'sculptural', 'work that addresses issues of form in space' (ibid.) and the 'pictorial' 'work connected to the making of images' (ibid.). Displaying the work as an installation is examined in relation to immersion and turning the spectator into a participant.

Artistic practices that invoke visceral embodied affect are interrogated. ‘Abstract animation’, i.e. time-based abstract images, is discussed. ‘Abstract images’ are images of intangible things, and images that have been ‘abstracted’ by removing or mapping elements. There is a continuum between mimetic and abstract images: where an image falls along this continuum depends on the observer. Affective fluxes in perception: perceiving visuals as mimetic then abstract, foreground then background and illusory depth are interrogated in relation to creating visceral embodied affect in the beholder. Turner’s *Rough Sea* (c.1840) is a key reference. Texture and pattern dominating over perspective and the use of foreground and background, positive and negative space, are discussed in relation to still images: Paul Strand’s and Alfred Stieglitz’s photographs of ‘found abstraction’, i.e. photographs that exclude the context of images and thereby emphasising rhythm, pattern and texture. Richter’s ‘movie-canvas’, i.e. using the whole shape of the screen, either as foreground or background, treating the screen like a painter’s canvas, is examined. This allows playing with positive and negative space, i.e. foreground becomes the background and vice versa. Imagery that plays with the beholder’s understanding of what is foreground and background is further explored in Klee’s paintings and McLaren’s animations.

Visual music is investigated from an animator’s perspective. I have substantial industry experience as an animator, 20 years in post-production, working for companies including The Mill and Cinesite, specialising in high-end commercial and broadcast work, and a background in fine arts. As an animator, I find that movement (i.e. both motion and change of attributes – colour, opacity and texture) is intrinsic to expression. The expressivity of movement is defined by ‘animation-tempo’, based on McLaren. This is timing – not metric time, not a pulse – but rate of change. For example, the animation-tempo of a punch may be defined as a specific acceleration. Movement, visual structures and motion are investigated in relation to McLaren’s taxonomy of movement, granularity and rhythm, and Klee’s individual–dividual rhythmical visual structures. The use of surprise to create a visceral embodied affect is reflected on with a in-depth look at *Blinkity Blank* (McLaren, 1955). Wider possibilities for animating visual music are further interrogated by questioning if animation needs to move: how the beholder can see animation in static images such as Eggeling's scrolls, Survage's series of images, and Klee's individual paintings.

The research in its entirety both informs and culminates in defining 'visual and expanded visual music'. 'Visual and expanded visual music' is a form of abstract animation with expressive movement in animation-tempo and affective non-verbal, sonic element vocalised by an *acousmêtre*. Visual and expanded visual music aims to reach beyond the duality of eye and ear by giving primacy to the phenomenological and affective. The aim is for the beholder to complete the open-ended composition by synthesising visual and expanded visual music through their experience of visceral embodied affect arising from their perception of causality, animacy, metaphor or surprise.

Visual and expanded visual music is not dependent on: musical structure, musical tempo, a visual interpretation of music, or conceptual linkages between the audio and the visual. Audio and visual events may be temporally aligned, i.e. have moments when they are synchronous. However, the relationship between visuals and audio is not dependent on any form of sound-to-image or image-to-sound mapping or algorithms, or the sonification of images. Given these differences from traditional visual music is this expanded concept still visual music? It is. The claim is justified by combining four elements:

First, visual and expanded visual music has tempo, animation-tempo, at its heart and key to its expressivity. The expressive quality is constructed hierarchically: expression first depends on animation-tempo and 'all change must have a tempo' (McLaren & Munro, 1976, DVD). Expression next depends on the five qualities of motion: constant, accelerating, decelerating, zero and irregular. McLaren asserts: ‘by their skilful use [of animation-tempo and quality of motion] animators give life, meaning, character and spirit to no matter what they make’ (ibid.).

Second, visual and expanded visual music aims to transcend the duality of eye and ear, by eliciting embodied visceral affect. This transcendent mode of direct perception has seminal precedents in visual music. Stan Brakhage, John and James Whitney and Jordan Belson aimed to affect beholders of their visual music compositions in a similar way. As Kerry Brougher states of their films: ‘Art was now beginning to operate directly on the body and mind.’ (Brougher et al., 2005, 158). Adrian Klein posited that in order to create a unity between visuals and audio they need to be ‘reduced to the same terms’ (Klein cited in Ox & Keefer, 2008, 1). Contrarily, eliciting embodied visceral affect means that unity can be created without reducing visuals to the same terms as audio. Therefore, light, found abstraction and human traces are integrated into the process of composing to elicit visceral embodied affect. Indeed, throughout the compositional process – from inspiration, through creation of the visual and the sonic to immersive display – the phenomenological and affective are given primacy.

Third, both the visuals and the sonic element are key to creating works that aim to elicit visceral embodied affect in the beholder. This differentiates visual and expanded visual music from much light art and from the works of seminal practitioners explored within this research: László Moholy-Nagy, Thomas Wilfred, Anthony McCall, United Visual Artists and James Turrell.

Fourth, visual and expanded visual music is created with the intent of composing visual music. Ox and Keefer state: ‘much of the best Visual Music is made with a clear intent of the artist of make Visual Music’ (Ox & Keefer, 2008, 5). This Practice as Research supports the intent of composing visual music with years of exploring existing visual music compositions and visual music theories alongside composing and exhibiting my own visual music.

### 1.2.3 Contribution to knowledge

The original contribution to the field is to expand on traditional concepts of visual music to include embodied visceral affect and a broader visual arts context, which underpin the development of a new visual and expanded visual music. Visual and expanded visual music is defined (Section 1.2.2 and Key Terms) and, along with perspectives from animation and a diverse range of art practices, used to develop a new and original framework for composing visual and expanded visual music (Figure 127). The definition of visual and expanded visual music and the framework for composing it are not dependent on musical structures, and therefore could make visual music composition more accessible to artists, experimental film-makers, animators and performers. All of these aspects expand the possibilities of visual music and contribute to the discourse of visual music practice.

### 1.2.4 The outcomes of the investigation

1. A contemporary framework and evaluative tool[2] for visual music composition, founded on the expanded concept of visual music and informed by artistic traditions in animation, photography, light-based artworks and painting.

2. A portfolio of creative works, including both fixed-screen and installations of visual music, created in the process of developing the framework.

[2] See Sections 4.1 and 4.4

## 1.3 Overview of the following chapters

Chapter 2 begins by defining visual music and discussing the linkages with wider artistic traditions that are key to unleashing the power of affect in 21st-century visual music through embodied visceral affect. The chapter then focuses in turn on the three main aspects of visual music, in addition to light, that concern me as an animator: movement, sound and immersion. Each element adds further complexity.

Chapter 3 discusses the research framework, using ‘Practice as Research’ based on Robin Nelson’s *Practice as Research in Arts: Principles, Protocols, Pedagogies, and Resistances* (2013), and the methodologies and works created using this framework. The main methodology was to pursue two opposing methods of composition: the first founded on an aspiration to create a universal language by synthesising visuals and audio; and the second starting from the premise of expressivity and phenomenological experiences.

Chapter 4 discusses the resulting framework for composing visual music. Aligning the works to the framework illuminates it further. The concepts and methodologies from Chapters 2 and 3 that underpin the framework are also discussed in relation to the framework. The outcomes and aim from Chapter 1 are revisited, the extent to which the aim was met is evaluated and future work is proposed.

# 2 Contextual review

This chapter consists of five sections. Section 2.1 contrasts a traditional definition of visual music with how visual music is defined in this research. Section 2.2 places visual music in a wider artistic context that links it to embodied visceral affect and phenomenology, through ‘synaesthesia’, metaphorical synaesthesia, light as an artform, and artistic vision informed by the tension between abstraction and mimesis. Section 2.3 considers visual structures in relation to movement: Klee’s methodology and framework as a basis of a methodology for animation, human traces, McLaren’s taxonomy of movement, and movement versus stasis. Section 2.4 looks at adding sound, discussing audio-visual structures in terms of: audio-visual perception, rhythm, mapping, and the impact of technology on composing visual music. Section 2.5 is dedicated to immersion: projected displays turning spectators into participants, open-ended performances and questions of showing the workings of the display.

## 2.1 Historicising and defining visual music

The impulse to find correspondences between music and visuals and use these to build a new mode of creative activity, indeed a new artform, has a long history. John Whitney, a seminal pioneer of computer animation, attributes the birth of visual music to Pythagoras (Whitney, 1980). Pythagoras described the first musical scale completely based on mathematics and these ideal whole-number ratios extended into the visual world of architecture and sculpture.

The historian Kenneth Peacock states:

> Sir Isaac Newton was the first to observe a correspondence between the proportionate width of the seven prismatic rays and the string lengths required to produce the music scale D, E, F, G, A, B, C.’ (Peacock, 1988, 398)

But, as the physicist Patricia Fara clarifies. ‘Newton never specified exactly what those quantities might represent in terms of light and pigments’ (Fara, 2015, 9). Even after three centuries, no one agrees on a musical note to colour mapping, as designer and innovator Fred Collopy (2006) demonstrates (Figure 1).

Figure 1. Matching colours to pitches (based on Collopy, 2006, 64)

There have been many attempts to make a synthesis between light and music, through colour organs, painting and painting onto film as well as making sound visible by showing oscillations caused by sound patterning sand (Ernest Chladini) or water (Alexander Lauterwasser), or the display of an oscilloscope. This process has been very widely defined to include a wide range of diverse practices such as Lumia, Colour Music, Synchromy, Audio-Visual Music, VJ-ing and Motion Graphics. In this thesis, there will be no attempt at a detailed and comprehensive survey of the entire development of visual music.[3]

[3] Much has been written about the history of visual music. The Centre of Visual Music has a large archive of films and historic documentation. William Moritz (1985) has written extensively on key practitioners. Robert Russett and Cecile Starr’s (1988) anthology of innovator-animators is key in highlighting experimental and abstract animation. Collopy’s site rhythmiclight.com is another excellent archive. Kerry Brougher et al. (2005) focus on the key issue of synaesthesia in visual music. There are also acclaimed exhibitions on visual music artists and their work, for example Abstract Visual Music, 2005–6, and see Lund & Lund (2009); conferences, such as Seeing Sound, SOUND/IMAGE, DRHA and EVA, reflect the current scene.

## 2.1.1 Definitions of visual music

Traditionally, visual music has been defined in relation to how it has been composed. The definition of the visual music given by Cindy Keefer and Jack Ox, has been widely cited (Hyde, 2012; Kanellos, 2018; McDonnell, 2007; Sykes, 2015). Ox & Keefer (2008)[4] distinguish four main strands, all of which start with music or musical structures or sonify images:

1. a visualisation of a pre-existing music using its musical structure
2. a new visual time-based composition – with or without sound – that uses a musical structure
3. sonifying images, for example, drawing or photographing images into an analogue-film's optical soundtrack and simultaneously showing these images
4. a non-time-based image in which an artist, inspired by a specific piece of music, implies movement through the composition of pictorial elements.

As a visual musician writing from the perspective of an animator, I give equal weight to methods of composition that start from the visual aspect. Therefore, I propose that there are three main strands of visual music that are mirrored (A and B):

1. (A) visual structure informing the composition of both image and sound
   (B) musical structure informing the composition of both sound and image
2. (A) visually representing sonic data
   (B) the sonification of images
3. (A) moving image created *to* pre-existing music
   (B) music created *to* pre-existing images.

As I have a visual background, this project will focus on creating works in Strands 1-A, 2-A and 3-A. In Strand 1-A, visual structure informs both image

[4] For their full definition see Appendix E

and sound. Usually, individual artists and animators create this strand. It includes silent works such as Hans Ritchter's *Rhythmus 21* (1921) and static works such as rhythmic paintings by Paul Klee. Musicians and composers usually create Strand 1-B, with a musical structure informing the composition of both sound and image. Strand 1-B is underpinned by a long legacy of musical structures. Examples include: Jean Piché's *Océanes* (2010/2011), Joseph Hyde's *End Transmission* (2008) and Bret Battey's *Estuaries* (2016/2017/2018).

As Ox and Keefer note, Strand-2, i.e. a direct translation of image to sound, has been identified as pure visual music (Ox & Keefer, 2008). Literally what you see and what you hear are one and the same, with a 1:1 mapping. The seminal animator Norman McLaren's *Synchromy* (1971) (Section 2.4.3) is more visually complex than just using the analogue film's optical sound track in vision, but nevertheless gives a good idea of this pure fusion. Direct translations of sound to image have been attempted through algorithmically transforming sonic or visual data into a data set that can generate or manipulate images and sound in real time. However, as discussed later in this thesis, these quantified signal mappings pose problems that have not been resolved. The differences between auditory and visual perception make this a problematic area. 1:1 mapping can be cold and mechanical, ignoring the overall emotion conveyed by the image or sound. Therefore, re-introducing the human gestural is key.

Strand 3 is usually the product of more than one person. For example, an animator may create an animation *to* pre-existing music created by a composer and musicians. Made with the intention of creating visual music, the animator visualises specific sonic elements in motion in relation to the pre-existing music. Oskar Fischinger's *Optical Poem* (1937) and Len Lye's *Trade Tattoo* (1937) are examples of Strand 3-A. Strand-3-B is also likely to be made by an animator plus composer-musicians. It will also be made with the intention of creating visual music, with the musician sonifiying specific visual elements. Examples include Sven Ingo Koch's score (2007) for Walter Ruttmann's *Opus IV* (1925) and Tom Reid's score (2014) for Walter Rutttmann's *Opus III* (1924); Ruttmann had his films scored and intended them to be viewed with music.

### 2.1.2 Visual music: a new domain

Visual music is not dependent on narrative structure or representation, as the visual musician Brian Evans suggests: 'It [visual music] is typically non-narrative and non-representational' (Evans, 2005, 11). In contrast to visual music, the great majority of animation is narrative driven and representational. Usually a narrative is written and characters' relationships developed with the aim of eliciting emotions through audience identification with characters. The settings, lighting, colour, sound design and the way the animator frames the action, all add clarity and impact to the action in order to engage the audience's emotions. The narrative is also often made clear through using a conventional dramatic structure: a beginning, middle and end. The ubiquitous audio-visual material on the internet and television and in the cinema is in the language of traditional narrative, or storytelling. According to the seminal historian of avant-garde and experimental cinema William Moritz:

> [N]on-objective animation is the purest and most difficult form of animation. Anyone can learn to 'muybridge'[5] the illusion of representational life, but inventing interesting forms, shapes and colors, creating new, imaginative and expressive motions 'the absolute creation: the true creation,' as Fischinger termed it (Fischinger, 1947) requires the highest mental and spiritual faculties, as well as the most sensitive talents of hand.
> (Moritz, 1988, Center for Visual Music website)

Visual music, and all non-objective animation, has not only to succeed within its own framework but to succeed so well that the beholder does not feel the lack of a traditional narrative, the lack of representational audio-visuals or a lack of engagement with the work. It would be even better if instead of

[5] Moritz is referring to Eadweard Muybridge's pioneering pre-cinema work that captured the movement of animals using multiple cameras to produce stop-motion photographs.

thwarting expectations by showing non-narrative and non-representational animation, expectations were exceeded. This gives an animator opportunities and challenges in 'creating new, imaginative and expressive motions'. This new domain is often approached through the electronic arts, mapping visuals to, often electronic, sound. At the 'Call for the Understanding of Visual Music 2013 Colloquium' visual music was defined as follows:

> [T]he intimate relationship between sound and image is combined through a diversity of creative approaches typical of the electronic arts. It may refer to 'visualized music' in which the visual aspect follows the sound's amplitude, spectrum, pitch or rhythm, often in the form of light shows or computer animation. It may also refer to 'image sonification' in which the audio is drawn – in some way – from the image. Sometimes visual music describes a non-hierarchical correlation between sound and image, in which both are generated from the same algorithmic process, while in other instances, they are layered without hierarchy or correlation altogether.
> (Sykes, 2015, 5)

In relation to my definition of visual music, this definition emphasises visually representing sonic data (2-A) and the sonification of images (2-B). Additionally it acknowledges algorithmic possibilities of electronically creating sound and image simultaneously, or at least without one following the other, and the possibility of layering sound and image without any correlation. The problem with 2-A is that often it is automated and there is too much redundancy; for example, lights brightening on every beat is too predictable to be engaging. The problem with 2-B is that images being read as sonic values produce sounds that do not conjure the visual image. More sophisticated algorithmic possibilities and more nuanced approach to mapping 2-A or 2-B all foreground conceptual linkages between sound and image, and background, or even disregard, the human gestural, emotion, feeling and embodied visceral affect.

Given the challenges outlined above, exploring possibilities for creating engaging visual music with non-objective animation by incorporating human traces and gestures offers a wealth of opportunities. In this age of burgeoning artificial intelligence in the arts this seems ever more crucial.

## 2.2 Visions of light: placing visual music in wider artistic contexts

This section discusses the linkages that are key to unleashing the power of affect in 21st-century visual music through embodied visceral affect; by placing visual music in wider artistic contexts. First, we consider how 'synaesthesia', mysticism and metaphorical synaesthesia are the impetus, underlying the quest for visual music (Section 2.2.1). Second, we look at how Turner and the sublime link to affect (Section 2.2.2). Third, we examine embodiment, phenomenology and affect (Section 2.2.3), and fourth, we consider how light as an artform moves towards creating affective experiences (Section 2.2.4). Fifth, we review how the tension between abstraction and mimesis within artistic vision, as expressed by new vision and found abstraction, gives rise to affect (2.2.5).

### 2.2.1 Synaesthesia and mysticism

This section considers the unifying impetus behind visual music, i.e. the idea of 'synaesthesia'. 'Synaesthesia' is an involuntary response in one sense, such as sight, triggered by the stimulation of another sense, such as hearing. If a cohesive and homogeneous synaesthesia were a universal attribute, there would be no need to create visual music, as everyone would experience visuals as music and music as visuals in a common way. In fact, the prevalence of synaesthetes is estimated at 1% of the population and synaesthetes' experiences of synaesthesia are unique to the individual. However, as the experimental psychologist Shinsuke Shimojo asserts, 'Cross-modal integration [of the senses] is performed on a vast level in the brain and contributes significantly to adaptive behavior in our daily life' (Shimojo, 2001, 505). Therefore, it is not surprising that there has been a quest to link and unify the senses and, through the senses, the arts. As noted above, ways of

linking colour and music have been sought for centuries but the exact linkage has never been agreed on.
Historically, the idea of synaesthesia has also involved a mystical aspect. According to Bruce Elder, the Canadian experimental film-maker and critic, 'The experiences of prayer, meditation, contemplation, trance and dream are not incorporated into modernity's model of normative cognition' (Elder, 2010, xxvi). Artists have long sought ways of creating transcendental experiences through their art. Arguably, much of art prior to the Romantics disseminated traditional organised religion and a sense of religious spirituality. In the later half of the 18th century, the Romantics' response to commodification, degradation and despoiling as a result of the factory system led to a new appreciation of nature as, philosopher Edmund Burke's term, 'sublime' (Rees, 1982). Burke defined the 'sublime' as darkness, obscurity, privation, vastness, magnificence, loudness and suddenness; he cited terror, the strongest passion, as the most effective route to the sublime (Burke & Phillips, 2008).

The concept of immersing oneself in nature to experience awe, to be affected, to transcend oneself in the universal, still holds sway today. Arguably, at the end of the 19th century, there were blurred boundaries between traditional religion, the transcendent including the sublime and the occult or belief in the paranormal and clairvoyant; whereas, in the 20th century, there was a continual dialogue between art and a sense of the spiritual. This dialogue started with the Bauhaus and painter Wassily Kandinsky, continued with Thomas Wilfred's spiritual-scientific use of his manifestation of light to immerse spectators in the immensity of space, then the Abstract Expressionists, including Rothko, and on into the new computer arts. Lipsey states of Kandinsky's *Concerning the spiritual in art*:

> Spiritual remains an old-fashioned word of vague meaning. Yet it is this word that Kandinsky seeded into twentieth-century art, and apart from any individual, it still speaks. It requires a positive response from us. (Lipsey, 1988, 7)

Kandinsky engaged with the idea of synaesthesia as a mystical way to achieve a higher, visionary state. Scientific discoveries[6] supported a mystical view of physics of the late 19th century: the idea that light waves and sound waves were both types of cosmic vibrations; that physiological sensations were affected by these vibrations and that there was a physical basis for a synaesthetic art. Synaesthesia was seen as a way of unifying the arts, especially through colour and music. Kandinsky wrote his pioneering work *Concerning the Spiritual in Art* in 1911, setting out his belief that art could induce spiritual awakening. He added his knowledge of Russian Symbolism and Theosophy to his research into his synaesthetic, multisensory responses and developed his own methodology of capturing his immediate artistic response, improvising on it and then developing his final composition.

> [C]olour is a power which directly influences the soul. Colour is the keyboard. The eye is the hammer. The soul is the piano, with its many strings. The artist is the hand that purposefully sets the soul vibrating by means of this or that key. Thus it is clear that the harmony of colours can only be based upon the principle of purposefully touching the human soul.
> Kandinsky (1977, 25)

At the Bauhaus, Kandinsky was in close contact with colleagues such as the artist Paul Klee (1879–1940), a gifted musician who realised convergences in visual art and music in his paintings and drawings, and the composer and painter Lyonel Feininger, who translated musical structures into images. However, Klee was not in sympathy with synaesthetic experiences. Instead he called on something analogous to the spiritual, being in touch with something beyond the self, in order to create art:

> What springs from this source, whatever it may be called, dream, idea or phantasy – must be taken seriously only if it unites with the proper creative means to form a work of art. Then those curiosities become realities – realities of art which help to lift life out of its mediocrity. For not only do they, to some extent, add more spirit to the seen, but they also make secret visions visible.
> (Klee & Findlay, 1966, 51)

[6] In 1807, Thomas Young published his discovery that light travels in waves. It had long been known that sound travels in waves. In 1897, J.J. Thompson discovered the electron, proof that the atom was made of smaller parts.

Other contemporaneous abstract artists, such as Robert Delaunay and Frantisek Kupa, who created works that expressed rhythm and formal structures like those used in musical composition, were also sceptical about a colour-musical analogy. Kupa describes the difference between music and the visual arts:

> Now the fact is that listening to a musical work evokes different images in everyone, an accompaniment that each draws from his own visual memory. That is, chromatism in music and musicality of colors has validity only in metaphor.
> (Kupa, cited in Brougher & Mattis, 2005, 41)

Viking Eggeling also referenced a metaphorical synaesthesia, not a literal synaesthesia. He gave instructions that his *Diagonal Symphony* (1924) would be screened mute, without music. Thomas Wilfred developed his light art as a silent form. He did not want his work to be associated with colour music, or synaesthesia, which he stated had been disproved by scientists (Wilfred, 1947). As a lumia composer, Wilfred wanted the freedom to compose his light works without being constrained by the parameters of other arts such as music (Orgeman et al., 2017). He saw emotional beauty and a radiant, spiritual quality made manifest by the light alone. He quoted Cheney Sheldon writing in 1923 about lumia in *A Primer of Modern Art*:

> Here is the beginning, or at least the first serious achievement, of an art as primitive, as complex, as capable of varied emotional beauty as music; and its medium is light – that light which was the earliest god of humankind, which to this day typifies all that is spiritual, joy-bringing and radiant. Perhaps, then, this is the beginning of the greatest, the most spiritual and radiant art of all.
> (Wilfred, 1947, 255)

However, many artists continued to search for a scientific, physical basis for synaesthetic art. The influential Dadaist Raoul Hausmann spread the idea that there was a unifying identity that applied to light and mechanical waves, based on the 19th-century theory of ether. He conceived his Optofonetik based on this concept. According to modernist scholars Anthony Enns and Shelley Trower:

> [T]he photo cell, with its capacity to transform light input into analog electrical signals, was for him the proof that there was a physical basis for a synaesthetic art.
> (Enns & Trower, 2013, 162)

Writing in 1925, the seminal innovator and art theoretician László Moholy-Nagy was convinced that supposedly scientific approaches like Hausmann's would afford new forms of art (Moholy-Nagy, 1987, 22). In the late 19th and early $20^{th}$ centuries, this physical basis for synaesthetic art seemed possible to spiritualists who understood colour and sound to be different forms of a vibration in the universe. As Bruce Elder (2010) posits, there was a cognitive crisis in modernity that give rise to untenable, spiritual, epistemological beliefs. Film and photography appeared to endow technological and therefore scientific validity to these beliefs.

The desire for unification of the senses, the interweaving of the scientific with the mystical and affordance of transcendental experiences continued to underpin visual music. This is evidenced by the work of the seminal practitioner James Whitney who made films from 1942 to1982 and was celebrated by William Moritz (1985). The works of Brakhage, the Whitneys and Belson were underpinned by their fascination with creating abstract motion that was analogous to music and the aspiration to make music and image into a seamless form, so unified that it would have a transformative effect on the viewer, bring the viewer into a pre-reflective state linked to an ideal world. 'Their films do not refer to the actual world but instead use optical effects to pluck at the musical inner mind and allow each viewer to become a synaesthete' (Brougher et al., 2005, 145).

**Conclusion**

This research does not investigate the mystical, or the spiritual or the occult. It does not propose that synaesthesia is widespread. Nor does it propose that synaesthetes share a common involuntary response. Nevertheless, the concept of metaphorical synaesthesia, an emerging mode of perception that transcends the duality of eye and ear, thereby eliciting embodied visceral affect, is fundamental to this research. Next we will turn to the experience of the sublime to discuss how it links to affect.

### 2.2.2 Turner, the sublime and affect

As Le Grice states: 'It is only though understanding the determinants of art practice and the historical continuities that the genuinely new and particular can emerge' (Le Grice, 2009, 320).' As a visual musician working with light and seeking to create embodied visceral affect, I take inspiration from J.M.W. Turner (1775–1851), 'the father of modern art' (Ruskin, 1897, 381). Moholy-Nagy made a similar connection to Turner:

> Abstract painting can be understood as an arrested, frozen phase of kinetic light display leading back to the original emotional, sensuous meaning of color of which William Turner (1775–1851), the great English painter, was an admirable predecessor.
> (Moholy-Nagy, 1947, 150)

Turner's work and his influence are enduring and form key links for this research project. In fully realising the sensation of light and movement, Turner's late work foreshadows Abstract Expressionism, Rothko's veils of colour, placing pure, intense sensuality in the foreground and obviating intellectual activity. In placing the viewer in the painting, in the colour and light, Turner foreshadows James Turrell's light works. In giving dominance to process over product, he foreshadows Paul Klee, and in giving dominance to the rhythm of his painterly process, the hand as important as eye, all in motion, he evokes animation. In addition to these key linkages, Turner is a pivotal connection to creating embodied visceral affect via the sublime.

In the mid-eighteenth century Edmund Burke's *Philosophical Enquiry* contrasted 'beauty' as aesthetically pleasing, calming, and an expression of God's kindness with the sublime caused by fear of death, brought about by the tension felt when experiencing vastness, magnificent nature and a sense of infinity. The sublime was understood to be beyond culture and beyond reasoning (Finberg, 1910). The idea of the sublime has had a long-lasting influence. Turner explored the sublime in his work and has long been associated with the romantic sublime: the mixture of awe and terror inspired by nature that paradoxically delights. In his late works, Turner concentrated on his experience of the visible world, however much it was dissolved by dazzle, mist and light. He discarded what he knew of the structure of objects and matched what he saw and felt using his painterly process. John Ruskin wrote:

> the aim to the great inventive landscape painter must be to give the far higher and deeper truth of mental vision, rather than that of the physical facts.
> (Ruskin, cited in Wilton, 1987, 222)

Figure 2. *Rough Sea* (Turner, c.1840)

Turner brings the viewer into his paintings, into his sensation of the light. In *Rough Sea* (1840) (Figure 2), he creates a viewpoint with no shoreline – the viewer does not have the safety of being on land. Turner compounds the effect by not defining the line of the horizon – leaving the viewer off-balance, moving with the sea and the light. On viewing *Rough Sea,* we experience light in motion, there is no need to search for a horizon line, or question what is sea or mist or air. The viewer's gaze is swept over and into this moment of light in tumultuous movement. *Rough Sea*, in the nature of all paintings, privileges a moment caught in time and yet its effect is absolutely dynamic: it encapsulates turbulent movement; it does not still the movement.

The French philosopher Gilles Deleuze hugely admired Turner's late work; he was drawn to its explosive power. Deleuze saw Turner as the creator of catastrophe that is part of an on-going cycle of destruction and creation. Turner was not just painting catastrophe, he created an artistic catastrophe that is both primordial, in its evocation of light, and broke with painting of his time to create new, life-affirming, visions of light and colour.

> Turner's last watercolours conquer not only all the forces of impressionism, but also the power of an explosive line without outline or contour, which makes painting itself an unparalleled catastrophe (rather than illustrating the catastrophe romantically).
> (Deleuze, Smith, & Conley, 2005, 85-6)

Deleuze posits that Turner's late works, even more than foreshadowing later art, have an ageless quality. He positions them as Turner's creative response to the tensions between reaching beyond aesthetic and technical limitations and a terminal, chaotic breakdown – a response that results in a breakthrough.

> The canvas turns in on itself, it is pierced by a hole, a lake, a flame, a tornado, an explosion. The themes of the preceding paintings are to be found again here, their meaning changed. The canvas is truly broken, sundered by what penetrates it. All that remains is a background of gold and fog, intense, intensive, traversed in depth by what has just sundered its breadth: the schiz. Everything becomes mixed and confused, and it is here that the breakthrough—not the breakdown—occurs.
> (Deleuze & Guattari, 2013, 157-8)

In his time, Turner's break with contemporary painting norms was much derided. The first curator of the Turner collection at the Tate, Andrew Wilton, quoted a review of that shows Turner's contemporaries' contempt for Turner's development of colour; *Ulysses Deriding Polyphemus* (1829) was described as:

> This is a picture in which truth, nature and feeling are sacrificed to melodramatic effect…he has reached the perfection of unnatural tawdriness. In fact it may be taken as a specimen of colouring run mad – positive vermilion – positive indigo; and all the most glaring tints of green, yellow and purple contend for mastery on the canvas, with all the vehement contrast of a kaleidoscope or a Persian carpet.
> (Wilton, 1987, 160)

Deleuze notes that Turner's breakthrough shows his art as process:

> We have seen this in the case of the painter Turner and his most accomplished paintings that are sometime termed 'incomplete': from the moment there is genius, there is something that belongs to no school, no period, something that achieves a breakthrough—art as a *process* without goal, but that attains completion as such.
> (Deleuze & Guattari, 2013, 420)

It is the process of painting, the tactile and haptic aspects of painting, that banish the optical sense of order to render a pure sensation of light and movement. Deleuze emphasises the manual aspects of painterly processes in freeing the artist from the absolute, and automatically assumed, norm of Turner's time, the figurative rendering of the world:

> And above all, they are manual traits. It is here that the painter works with a rag, stick, brush, or sponge; it is here that he throws the paint with his hands.…These almost blind manual marks attest to the intrusion of another world into the visual world of figuration. To a certain extent, they remove the painting from the optical organization that was already reigning over it and rendering it figurative in advance. The painter's hand intervenes in order to shake its own dependence and break up the sovereign optical organization: one can no longer see anything, as if in a catastrophe, a chaos.
> (Deleuze, Smith, & Conley, 2005, 82)

Deleuze uses the term 'diagram' to delve into painterly processes:

> The diagram is the operative set of asignifying and nonrepresentative lines and zones, linestrokes and color-patches. The diagram ends the preparatory work and begins the act of painting'
> (ibid., 83).

The diagram organises space sensually through line, tone and hue, rather than in an optical grid-perspective or through mimicking the direction of light in order give the illusion of three-dimensional form. Deleuze delineates different paths through nonfigurative ‘chaos’, paths that are not mutually exclusive. One path is abstraction; it has a minimal diagram. By contrast:

> A second path, often named abstract expressionism or art *informel*, offers an entirely different response, at the opposite extreme of abstraction. This time the abyss or chaos is deployed to the maximum.
> (ibid., 85)

This path is where the diagram and the final work are one and the same. Process is all. Deleuze includes Turner’s late works here – ‘an explosive line without outline or contour’ (ibid., 85), and Jackson Pollock’s work:

> [T]his line-trait and this color-patch will be pushed to their functional limit: no longer the transformation of the form but a decomposition of matter, which abandons us to its lineaments and granulations. The painting thus becomes a catastrophe-painting and a diagram-painting at one and the same time.…Action Painting, the "frenetic dance" of the painter around the painting, or rather in the painting…The diagram expresses the entire painting at once; that is, the optical catastrophe and the manual rhythm.
> (ibid., 86)

Turner also worked frenetically at his canvases

> [H]e began by pouring wet paint till it was saturated, he tore, he scratched, he scrubbed at it in a kind of frenzy and the whole thing was chaos – but gradually and as if by magic the lovely ship, with all its exquisite minutiae, came into being.
> (Wilton, 1987, 114)

Turner’s hugely energetic methods and his obsession with the sun and light led to his breakthrough, which links the sublime through an artist’s vision to embodied visceral affect. The German philosopher Immanuel Kant, in his *Critique of Judgement* of 1790, analysed what he called the feeling of the beautiful and how it arises from rationally controlled order and harmony. Then he analysed the sublime more formally than Burke, identifying scale and modes as key. He defined a vast scale, the ‘mathematical sublime’ as overwhelming because it is too big to comprehend in a single look or hearing. He stated that the human body is our standard unit of scale, as the universe is, depending on the point of view, infinitely large or infinitely small and therefore un-measurable. He defined the ‘dynamic sublime’ as relations between different modes that exist in the same thing that we cannot reconcile, giving it 'might over the mind' (Kant & Pluhar, 1987, 269). Therefore, our experience of nature or art can lead to us being overwhelmed by our experience. Both the mathematical and the dynamical sublime overwhelm us, and for Kant it is only by reason that we can reconcile them, after the event. This is similar to recognising a pre-reflective, embodied state.

Arguably, Turner would have agreed with Deleuze's development of Kant's concept of the sublime when Deleuze wrote of film:

> [T]he whole could become organic whole, dialectical totalisation, measureless totality of the mathematical sublime, intensive totality of the dynamic sublime.
> (Deleuze, 2005a, 57)

Deleuze's 'organic whole' is the pool of possibilities for different embodied affects and his 'dialectical totalisation' is a linking together of the whole. Thus, Turner's 'breakthrough' elicits embodied visceral affect via the sublime. When Turner 'broke' the canvas with light and rhythm he became the creator of a new form of expression and a progenitor of visual music (although the term did not exist in his time). Incorporating Turner into the visual music canon allows us to bring in new affective possibilities of expression today.

## 2.2.3 Embodiment, phenomenology and affect

Turner's *Rough Sea* has been described as creating affective experiences. But how can a viewer be affected by an image? Embodiment is key to being affected by an image. Embodiment, as proposed by the French phenomenological philosopher Maurice Merleau-Ponty, posits that there is no difference between perception and experience: we experience the things that we perceive; it is direct. We don't receive information and then process it. This undermines the distinction between the subject and the object (Merleau-Ponty, 2014). This is the opposite of the dualist, rationalist view of the mind being separate from the body as proposed by the French philosopher René Descartes. Merleau-Ponty's theory of embodied existence undermines the distinction between the subject and the object, as the body exists as both subject and object. He always starts from the body; we perceive from within our bodies, the body is the agent of perception and the body is within the world.

Merleau-Ponty defines three levels of embodiment. The first is physically sensing, sensing being in an environment: 'The body is the vehicle of being in the world' (ibid., 84). The second level is habit or skill, 'every habit is simultaneously motor and perceptual because it resides, as we have said, between explicit perception and actual movement' (ibid., 153). The third level is associating cultural skills with the body. Skills are not stored as mental representations but as the know-how to respond to the world. 'Consciousness is originally not a "I think that" but rather an "I can"' (ibid., 172). The body is alive; it changes and is changed by the world. 'It [the body] is a knot of living significations and not the law for a certain number of covariant terms' (ibid., 153).

The 'body schema' is a pre-conscious framework that allows the phenomenal body to experience sensations such as touch, physically position itself in the world and gives it a kinaesthetic sense of its own movement. The body schema includes 'situational spatiality' that allows orientation towards tasks (ibid., 100-103). The ability of the phenomenal body to respond to the current situation is defined as the 'intentional arc'. Merleau-Ponty writes:

> [P]erceptual life is underpinned by an 'intentional arc' that projects round about us our past, our future, our human milieu, our physical situation, our ideological situation, and our moral situation, or rather, that ensures that we are situated within all of these relationships. This intentional arc creates the unity of the senses, the unity of the senses with intelligence, and the unity of sensitivity and motricity. (ibid., 137).

The phenomenal body uses its skills and intentional arc with the aim of creating an optimal relationship to the current situation. The phenomenal body does not need to form an explicit goal to make a purposeful response to a situation, as its tendency is to continuously refine its responses to the world.

Acquired skills allow more fine-honed responses and orientation in the world and future skills acquisition, all of which enhance the intentional arc. The phenomenal body imagines different possibilities and perspectives through its aspect of the ‘virtual body’, which is ‘an imaginative ability to consider alternative uses of the body and to assume different perspectives from which to observe a situation’ (Steeves, 2004, 22). The negotiation between the imaginings of virtual body and habitual skills endow embodied existence with the possibility of creativity and aesthetic experiences.

.

> The phenomenal body involves a dialectic between habitual behavior and what Merleau-Ponty calls the virtual body, the ability to imagine alternative perspectives and modes of embodiment and to use that ability to develop habits into symbolic activity. The to and fro movement between acquired and creative modes of embodiment underlies both ordinary perception and aesthetic activity, instilling in the heart of embodied existence an element of creativity and imagination. (Steeves & DePaul University, 2001, 370)

Therefore, when looking at images, the virtual body can imaginatively enter into the image. When viewing *Rough Sea,* one can imaginatively embody the physicality of being at sea, being thrown around in the tumult of the waves, being in the damp mist, the salt air and the bright sunlight; all the senses can be called on by the virtual body. The intentional arc applied to this virtual-body experience can summon every relationship that could situate us in our embodied imaginings. When viewing *Rough Sea,* these could include: past memories of the sea, future hopes and fears of being at sea, or our ideological relation to the sublime. It is possible to ‘fall’ into a painting, i.e. the virtual body does not need to be explicitly told to imagine being in the painting. Once this ability to project has been acquired, it will be used if it tends towards an optimal relationship to the current situation. The phenomenal body directly experiences art.

Deleuze’s concept is different from Merleau-Ponty’s. Deleuze is similar to Spinoza for whom there is also something unfolding, unfolding simultaneously on two levels, but it is always the same kind of substance; it has a physical aspect and an aspect that is thought, and these are parallel. The percept is the object outside the subject, and affect is the relational – that which affects the subject. Deleuze wants to go beyond the edges of the body and talk of a dissolving of subject/object, which become reversable parts of one thing. In other words, I and the thing I am experiencing intermingle:

> The being of sensation, the bloc of percept and affect, will appear as the unity or reversibility of feeling and felt, their intimate intermingling like hands clasped together.
> (Deleuze & Guattari, 1994, 178)

The embodied visceral affect of art is distinct from emotions and feelings aroused by art. In this research, affect is considered to be pre-reflective rather than pre-personal, as unconscious and neurological responses are personal to individuals. The body responds with an analogue of the intensity of the affect, in 'the facial muscles, the viscera, the respiratory system, the skeleton, autonomic blood flow changes, and vocalisations' (Tomkins & Demos, 1995, 19).

Whereas affects are non-verbal, emotions are 'complex, constructed experiences' (Eerola et al., 2017, 3). As Shouse (2005) identifies, emotions are socially displayed feelings. Feelings are personal because each individual has a distinctive pool of memories of sensations to draw on when interpreting and naming their feelings.

> The power of affect lies in the fact that it is unformed and unstructured (abstract). It is affect's 'abstractivity' that makes it transmittable in ways that feelings and emotions are not, and it is because affect is transmittable that it is potentially such a powerful social force.
> (Shouse, 2005, 3)

Affect is transmitted by primitive 'emotional contagion', defined by Hatfield et al. as an automatic mimicry of the facial expressions, vocalisations, postures, and movements of another causing similar emotions to arise (Hatfield et al., 1994, 5). Primitive emotional contagion is performed unconsciously, at incredible speed and ubiquitously.

**Conclusion**
Embodied experience and the phenomenal body are concepts that frame affect as seen from a philosophical standpoint. Embodied experience and the phenomenal body explain how images can affect viewers. Deleuze goes beyond Merleau-Ponty in dissolving the subject/object. Affect is pre-reflective, unlike feelings, which draw on memories and emotions, which are feelings that are socially displayed. The social power of affect is that it can be passed on by primitive emotional contagion.

## 2.2.4 Light as an affective artform

Metaphorical synaesthesia (Section 2.2.1) and the sublime (Section 2.2.2) elicit embodied visceral affect. Now we will discuss how light as an artform is affective. The perceptual psychologist and visual theorist Rudolf Arnheim writes of the powerful and fundamental experience of light:

> Light is one of the revealing elements of life. To man, as all diurnal animals, it is the condition for most activities… It is the most spectacular experience of the senses, an apparition properly celebrated, worshiped, and implored in early religious ceremonies. But as its power over the practice of daily living become sufficiently familiar, it is threatened with falling into oblivion. It remains for the artist and the occasional poetical moods of the common man to preserve the access to the wisdom that can be gained from the contemplation of light.
> (Arnheim, 1974, 292)

Artists have long been fascinated by light, a medium that has no gravity and no solidity, a medium of immateriality. This section will focus on examining light-based artworks, which enable the beholder to experience light, to contemplate light, and to suspend interpretation in favour of an extra-verbal, embodied experience. We examine works from several seminal artists including: László Moholy-Nagy, Thomas Wilfred, Anthony McCall and United Visual Artists. Later artists were aware of and influenced by earlier works and so there is a loose lineage in this art of light: from the painting of light by

Turner, through the sculpting of light based on abstract painting, to photograms, projected light experiments and solid light works.

Photograms are created working directly with light, without a camera. They give the beholder a different experience of objects as translucent capturers of light; the unexpectedness of the images causes the beholder to look afresh, which is an embodying experience. The process is analogous to collage, but created with light. Three-dimensional objects are placed onto, or held above, a light sensitive surface, which is then exposed to light and developed. The objects block the light creating white shadows on a black ground. Variations in the opacity of the objects result in variations of tone: completely opaque objects create white shapes, while semi-transparent objects create grey shapes. Photograms are created with an element of chance, as the end result cannot be previewed. In the photogram, the fundamental element is the reaction of the photosensitive layer to light.

> The main instrument of the photographic process is not the camera but the photosensitive layer; the specific rules and methods of photography accord with how the layer responds to lighting effects produced by different materials according to their light or dark, smooth, or rough characteristics.
> (Moholy-Nagy quoted in Respini et al., 2016, 14)

The response of the photosensitive layer to light through the objects unveils a new sense of depth that is non-perspectival. The ambiguities of photograms allow the beholder to complete the image.

The new objectivity painter Christian Schad pioneered using the photogram for non-scientific use. He collected ‘things left lying around in the street, in shop windows, cafés, bins [that he selected] because of the patina and magic they contained and gave off’ (Schad quoted in Hugnet et al., 2013, 309–310). His methodology was to rely on chance combined with his artistic impulse to find objects that for him contained magic. He created poetic juxtapositions of textures and multi-layered depth, from which it is impossible to unpick the original elements – creating a new, mysterious, whole (Figure 3). Schad’s photograms demonstrate that photography was not just recording but also producing art. His photograms of found objects epitomise the importance of the artist as finder, as collector and as a creator, evoking the transcendental through glowing light.

Figure 3. *Amourette* (Schad, 1918)

In contrast to Schad, Man Ray used photograms to show not special objects but new views of everyday objects. Man Ray saw the darkroom as the centre of creation. Just as Turner ‘broke’ the canvas, Man Ray’s process ‘broke’ the known material qualities of everyday objects, showing them afresh. He called his photograms ‘rayographs’. In *Rayograph* (1922) (Figure 4), a comb is central, prominent, backlit by the oval it vertically dissects.

Figure 4. *Rayograph* (Ray, 1922)

The comb is a familiar object but appears afresh, in black and white – but not a photograph, not an x-ray, not a graphic, nor a drawn silhouette, nor a collage. Man Ray 'breaks' the perspective present in a photograph of an object because he does not show these objects reflecting light in a realistic photographic way. Further, he 'breaks' the understanding of perspective through depth cues, especially overlap, as the overlapping shapes blend into the white or black space and become subsumed. The base of the comb completely disappears into the black; it becomes two-dimensional at its base. Man Ray leaves the beholder slipping between two and three dimensions, between silhouette and textural depth, between foreground and background, between negative and positive spaces. Extended viewing allows more layers to be traced around and more nuance of depth to become apparent, but the whole remains enigmatic. Man Ray's 'rayograph' process also creates ambivalence around time, the caught and privileged moment, through motion: the fine white lines are static but the blurred elements contain traces of movement and suggest animation, life.

**From photogram to film**

At the Bauhaus Moholy-Nagy took a painterly approach and extended concepts he had explored in his constructivist paintings in his photograms. Crucially, in his camera-less compositions, his photograms, he could render light-based images directly for the eye without any of the distortions caused by a camera lens. His compositions in light can be seen directly without being mediated by a camera.

> [O]ur intellectual experience complements spatially and formally the optical phenomena perceived by the eye and renders them into a comprehensible whole, whereas the photographic apparatus reproduces the purely optical picture (distortion, bad drawing, foreshortening).
> (Moholy-Nagy, 1923, 284)

Moholy-Nagy used geometric shapes, similar to those in his constructivist paintings, composing images from rectangles and circles cut from paper or card. He placed these on the light-sensitive surface, creating distinct planes and a sense of depth (Figure 5).

Figure 5. *Untitled* (Moholy-Nagy, 1925)

He saw new, creative possibilities in working with light and valued the apparent direct translation from objects to images that the process allowed:

> I call this shaping of a newly mastered material, light, which contains strong creative power, a photogram… Photograms must be created from their own means; their composition makes nothing appear and means nothing other than themselves.
> (Moholy-Nagy quoted in Baker et al., 2018, 19)

Moholy-Nagy made the progression from painting to photogram, to light sculpture and light projected in space, to ideas that foreshadow Gene Youngblood's 'expanded cinema' that is cinema as an artform for an expanded consciousness in which the artist is an ecologist who designs environments. Moholy-Nagy extended the effects of the still photogram – the movement caught-in-motion as blur, the nuanced build of layers – by adding concepts of time, space and movement into the display. In 1922, he started to develop an apparatus created with innovative optics, which eventually became his Light–Space Modulator, in order to control his compositions in light (Figure 6).

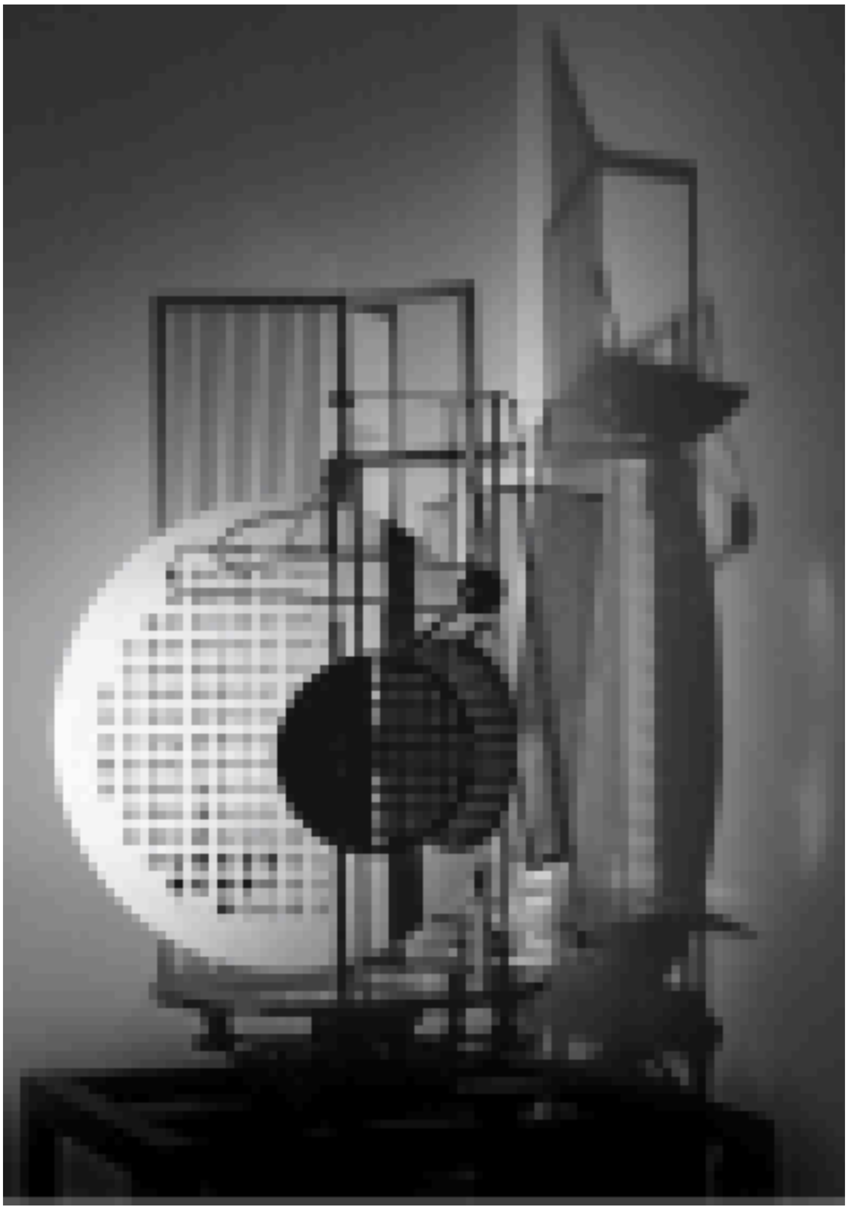


Figure 6. *Light–Space Modulator* (Moholy-Nagy, 1922)

> Light would be controlled as a new plastic medium just as colour and tone in music…The possibilities of this medium of expression become greater as we proceed from static representation to the motion-pictures of the cinematograph… I have attempted to *control* its action by means of lenses and mirrors, by light passed through fluids like water, oil, acid, and crystal, metal, glass, tissue, etc. This means that the filtered, reflected or refracted light is directed upon a screen and then photographed.
> (Moholy-Nagy, 1923, 284)

The Light–Space Modulator was a kinetic sculpture with pierced metal, glass, light and reflected light, which creates an awareness of surface and depth.

Moholo-Nagy sought to expand the flat projection screen by projecting on to walls surrounding the Light–Space Modulator. He synthesised many of his earlier experiments with light movement and structure in his film *Lightplay: Black White Grey* and there is a distinct similarity between the projected shadows and the abstract films of this time. Indeed, he stated: 'Since these light effects almost always show themselves in motion, it is clear that the process reaches its highest development in the film' (Moholy-Nagy, 1923, 284).

Moholo-Nagy imagined displaying his work beyond the rectangular projection screen:

> A cinema should be built equipped for different experimental purposes… a landscape of mountains and valleys… a projection screen in the shape of a segment of a sphere.
> (Moholy-Nagy, 1987, 41)

He envisioned playing two or three films at once on a screen, with continually moving projections to show parallel action: 'I became interested in painting with light not only on to canvas but directly on to space… films could be the purest form of human expression' (Moholy-Nagy quoted in Halas, 1990, film). This echoes the work of Moholo-Nagy's contemporary Thomas Wilfred, and foreshadows light-based-art installation.

Other artists also turned to light; the desire to use light as an artistic medium was prevalent at this time. At the Bauhaus, besides Laszlo Moholy-Nagy, artists including Kurt Schwerdtfeger, Josef Hartwig and Ludwig Hirschfeld-Mack were using light as their medium. They innovated and produced moving-image experiments and different types of installation. Hirschfeld-Mack's *Reflecting Colour Instrument* resembled a colour-organ and radiated light. Kurt Schwerdtfeger and Josef Hartwig created moving colour-compositions using a manually operated apparatus, which lit cardboard shapes so that they threw shadow patterns onto a transparent projection surface. They discovered an optical effect created through dual warm and cold shadows. They premiered *Reflecting Light Games* (Figure 7) to

Kandinsky in 1922, and this was integrated into the Bauhaus stage (Hoormann, 2003).

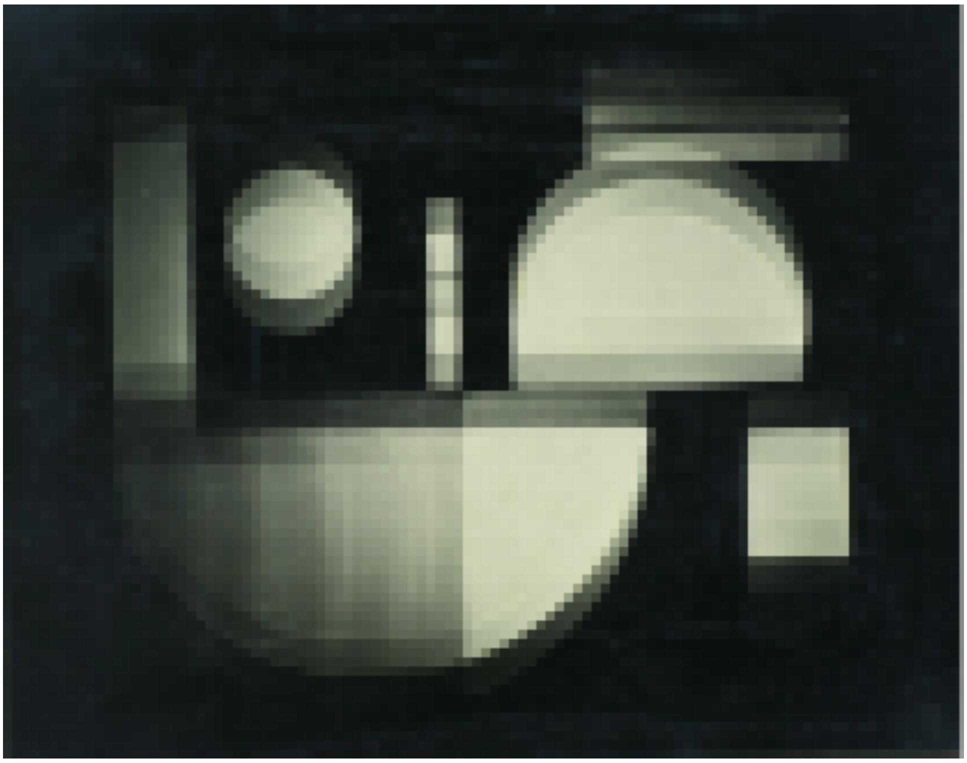


Figure 7. *Reflecting Light Games* (Schwerdtfeger, 1922)

At the same time, seminal light artist Thomas Wilfred was sculpting light and creating beautiful abstract images, which he named lumia. He influenced modernist innovators, such as Moholy-Nagy (who acknowledged Wilfred's work) and visual musicians such as Fischinger, Brakhage, the Whitneys and Belson. His work continues to exert an influence on artists, such as James Turrell, today.

**Light Itself**

Wilfred's compositions have a mesmeric flowing character, akin to aurora borealis; the undulating, vibrant, sculptural light shapes evolve out of the darkness and into each other (Figure 8). His work started in darkness, and ended in darkness, in an analogous way to music starting and ending in silence. His larger screens had black at the edge so that they could meld with the darkness in the auditorium. The ethereal performances seemed to come alive within the larger dark space of the auditorium:

> These colors, these forms, utterly unconnected with anything we have known heretofore… set the imagination free and they are by turn amusing, exciting and menacing, with flashes of quite unearthly beauty. (Deems Taylor quoted in Orgeman et al., 2017, 78)

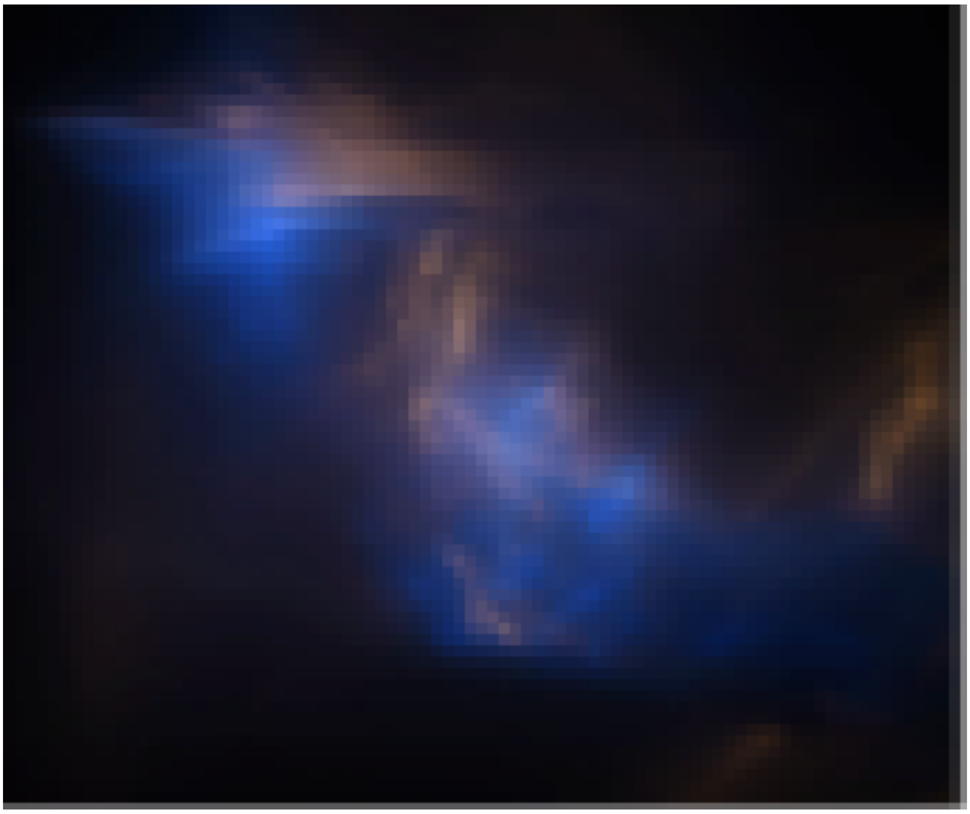


Figure 8. *Lumia Opus 140* (Wilfred, 1948)

Like many other seminal figures in visual music, Wilfred was a pioneering innovator and inventor as well as an artist.

> To master light in this way is unique. You can't form light as with clay or wax. You can't carve it as with wood or stone. You can't piece it together or weld it. You have to make the instrument that produces it. Something akin to dreaming up a symphony and then having to create the instruments to produce the sound.
> (James Turrell in Orgeman et al., 2017, 18)

Wilfred created lumia performances starting from the premise of light as an art-medium.

> Aesthetic concept: The use of light as an independent art-medium through the silent visual treatment of form, color and motion in dark space with the object of conveying an aesthetic experience to a spectator. Physical basis: the composition, recording and performance of a silent visual sequence in form, color and motion, projected on a flat

white screen by means of a light-generation instrument controlled from a keyboard.
(Wilfred, 1947, 252)

As his lumia diagram (Figure 9) shows, in Wilfred's work there is no narrative; he created a visual structure.

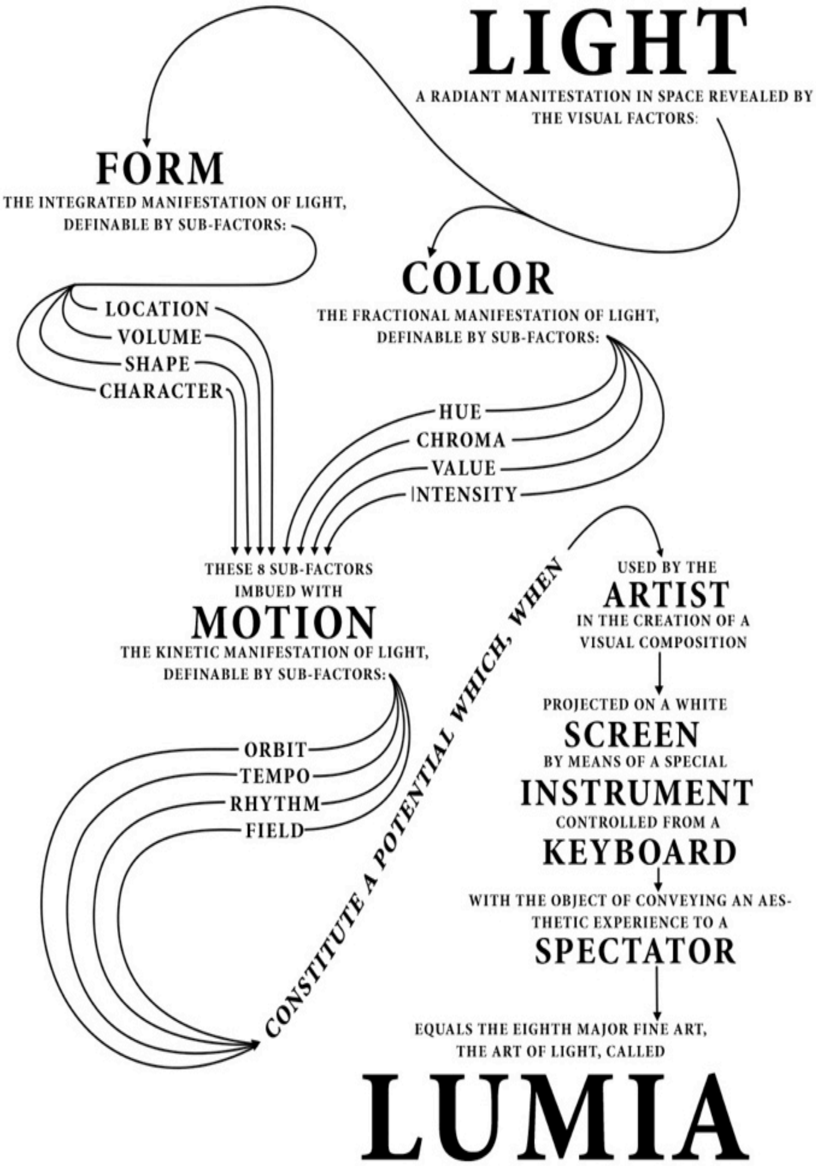



Figure 9. *Lumia Diagram* (Wilfred, 1940) (redrawn based on Orgeman et al 2017, 40)

He achieved this through creating forms, adding colour and, lastly, adjusting the intensity of the light, in a manner analogous to a crescendo, to mark out specific passages of colour changes for special attention. He identified form and motion as absolutely key, even more so than colour, when he set out the parameters for his instrument: ‘Form, color and motion are the three basic factors in lumia – as in all visual experience – and form and motion are the two most important’ (Wilfred 1947, 252). Wilfred’s vocabulary – his framework – was influenced by a painter of projected light, Van Dearing Perrine, who used the term ‘lumia’ to define his mode of painting.

> Perrine had from the beginning rejected all musical analogy theories and experimented with light as an independent aesthetic medium. He built several instruments based on the silent use of form, color and motion, and was one of the first important pioneers in lumia (Wilfred 1947, 250)

Wilfred’s factors – form and colour and their sub-factors – are elements within painting (see Figure 9).

He created a device (the Clavilux, described below) to allow these abstract, painterly elements to be realised as three-dimensional with both forms and colours in motion: ‘The lumia artist conceives his idea as a three-dimensional drama unfolding in infinite space’ (Wilfred 1947, 252). New lumia artist Trent Kim considers that, although Wilfred built an instrument that projected light, he theorised about image, not light: ‘[Wilfred’s] lack of distinction between image and light has ended up sacrificing light for fulfilling his artistic interest in abstract painting by light in motion’ (Kim, 2018, presentation).However, the way in which colours and tones dynamically change and evolve differentiates Wilfred’s lumia from static abstract painting. The three-dimensional sculptural quality of lumia also differentiates Wilfred’s lumia from film. Wilfred’s lumia appears to generate forms, it evokes caustic effects in nature; it has the organic feel of the play of sunlight on water. James Turrell, the light artist, writes that Wilfred’s work: ‘maximises direct perception, develops over time, is performed or performs itself’ (Orgeman et al., 2017, 19).

Wilfred created his ethereal lumia on his invention, a Clavilux, which was analogue and mechanical; he controlled the form, colour and motion of light through the Clavilux’s keys. The architecture of the Clavilux was designed so that light bulbs projected white light through translucent glass, some plain and some coloured, which, combined with reflective surfaces and created polymorphous 3D forms and caustic effects. The movement of the lights, glass and reflectors created a rhythmic motion. He added intensity to the lumia by increasing the wattage on the bulb. Wilfred is a key link to pre-cinema cinematic work, with:

> ties to the populist work in the large exposition of the nineteenth and early twentieth centuries – dioramas, panoramas, and camera obscuras were all installation works, like the Clavilux… a work that speaks to the long tradition of direct perception through the use of light in art.
> (Orgeman et al., 2017, 19)

In 1933, he likened the experience of his lumia to an incredible experience – a voyage in space amongst radiant lumia – and simultaneously to the very familiar experience of sunlight on skin (Kim, 2018). Light is central to Wilfred's work. He stated that seeing and being affected by fleeting lighting effects in nature primed his audience for 'the eighth art', lumia. He described light as 'the greatest symbol of conscious mankind's longing for understanding and liberation' (Wilfred quoted in Orgeman et al., 2017, 27). Wilfred approached light and lumia with an awareness of the human longing for light to create transcendental experiences: 'a cosmic consciousness, a balance between the human entity and the great common denominator, the universal rhythmic flow?' (Wilfred quoted in Youngblood, 1970, 345).

Wilfred's influence is notable for its longevity and profundity. His lumia create enduring links to the sublime. The example of his lumia helps to expand on the concept of visual music, which, displayed as light-based artworks, could elicit embodied visceral affect.

**Projected White Light**

Anthony McCall's non-filmic cinema,[7] is conceptual and performance-based. He makes 'solid light films' that exist only when they are projected through

---

[7] This is 'paracinema' in the avant-garde film-maker Ken Jacobs' term, meaning an experimental film that discards one or many of the material aspects of film as a medium, such as camera or screen.

haze. They are cinematic and sculptural (see Key Terms). Like photograms, these films are not created with a camera but nevertheless reveal the play of light. Just as Wilfred sought to sculpt light, these films reject two-dimensionality. Like Wilfred's performances and light-projection performances at the Bauhaus, these films also require the viewer to be present (Figures 10 and 11). From McCall's 1974 artist's statement for *Line Describing a Cone*:

> The film exists only in the present: the moment of projection. It refers to nothing beyond this real time. It contains no illusion. It is a primary experience, not secondary, i.e. the space is real, not referential; the time is real, not referential.
> (McCall, 2003, 42)

He experiments with process, the materials involved in film-making and presenting films, time, space, audience involvement.

Figure 10. *Long Film for Four Projectors* (1974) (still from McCall, 2014)

Figure 11. Diagram of *Long Film for Four Projectors* (1974) (still from McCall, 2014)

In *Line Describing a Cone*, a dot of light traces an outline of a circle over 30 minutes (Figure 12). Simultaneously a volumetric cone starts to develop in three-dimensional space. The viewer experiences continuous change (Figure 13).

Figure 12. *Line Describing a Cone* (1973) (still A from McCall, 2014)

Figure 13. *Line Describing a Cone* (1973) (still B from McCall, 2014)


Figure 14. *Line Describing a Cone* (1973) (still C from McCall, 2014)

The viewer is in a large dark void with the white light. The environment is austere. This space is real and the light looks like a slowly, ever-evolving, three-dimensional sculpture. The viewer becomes a participant; they can journey into and around and intersect with the conical light form (Figure 14). *Line Describing a Cone* is both cinematic and sculptural. Viewers need to move through the space to see the light from different positions, as one would a sculpture. The ‘solid light’ effect is surprising at the level of embodiment as well as vision: light is usually immaterial but here is has become sculptural. Viewers have to share the space with each other, so they can all see the solid light form; this creates a kind of participatory performance. It also means that each performance is unrepeatable and that each viewer experiences a truly unique journey – in, around and through the solid light.

McCall uses a cinematic device, a wipe, in order to generate fluid evolutions of form, integrating a changing wave shape with a moving ellipse, to give the participant a sense that the light is a living form (Figures 15 and 16). At the same time, he distances his work from cinema in two ways. First, he expanded the duration to a minimum cycle time of five-and-a-half hours, in order to encourage participants to come and go, rather than to witness a performance; each viewer experiences their own version of his film and is an ‘individual spectator’. Second, he created vertical forms that evoke more sculptural reference points, as sculpture is associated with the architectural and the vertical, whereas cinema is associated with the horizontal.

Figure 15. Moving white line formed from two animating shapes wiped together to create *Breath III* (2005) (still from McCall, 2014)

Figure 16. *Breath III* (2005) (still from McCall, 2014)

United Visual Artists created a ‘spatial instrument’ called Momentum for the Barbican Centre’s Curve gallery. Twelve pendulum-like objects were hung in the space; each had its own sound and projected white light. The spatial instrument was specifically designed for the Curve, to project light using all the surfaces. The dark spaces between the lights were as important as the lit areas. It was programmed as a whole, partly like a natural pendulum and partly unnaturally. Visitors shaped their own unique experiences as they moved freely through the gallery piece. As Matt Clark from United Visual Artists explained, the focus of interest was in creating a tension between the synthesised and the natural:

> You’ve got no option but to be in the work, so I can imagine the emotions ranging from [Matt mimics surprise and pulls back] ‘quite strange’ to meditative. There is a hypnotic nature to the work. Momentum is an installation we have designed to mess with your perception of both time and physical space.
> (Clark, 2014, video file)

I visited the work. The size of the exhibit, with 6-metre-high walls and 90 metres around the curve, was highly impressive; its ‘bigness’ (Griffiths, 2008, 9) alluded to the sublime. The experience was enhanced by the number of visitors at any one time being limited, giving one enough space to be confident of moving around without bumping into others. The freedom to move back and forth around the exhibit was excellent for mapping out one’s own experience within the unknown territory, where the lights went on and off, seemingly at random. I found the lighting and large pools of complete darkness more affecting and memorable than the acousmatic music that oscillated between gentle shimmering tones – almost overtones – and a noisier sound like a helicopter. Visitors augmented the planned lighting effects by photographing each other using flashlight, and using smartphones that suddenly beamed a spotlight, until an assistant asked the visitor to turn it off. If one traversed the space alone, it could have been, to use Clark’s terms, ‘strange’, and ‘meditative’, and certainly aspects felt otherworldly. However, in practice, for me, the experience swung between being immersive and a social experiment observing others’ behaviours.

**Conclusion**
All of these artists turned to light itself as a creative medium – a medium that could evoke transcendent, extra-verbal, embodied experiences beyond the duality of eye and ear. This is demonstrated in: Schad's photograms of chosen objects; Man Ray's 'rayographs' – collages of light mediated by everyday objects; Moholy-Nagy's journey through painting, to the photogram, to light sculpture and light projected in space, to ideas for an expanded cinema; and Wilfred's lumia. Their influence continues to inspire artists. Although they are all using light in different ways, they are all moving towards creating affective experiences – towards suspending interpretation in favour of an extra-verbal, embodied experience. Whereas the processes and displays are very different, they all enable spectators to surrender to the beauty of light, and to be utterly in the present moment. However, there is a difference of degree; although the light caught in photograms can be affective, and I find them affective, the works which allow the visitor to step inside, such as McCall's works and United Visual Artists' *Momentum*, are also immersive and one is aware of becoming more than a spectator; one is aware of participating in the work.

## 2.2.5 From new vision to found abstraction

After the First World War, artists, through selection, aspired to re-present the world, to create a 'new vision', this led to 'found abstraction', i.e. excluding the context of images and thereby emphasising rhythm, pattern and texture. This section examines new vision and found abstraction alongside the tension between abstraction and mimesis and art as expressive and embodied visceral affect rather than as mimesis.

'Representation', or mimesis is a fundamental concept in art that has been theorised about since Plato. Plato asserted that artists are doubly removed from the true original creation, as what the artist perceives is an imitation of universal ideal types, like shadows and reflections in a mirror, so they represent imitations of imitations, shadows of shadows. Plato was concerned with the ethics of mimesis and concluded that, by re-presenting appearances, the works of art cannot provide a truth, or insight into truth as the philosopher Alexander Nehemas explains (Moravcsik & Temko, 1982). Aristotle disagreed with Plato's theory of universal ideal types, arguing that universal ideal types are intrinsic to objects. He argued that all humans learn through and find pleasure in imitation and that all art is mimetic. In his use of the term, mimetic means representing the individual object, not a shadow of the universal ideal of that object (Gebauer & Wulf, 1995). Aristotle argued that artists actively create matter and form. By using an organic process like nature, artists originate art, synthesising their experience of the object, what they know and feel about the object, the universal and the particular. Therefore, an artist's mimesis of an object can synthesise aesthetic and universal truth (Melberg, 1995).

Can Aristotle's theory be expanded to include the case of artistic vision but no evident mimesis of an object? The tension between mimesis and the artist's vision is thousands of years old and continues today.[8] Progenitors of abstract art were seen as early as during the 1860s. As Philip Gilbert Hamerton wrote in *Imagination in Landscape Painting* (1896), the extreme classicists of Paris were painting what:

> [T]hey hold to be the visible melodies and harmonies – a kind of visible music – meaning as much and narrating as much as the music which is heard in the ears and nothing whatever more… artistic abstraction, seeing the outer world merely as a vision of shapes.
> (Hamerton quoted in Gombrich, 1965, 147)

At this time, Turner experimented in this type of artistic vision, entering a state of mind that:

> [M]ay perceive the most unsuspected relations between colour and form in landscape, and even in accidental combinations of mere pigments, as when Turner got three children to dabble water-colours together till he suddenly stopped them at the propitious moment. These

[8] There is literature spanning 3,000 years on mimesis and the nature of the real, which underpins art theory and which lies beyond the scope of this thesis.

> researches… are certainly not a desertion of art, for there may be a colour music without meaning, invented by the imagination, exactly as there is a sound music without meaning, or, at least, of which the meaning could not possibly be expressed in any other language but its own.
> (Hamerton quoted in Gombrich, 1965, 147)

Composers of visual music have long sought to create meaning that 'could not possibly be expressed in any other language but its own'. Later in this thesis we will examine the pioneers of visual music, Richter and Eggeling, Avraamov with his Graphical Sound, Michaux with his gestural painting, all of whom, aimed to create a universal language. Creating a new language in my work is explored in depth in Chapter 3. This speaks to the dichotomy explored in this thesis between approaching visual music as conceptual links between image and sound versus taking a phenomenological approach to visual music.

**New Vision**

Contemporaneously with Schad choosing objects and Man Ray creating a new way of seeing everyday objects in his 'rayographs', a key historical moment occurred in the development of the visual artist as a sensitive, selecting eye. In the late 1920s, Czech literary critic Frantisek Xavier Salda stated, 'After great catastrophes, in some sense one always starts over from the alphabet' (Salda quoted in Witkovsky et al., 2016, 25). 'Starting over from the alphabet' was a catchphrase of the time in Europe and expressed the recognition of the need for cultural reflection in the aftermath of the First World War. The need for a new vision was strongly felt. Photography itself was influential in shaping this new vision. In the 1920s, photography was the medium of modernity; it allowed fresh perspectives on the world and encouraged looking at the world anew, challenging old viewing habits and compositions.

The new handheld cameras allowed photographers more freedom to dramatise the new skyscrapers, factories and neon signs using new points of view, such as low angles or aerial shots. They captured perspectives that flattened space; they emphasised light and shadow, shape and tonal contrast. By distorting reality through the camera's lens, they engaged the viewer's interest in the everyday urban landscape. Rodchenko was an advocate of 'new objectivity' in photography, i.e. of capturing unexpected views and patterns with a camera.

> Painters conventionally rendered trees 'from the navel' for hundreds of years, and photographers followed them. If I photograph a tree from the bottom up like an industrial object, a chimney, it is a revolution in the eyes of conformists and old lovers of landscape.
> (Rodchenko quoted in Baker et al., 2018, 17)

Moholy-Nagy, Man Ray and Rodchenko were painters who turned to photography, which was already being promoted as fine art. In New York, from 1905 to 1917, Alfred Stieglitz and Edward Steichen's innovative gallery, '291' displayed photographs, sculptures and paintings at the forefront of modern art, including Picasso's cubist paintings. Photographers were inspired to produce more abstract work. Arguably, abstract photography can be defined as images such as photograms created solely from light and photo-sensitive paper or plates, also as images from the world that have been 'abstracted' from the original image by removing the context and revealing formal artistic elements such as pattern and rhythm or images of intangible things such as feelings.

**Found Abstraction**

A new mode of being an artist was made visible through new objectivity in photography. By taking un-posed and un-retouched images, the photographer could demonstrate their own selectivity and sensitivity to the world – and how they lived in the moment, ready to exploit chance. The photographer Paul Strand's work epitomises the new objectivity and 'found abstraction'. He selected everyday subjects and presented them with a new vision, allowing the beholder to see the everyday afresh. He photographed close-ups or high angles of objects, framing-up close in, excluding their context and thereby abstracting them. He worked in black and white, further distancing his photographs from the objects and emphasising expressive forms. *Porch*

*Shadows* (1916) (Figure 17) is typical of his dynamic rhythmic composition; the strong diagonals lead the eye into the image, while the curve acts as a delicate counterpoint, for the eye to trace around. The composition is both bold and nuanced. There is a tension between the strong tonal contrasts flattening the image and the draping shadows describing the three-dimensional forms. Where others might have seen an everyday scene or a random view, Strand has created patterns of light and dark; he has created order, created 'found abstraction' from light and shadows. He privileges rhythm and pattern over depicting a subject for a beholder to see and name.

Figure 17. *Porch Shadows* (Strand, 1916)

Alfred Stieglitz went further than found abstraction in *Songs of the Sky* (1923–25) and *Equivalents* (1925–29), series of photographs of clouds. He encapsulated and expressed his feelings through his photographs; they made his inner feelings visible (Sontag, 2008). In 1923, Stieglitz stated:

> I know I have done something that has never been done. Maybe an approach occasionally found in music. I also know that there is more of the really abstract in some 'representation' than in most of the dead representation of the so-called abstraction so fashionable now. (Stieglitz quoted in Sontag, 2008, 110)

His cloud studies are series of photographs of clouds that do not include a horizon line or land, the clouds are unbounded; they form their own space. The abstracting effect of looking directly up at thick, wavy ridges of cloud pierced by the sun is caught in his photograph *Equivalent* of 1929 (Figure 18).

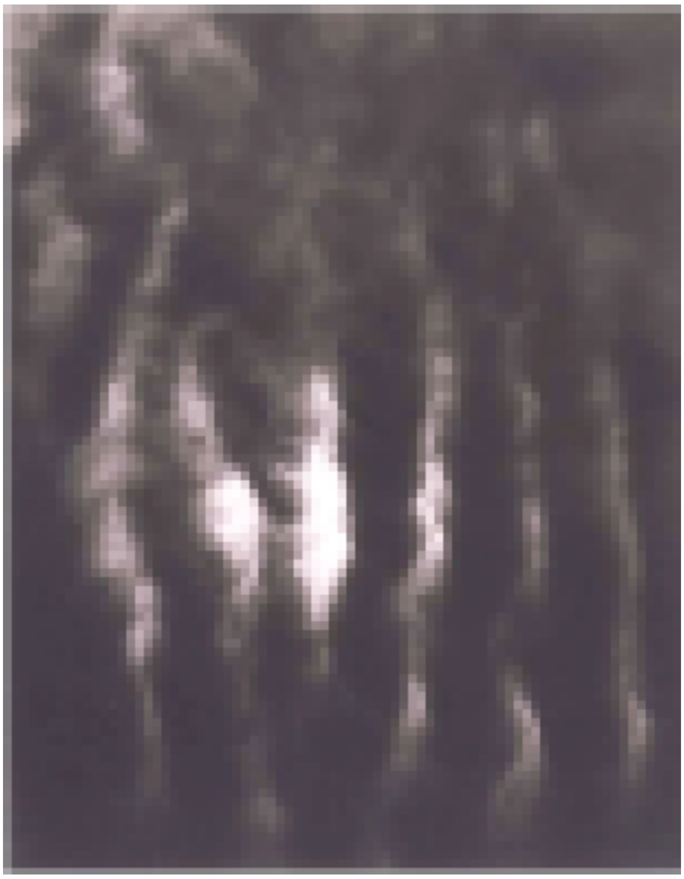


Figure 18. *Equivalent* (Stieglitz, 1929)

Just as in Turner's *Rough Sea* (Figure 2), there is no horizon line to balance the viewer. In *Porch Shadows* (Figure 17), the view is off-kilter; in *Equivalent*, the sky floods over, boundless. There is nowhere to go but into the image. Rhythm, pattern and texture are illuminated, evoking an emotional resonance, which is analogous to music.

As found abstraction demonstrates, there is no clear line between the 'real' and the 'abstract'. The degree of realism and abstraction can be said to lie with the observer rather than the observed. The composer John Young wrote of music – and this also applies to images:

> 'Reality' and 'abstraction' are notional absolutes, which may appear to the listener to be in constant flux and with distinctions is not always clear-cut... the range of ambiguous states between these two polarities form a continuum, within which there are not necessarily fixed or absolute increments.
> (Young, 1996, 83-84)

Footage-as-data is a mode of gathering material so that the visual can be abstracted as data, becoming artistic material that enables new experiences. Gathering footage-as-data is much more far-reaching than creating new processes; it allows new and different ways of seeing. As Le Grice asserts of Len Lye's work:

> It also embodies in the meaning of the work a philosophical concept that information subject to abstraction as component 'data' becomes a new form of 'raw material' available for 'retrieval' in ways which construct a new experiential model of the world.
> (Le Grice, 2009, 317)

Found abstraction creates a constant flux between visuals being seen as abstract and mimetic; this gives rise to phenomenological experiences, similar to those created by *Rough Sea*. Both recognising and creating found abstraction is key to developing embodied visceral affective non-representational visual music that reaches beyond formal geometric abstraction without being mimetic.

**Conclusion**

Artists sought to find a new language as a result of the tension between mimesis and the artist's vision. Artists who turned from painting to photography found new ways of seeing, which developed into found abstraction. Stieglitz further developed found abstraction by taking abstract photographs that expressed his feelings. These practices allow the degree of realism or abstraction to lie with the observer. The flux between the abstract and the mimetic is key to this research. Next we turn to Paul Klee, who keenly observed nature, not to copy it, but to feed his artist's vision and create work that lies between the abstract and the mimetic.

## 2.3 Adding movement – visual structures in motion

In this section, we first discuss Paul Klee's methodology and visual framework (Section 2.3.1). Next, we discuss visual gestures in relation to visual music (Section 2.3.2) and audible, especially vocal, gestures (Section 2.3.3). Finally, having looked closely at paintings, photographs and photograms, and how they embody movement, we look at the moving image (Section 2.3.4). Finding the liminal space between stasis and just-animated, even imperceptibly moving, is a way of acknowledging the power of the still image in visual music – of trying to combine the richness of the still image with a small degree of motion. The birth of movement in animation is historicised with the aim of reflecting on the possibilities for contemplative visual music in this liminal space.

### 2.3.1 Paul Klee's methodology and visual framework

Merleau-Ponty would argue that all of our experiences inform our creative practice. Paul Klee's work, methodology and framework support this, as he created work beyond the duality of perception and embodied visceral affect by working in a very intuitive way with his experiences, whilst also being an exemplar of cataloguing and scientific method. Furthermore, he produced static visual compositions in which 'the movement of the painted elements can and have achieved a kind of Visual Music, serving as an artist's visual interpretation of specific music' (Ox & Keefer, 2008, 2).

**Render visible**

Paul Klee defined two modes of experience: constructive-geometrical and metaphysical (Klee & Findlay, 1966). These modes are not discrete; they are interrelated and inform each other.

> His forms are derived from nature, inspired by observation of shape and cyclic change but their appearance only matters in so far as it symbolizes an inner actuality that receives meaning from its

> relationship to the cosmos… Paul Klee uses the familiar object in unfamiliar relationships to materialize the unknown.
> (Klee & Moholy-Nagy, 2000, 7)

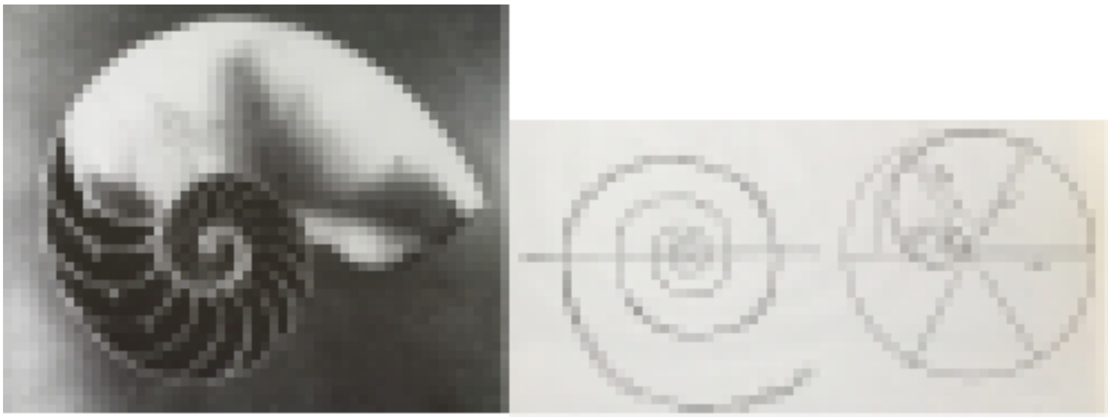


Figure 19. ‘Irregular spiral composed of normal circumferential segments of abruptly changing radius’ (Klee, 1992, 289-291)

Klee collected natural forms, such as shells and drew these. He analysed their forms mathematically using the golden mean and Fibonacci series. He abstracted natural forms. He also explored the abstracted forms as if they were plants or creatures: defining their possibilities for motion, personifying their potential kinetic changes. The perfection of the shell in the photograph is not copied (Figure 19). Klee’s line drawing does not seek to show the regular mathematical perfection found in nature, or the shell’s three-dimensionality, shade and tone or textural detail. His drawing is not of a specimen but of life. The irregularity of the spiral and the doubled-up-emphasis of the line describe life and movement. In his drawings, the line appears to be a living line and gives the forms an anthropomorphic quality.

Klee’s work ranges from the abstract to the mimetic: from formal constructions to associative images that recall a star or plant, to images that represent a subject – such as a man. His work delineates the tension between creating mimetic work and creating a highly individualistic style of expression that expresses the artist’s experience and imagination. He was keenly aware of the problems of creating artistic work with such a wide span. He exclaimed:

> Sometimes I dream of a work of really great breadth, ranging through the whole region of element, object, meaning and style. This, I fear, will remain a dream… We have found parts, but not the whole!
> (Klee & Findlay, 1966, 54-5)

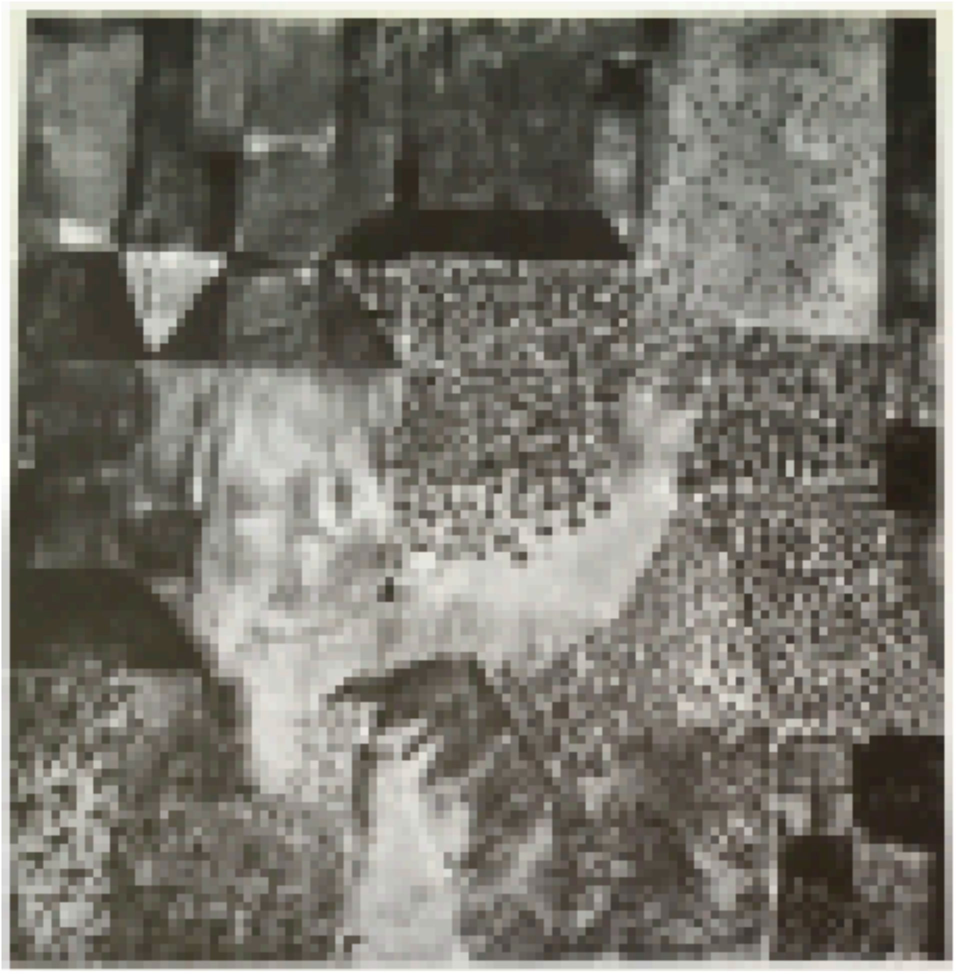


Figure 20. *Overgrown Houses* (Klee, 1915) (Klee, 1992, 212)

The artist described *Overgrown Houses* (Figure 20) as: 'Alternation of structurally accented and unstructured areas' (Klee, 1992, 212). It is an example of his work that blends geometric shapes such as rectangles, associative shapes such as leaves, and an impression of a collection of houses, all created within his individual style. The rhythmic patterning is pulling together the fragmented picture-plane; depth and realistic perspective have been replaced by non-realistic, multiple viewpoints. The influence of early cubist collages, such as Pablo Picasso's *Guitar* (1913) (Figure 21), can be seen in non-realistic perspective, multiple viewpoint, and fragmentation of the screen (picture-plane).

Figure 21. *Guitar* (Picasso, 1913)

Early cubist collages feature innovative, visual, hide-and-seek surprises in the interrelationships of image-planes, which are freed from being coherent in perspectival space, freed from having to represent or connote. Moholy-Nagy describes his response to early cubist collages:

> one can enjoy the pictorial and graphic wealth of these interpenetrating planes, shadings and textures… a rhythmical and emotional exultation … arriving at a new visual microcosmos of primordial emotional values. (Moholy-Nagy, 1947, 128)

Creating a non-realistic perspectival space allows the inclusion of a more child-like perception. By showing the objects in their own unique perspectives (rather than in a picture-plane created from one perspectival viewpoint), objects are given their own existence. As Stephan Gunzel writes:

> Cézanne carries the objects into the perspectival painting as they are… [like] the drawings of children: they show the world from a topological point of view (from the object), and not from a perspectival one (from the subject). For Merleau-Ponty, Cézanne's paintings are displaying an exemplary crossing of the cogito with the world: the ego sees the world in perspective, but the objects come towards it from out of the world. (Gunzel, 2014, 41)

This more child-like perception is also an embodied perception of the world. This art is a progenitor of phenomenological art: the artist’s phenomenal body is immersed in the material world, in a non-perspectival, textural, chaotic view with many perspectives merged together. Simultaneously showing multiple perspectives is affecting. It has an impact on the nervous system as the virtual body can be in several places at once. This creates intensity, immediacy and a sense of seeing the world afresh. This is very similar to the new vision in photography, as each artist has a fresh way of seeing the world, and also to the embodied visceral affect of Turner's *Rough Sea*.

In seeking to create embodied visceral affective experiences, visual musicians have long sought to see so freshly that the world appears anew and full of wonder. The visual musician Stan Brakhage took this approach. He wrote:

> Imagine an eye unruled by man-made laws of perspective, an eye unprejudiced by compositional logic, an eye which does not respond to the name of everything but which must know each object encountered in life through an adventure in perception. Imagine a world alive with incomprehensible objects and shimmering with an endless variety of movement and innumerable gradations of color. Imagine a world before the 'beginning was the word'.
> (Brakhage & McPherson, 2001, 12)

Brakhage links naming objects to defining objects through perspective, to the subject having a fixed viewpoint from which the 'man-made laws of perspective' make sense of objects in the scene. This is contrasted with the life, light, colour and motion seen 'through an adventure of perception'.

The concept of an artist's vision, the artist as a conduit, is fundamental to Klee's seminal methodologies and teachings. Klee writes of an artist's inductive methodology beginning with their unique 'specific gifts'. If artists follow their passion and let their work grow, then their curiosity can lead to new realities, a new vision. This vision, and each artist has a fundamental right to their own unique vision, needs to be realised, developed into works of art (Klee in Klee & Findlay, 1966, 11–19). Similarly, Merleau-Ponty posited: 'The Painter, whatever he is, while he is painting practices a magical theory of vision' (Merleau-Ponty & Edie, 1971, 178).

Klee taught that the painter's eye is able to be both passive and creative; artists look beyond outer forms, to seek the essence of nature. To this end, the artist is less concerned with realism, and less concerned with the final product, and more concerned with process. Klee rejects Aristotle's concept of hylomorphism (from the greek hylē, 'matter'; morphē, 'form'), which posits that matter, or potential, and the actual, or form, make up all physical objects, and instead values the powers 'which do the forming'. Klee wrote:

> [H]e [the artist] does not attach such intense importance to natural form as do so many realist critics, because, for him, these final forms are not the real stuff of the process of natural creation. For he places more value on the powers, which do the forming than on the final forms themselves.
> (Klee & Findlay, 1966, 45)

This artistic sensitivity to the world is combined with imagination, which frees artists from copying a current reality and allows them to see creation as an on-going process with possibilities from the past to the future, from the microcosm to the universe (Klee & Findlay, 1966).

Like Turner's 'breakthrough', Klee's artist's vision foreshadows Deleuze's dialectical totalisation, a linking together of the whole, and elicits embodied visceral affect via the mathematical and dynamical sublime (Section 2.2.2). Klee's writings demonstrate his ability to mix scientific methodology and an almost mystical, transcendental approach. As Sibyl Moholy-Nagy stated in 1925 in her introduction to Klee's *Pedagogical sketchbook*:

> [A] reverberation of the finite in the infinite, of outer perception and inner vista. The experience of this dual reality of the SEEN and the FELT essence of nature, impels the student toward a free creation of abstracted forms which supersede didactic principles with a naturalness, the naturalness of the work.
> (Klee & Moholy-Nagy, 2000, 12)

Deleuze echoes this mystical aspect of artistic creation that links back to metaphorical synaesthesia (2.2.1), when he writes of Klee's process: 'the visual material must capture nonvisible forces. *Render visible*, Klee said; not render or reproduce the visible' (Deleuze & Guattari, 2004, 377).

Klee did not give solutions in the form of rules but proposed processes in his writings and by his own example, processes that would lead artists to find their own solutions. He was a progenitor of Practice as Research; his theories and practice fed into each other. He developed his paintings and drawings in series using rigorous scientific methodology. Klee's methodology was founded on his joy in meticulously cataloguing his works, and preserving the development of his ideas, processes and teachings (Rewald & Klee, 1988). Klee's writing is both meticulously ordered and poetic – full of metaphor. He wrote with a keen awareness of the difficulty of writing about images, which are not read linearly in the manner of text.: '[in words] we lack the means of discussing in its constituent parts, an image which possesses simultaneously a number of dimensions' (Klee & Findlay, 1966, 15).

**Granularity and rhythm**

Klee used a scientific approach to creating a visual framework; he identified key variables and how they interrelate. He tested these key variables individually and in different combinations, noting:

> I have tried pure drawing. I have tried painting in pure tone values. In colour, I have tried all partial methods to which I have been led by my sense of direction in the colour circle. As a result, I have worked out methods of painting in coloured tone values, in complementary colours, in multicolours and methods of total colour painting.
> (Klee & Findlay, 1966, 54)

His variables are the formal visual factors of line, tone value and colour, and the relationship of 'dividual' and 'individual' structures to rhythm and to these formal factors. Klee not only explored each variable in depth, he also defined the interrelationship between the variables using 'Quality', 'Weight' and 'Measure' to create a taxonomy:

> Colour is primarily Quality. Secondly it is also Weight, for it has not only colour value but also brilliance. Thirdly, it is Measure, for besides Quality and Weight, it has its limits, its area and its extent, all of which may be measured. Tone value is primarily Weight, but in its extent and its boundaries, it is also Measure. Line, however, is solely Measure.
> (Klee & Findlay, 1966, 23)

Klee quantifies tones (light to dark); this is analogous to the pitch and duration of a note. He likens a wide range of tones to deep breathing, grey to a whisper, lighter tones to violins and darker tones to cellos (Klee, 1992, 389). However, he could not translate his facility for measuring and weighing tones into measuring and weighing colour; he found it impossible to quantify the overall colour of a composition and likened this to emotion embodied in music.

Klee identifies ‘dividual’ and ‘individual’ structural elements, explaining how these visual structures can demonstrate the dualism of repetition and change and how they can construct visual rhythms. ‘Dividual’ are repeated structural elements that can be divided or added to without changing the structure they form. In contrast ‘individual’ structural elements are patterns, such as a cross, in which if a part is added or subtracted it no longer forms the same pattern (Figure 22).

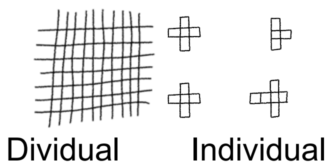



Figure 22. Diagram of dividual in contrast to individual (based on Klee, 1992, 183–185)

Klee used ‘structural’ grid systems made of dividual elements, which could be alternated with other forms or altered, for example by inverting, or rotating or overlapping (Figure 23).

Figure 23. Diagram of overlapping dividual elements creating intermediate elements (based on Klee, 1996, 196)

Visual composition may be predicated on a constructive geometric (or even algebraic) basis, a graphic basis, or a pictorial/figurative basis. Examples include: the geometry of a cross in a grid, the graphics of text in a pattern, or the pictorial mimesis of a fish’s embodied experience of articulation (Figure 24). As Klee states: ‘The structural and individual elements might also be located by a process in which the individual experiences structural articulation in his own body' (Klee 1996, 189).

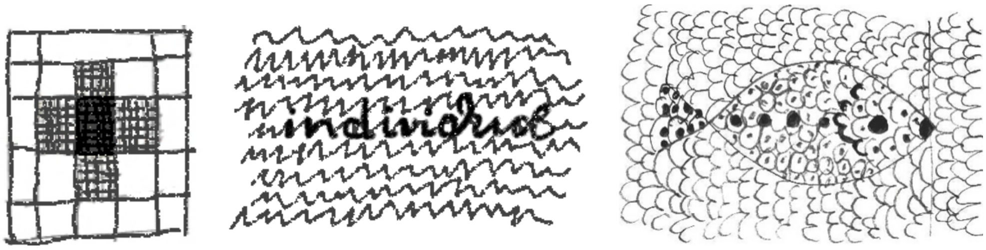



Figure 24. Diagrams of constructive geometric, graphic and pictorial/figurative basis (based on Klee, 1996, 187–189)

This structural element plays a supporting role to the individual structure (Klee, 1992, 283) (Figures 24 and 25). When structures are combined, visual rhythms are created. Klee wrote that the dividual structure is unaccented and forms a rhythmic base, a 'structural norm', whereas the individual structure (which does not have to connect up with itself) is accented or 'rhythmicised' (Klee, 1992), (Figure 25).

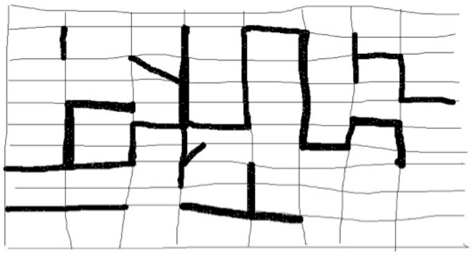


Figure 25. Diagram of rhythm linking and articulating dividual-individual relationship, based on (Klee, 1992, 209)

> [T]he smallest individuals are the simple rhythmic ones, then come the composite rhythmic ones, and finally those that are not rhythmic (individual) or those that are beyond rhythm.
> (Klee, 1961, 259)

Klee used rhythm as it 'marks the movement of time in music but also in art' (Düchting, 2012, 14). He noted:

> We can perceive rhythm with three senses at once. First we can hear it, second see it, third, we feel it in our muscles. This is what gives it such power over our organism.
> (Klee, 1961, 267)

Dividual and individual structures are not fixed; they are a matter of perception and value judgements. Klee explained:

> [T]he fish seen as an individual, breaks down into head, body, tail, and fins. Seen dividually it breaks down into scales and the structure of the

> fins… A few scales may be missing from the body, but we cannot do without the head, the eye, or any of the fins… Thus the distinction between dividual and individual involves a value judgment. But is the fish always an individual?… [N]ot when 'it's teeming with fish', as the saying goes… The concepts lower (or dividual) and higher (or individual) are not absolute but mutually dependent; when I broaden the conceptual field I create a higher perceptible whole.
> (Klee, 1961, 264–266)

The individual, those outside the rhythm, can be figurative. Figure 26 demonstrates how Klee used his three main formal visual factors of line, colour and tone to create dividual-individual synthesis.[9]

| | dividual | individual |
|---|---|---|
| Either: | unaccented line | accented line |
| or: | line | tonality |
| | line | colour |
| or: | tonality | colour |

Figure 26. Means of representation (based on Klee, 1992, 203)

Klee's artistic process is lensed through the scientific rigour he applied to creating this cohesive but open visual framework. He extended this rigour to meticulously cataloguing and systematically arranging his work. This both aligned his work and his framework and clarified innumerable other possibilities for more work (Klee, 1961, Klee, 1992). Perhaps in response to this myriad of possibilities, Klee's work leans towards the binary, for example with a line being either present or absent, in the manner of an etched line rather than a smeared pastel or charcoal line. Klee asserted:

> Vagueness in one's work is therefore only permissible when there is a real inner need. A need which could explain the use of coloured or very pale lines, or the application of further vagueness such as the shades of grey ranging from yellow to blue.
> (Klee & Findlay, 1966, 25)

Klee saw white as 'devoid of movement, without a trace of life' (Klee, 1992, 304) and similarly that black was dead without white. In this tonal scale, grey can be not-black and not-white or it can be both black and white

[9] Klee's concept of the dividual and individual underpinned Edward Zajec's *Orphics*, in whch he wrote: 'a theory of dividual color-time articulation might prove to be that long-sought common ground bridging the two art forms [visuals and music]' (Zajec, 1988, 115).

simultaneously. Grey can create a stalemate; the challenge of tonality needs the full tonal scale. In animation, a linear fade from black to white can create a 'dead' grey. This loss of energy drags at the timing of the animation – the creative use of dynamic dissolves (based on curves), organic wipes and flares has long been pitted against this problem. Klee was not interested in light's direction and quality but in tonal value as Weight. This non-mimetic approach allows a mathematical measurement of tones away from a 'norm' i.e. the background, starting with a white or black background.

Klee created a logical framework by defining opposites: 'A concept is unthinkable without its opposite' (Klee, 1961, 15). Deleuze's paths through nonfigurative chaos elucidate both Klee's and Turner's artistic methodologies (Section 2.2.2). Deleuze wrote:

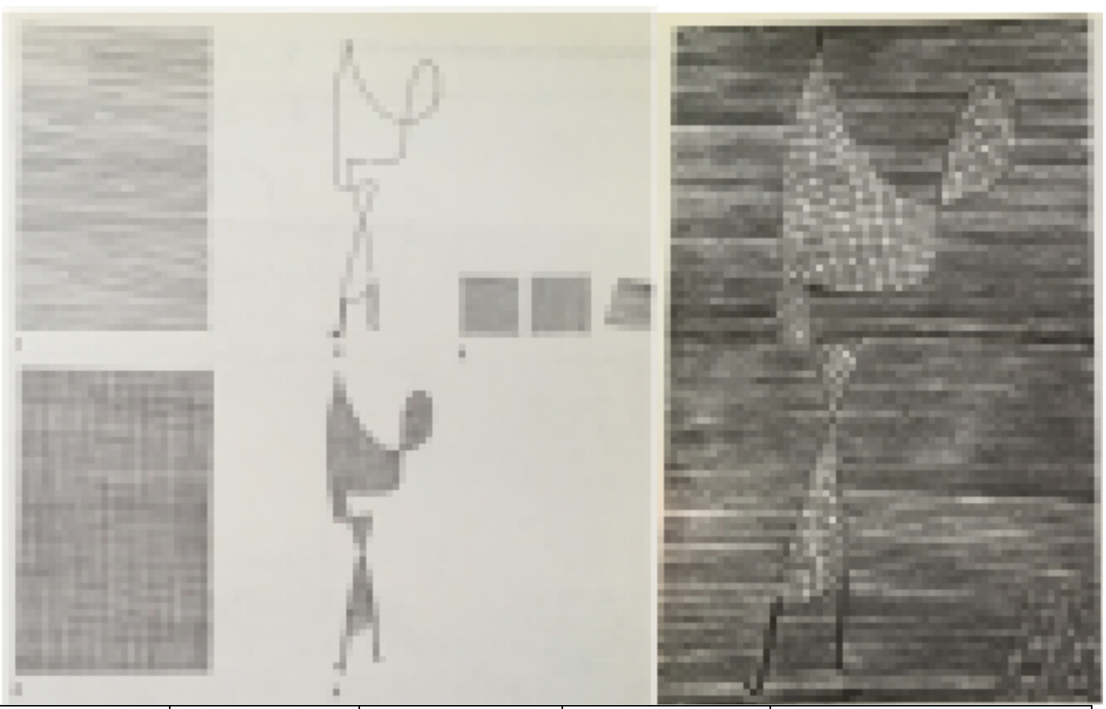
> Abstraction would be one of these paths, but it is a path that reduces the abyss or chaos (as well as the manual) to a minimum: it offers us an asceticism, a spiritual salvation… But it follows that what abstract painting elaborates is less a diagram than a symbolic *code*, on the basis of great formal oppositions…. Thus, according to Kandinsky, vertical-white-activity, horizontal-black—inertia, and so on. From this is derived a conception of binary choice that is opposed to random choice.
> (Deleuze, Smith, & Conley, 2005, 84)

Klee used his framework of diametric opposites, such as long and short, black and white, as diametrically opposite poles to measure and weigh the key formal pictorial factors he had defined, such as size and density, against each other. Klee differentiated between 'constructions' and 'compositions'; 'constructions' were compositional designs that he usually completed before adding narrative objects or associations which elevated the 'constructions' to 'compositions' (Klee & Findlay, 1966). There was a mathematical underpinning to his constructions, using grid structures, geometric forms, measurable tones and hues.

**Optical illusions and surprises**

Whilst developing his visual framework and methodology, Klee also developed his own highly individualistic style – a cohesive world in his artistic compositions. He was not interested in creating a sense of balance and rest. He was more interested in exploring tensions and discord; he created optical illusions that keep the eye in movement. In Klee's compositions, the abstract and the mimetic are melded together to create a new reality, which echoes with the artist's universe and reflects back resonant associations. Some judged the resulting drawings to be naïve and even childish. However, Klee identified: 'a happy association between my vision of life (*Weltanshauung*) and pure artistic craftsmanship' (Klee & Findlay, 1966, 53). His work is a celebration of figurative and purely geometric elements fusing together to create lively, organic images.

A good example of this fusion is *Grid Dance* (1935) (Figure 27), which combines geometric forms and a figure. The individual figure stands out from the rhythmic dividual wavy horizontal lines in the background.



| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Dividual | Individual | Dividual | Dividual | Individual |
| Basic pattern | Controlling proportion | Movement | Counter-movement | 3+4 underline the individual movement |

Figure 27. *Grid Dance* (Klee, 1935) and table based on Klee's formal analysis (Klee, 1992, 284–285)

The figure is composed of a warped grid and controls the proportions in the image. Klee echoed Kant's concept of the human body being the standard unit of measurement: 'As human beings, we have it [proportion] within ourselves and about ourselves' (Klee,1992, 285). The concept of a sensual scale, a human scale, is fundamental to this research and allows the contrast of a sublime scale that is large enough to immerse a person (Section 2.2.2).

Proportion (unlike tone) is not considered mathematically. Proportion is determined by the difference of at least two parts; it is relative. Klee stated:

> We are not face to face with mathematics here. Nor is it a matter of fathoming measurabilities or weighabilities. We are concerned with comparing the impressions made by the various parts, and it is precisely the difference between at least two parts on which a higher proportion hinges. You will often find, for example, that parallels are no longer parallels, when some third element intervenes and interferes (optical illusion as reality).
> (Klee, 1992, 79)

The verticals of the figure form a countermovement to the horizontal lines of the background. The warping of the grid, that is the form of the figure, creates movement and countermovement. The image looks carefree, but it is very carefully constructed: each horizontal line in the figure joins exactly with a line in the background. The figure in the foreground allows the lines in the background to be discontinuous across the image. The dividual elements are completely supporting the individual and their fixed repetitive nature makes an excellent foil to the movement and sense of growth of the figure. The playful movement of the grid and proportions of the figure give the viewer the feeling of a moment of embodied, dance movement. These allusions to human traces create visual rhythm and demonstrate how human traces can create visual structures. The warping and twisting of the grid in *Grid Dance* gives the illusion of pictorial depth; this is quasi three-dimensional, in digital animators' terms, 2.5D space.

Klee also created optical illusions, which dance between 2D and 3D space by using structures to produce tonality. Klee described *Castle of Chivalric Order*

(Figure 28) as: ‘Dividual-individual synthesis in linear & rhythmical arrangement combined with an alternation of density and rarefaction’ (Klee, 1992, 200).

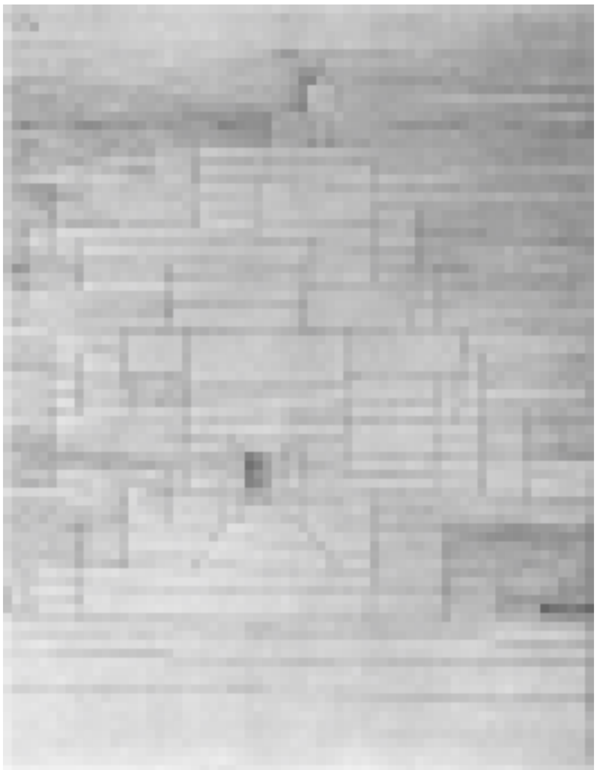


Figure 28. *Castle of Chivalric Order* (Klee, 1929)

The dividual rhythmic elements are synthesised with individual elements such as the door and turret through a careful use of increase and reduction in the density of the number and closeness of the horizontal lines. The resulting image is a fusion of geometric and figurative elements, of two-dimensionality and three-dimensionality. The image-planes created by the ‘rarefaction’ of the horizontal lines and the counterpoint of the verticals are delicate; the foreground and background are very closely balanced – the castle almost disappears into the sky.

These illusions form visual surprises, which are key to creating engaging animation. We make an assumption of continuity and ‘grade information according to the degree of surprise’ (Gombrich, 1979, 108). Moving between 2D and 3D space, that is constructing a scene in which an element changes from being perceived as 2D to 3D or vice versa, is one of the ways animators create surprise in fixed-screen work. Other visual surprises include: foreground-background reversal in the interrelationships of image-planes that can be seen in cubist collages and animations such as Richter's *Rhythmus 21.*

> Our whole sensory apparatus is basically tuned to the monitoring of unexpected change. Continuity fails to register after a time, and this is true both on the physiological and the psychological level.
> (Gombrich, 1979, 107)

Surprise is a 'failure of expectation' (Huron, 2007, 21) that results in arousal, increased attention on the event, and, if the surprise appeared at first to be a feared outcome and was then understood to be harmless, the opiates the body releases will result in a feeling of happiness.[10] Surprise is both pre-reflective and reflective and affects us in many ways.

> [C]orrelates of surprise have been described at nearly all stages of neural processing… at higher levels of abstraction, surprise and novelty are also central to learning and memory formation.
> (Itti & Baldi, 2009, 1295)

Exploring the use of surprise is central to creating visual music that has embodied visceral affect.

Klee extended his research into the dividual and into tone by perfecting the technique of thinly diluting watercolour and spraying it through an atomiser to gradually build up veils of colour. *Historic Site* (1927) (Figure 29) demonstrates how the dividual can be implemented as a soft luminous background. The repeated structural elements that can be divided or added to without changing the structure they form are now tiny dots of colour, which create a hazy atmosphere. The veil effect of layers of transparent colour creates a sense of movement. The softness of the background contrasts with the strongly rhythmical black geometric lines describing the architectural forms. The forms are drawn with very fine lines, counterbalanced by much

[10] Huron links surprise to Burke's definition of the sublime: 'The aesthetic experience of the sublime depends on an initial sensation of fear that is ultimately appraised as inconsequential' (Huron, 2007, 25).

thicker lines. The thicker lines are mainly horizontal; creating a sense of rhythmic travel across the image and giving weight to the forms.

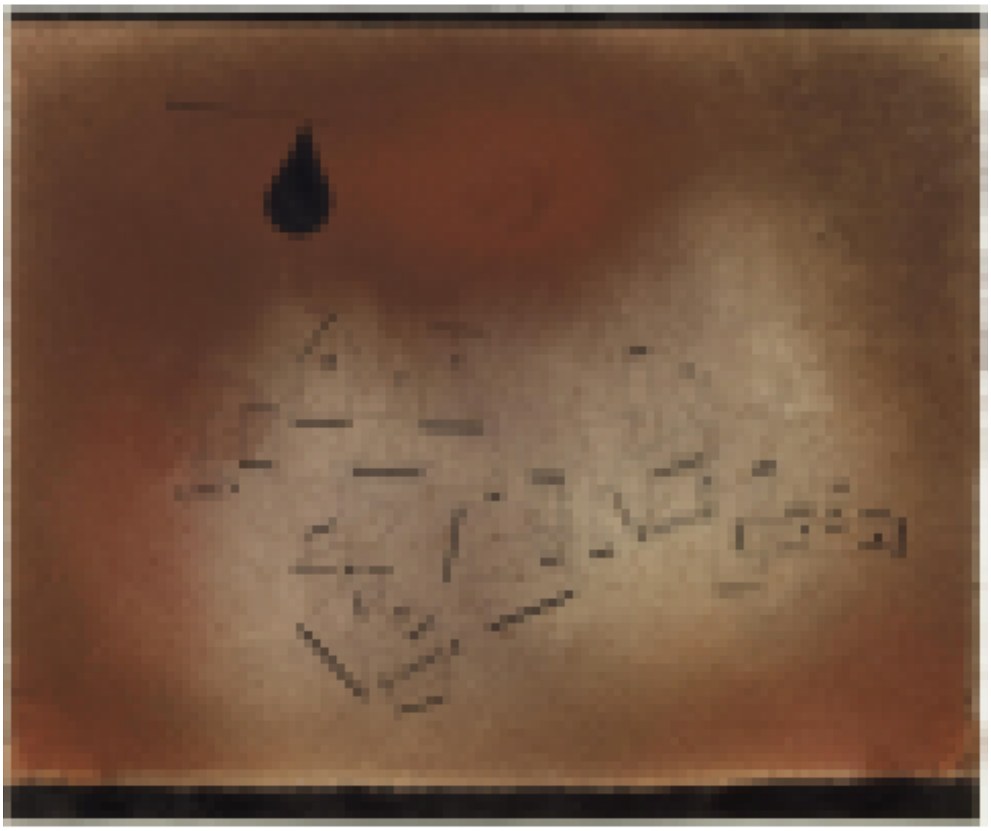


Figure 29. *Historic Site* (Klee, 1927)

The luminosity of the background supports the individual rhythmic shapes. This continuum of blur, to the granularity of dividual elements, differentiation of individual objects and dividual-individual synthesis using line, tone and colour is a useful framework for visual structures in visual music. This continuum of granularity allows a virtual zoom in or out that has no correlation in audio and that eases elements transforming from being dividual to individual as the animation progresses, for example from a fish scale to a fish to a school of fishes.

**Conclusion**

Paul Klee's methodology centred on the artist's vision seeing the world afresh through two modes of experience: constructive-geometrical and a metaphysical openness. The painter's eye could be both passive and creative, could see outer forms and seek the essence of nature. He was a progenitor of phenomenological art, creating works beyond the duality of perception and affect. His methodology allowed him to '*render visible'* or materialise the unknown, by using 'the familiar object in unfamiliar relationships'.

Paul Klee epitomises how an experiential, aesthetic appreciation, and the technical investigated with scientific rigour can come together to inform a methodology, a visual framework, artworks and teaching. Further, his work is an exemplar of the technical being in service of the aesthetic. Klee was more concerned with process than with the final form. He created – in his writings and through the example of his own work – a visual framework not of rules but of processes. His methodology and his visual framework are based on scientifically analysing key variables in art. He used logic; he defined opposites. He used mathematics; he measured and weighed key formal pictorial factors. But his fundamental sense of proportion was (like Kant's) his sense of scale as a human. His play with the illusion of pictorial depth creates visual surprises; surprises are much used by animators. *Historic Site,* demonstrates a continuum of granularity from blur, to dividual to individual objects, a continuum that offers a possible visual framework, within which elements could, with a virtual zoom, change from one level of the continuum to another.

Klee was intensely musical and used rhythm within his methodology. Klee's work gives the viewer a sense of movement in many ways: the liveliness in the figures, the embodied dividual-individual articulation, the rhythmic use of dividual elements, the veil effect of layers of transparent colour, the delicate foreground-background balance that shifts as we look and the optical illusions that shift our gaze between a two-dimensional and three-dimensional image. Doubtless, his musicianship fed into this creation of movement, informing his visual embodiment of rhythm and harmony.

## 2.3.2 Human traces: visual gesture

Can incorporating human traces – visual gesture and vocal expression – into visual music allow greater opportunity to create visual music with embodied visceral affect? There are two main challenges to creating expressive visual music in the 21st century. First is the centuries-old challenge of overcoming the duality of eye and ear to create 'an equal and meaningful synthesis of the visible and audible' (Lund & Lund, 2009, 149). The second main challenge is that the trend to produce visual music algorithmically tends to be based on conceptual linkages between sound and vision rather than starting from the premise of expression. Human gestures are proposed as the antidote to these challenges. This argument is developed through Michotte's perception of causality, animacy, and McLaren's taxonomy of animation, in which expressive movement is founded on animation-tempo (see Key Terms). It is then expanded to include perception of motion in moving image, referring to Freedberg and Gallese's 'mirror neurons'.

For over a century, gesture has engaged viewers within animation. From Disney onwards, character animation has had a tradition of using human actors to closely model animation on dramatic performance and so engage the audience in the story. As Matthew Stone et al. assert: 'Engaging dramatic performances convincingly depict people with genuine emotions and personality' (Stone et al., 2004, 1). This has been further developed with motion capture and is widely used today. Abstract animation, by contrast, involves time-based abstract images, i.e. images of intangible things, and images that have been 'abstracted' by removing or mapping elements. There is a continuum between mimetic and abstract images, and where an image falls along this continuum depends on the observer. Abstract animation can draw on the audience's understanding of character animation and has its own history of conveying emotion through animating motion. John Whitney states: 'Structured motion begets emotion' (Whitney, 1980, 41). Like narrative animation, abstract animation can employ metaphors and analogies, but they are abstracted; for example, non-conformity, the inability or refusal to conform, could be expressed through colour, shape or movement. Even abstracted patterns of movement and change that we are familiar with, such as the fading of light at sunset, communicate as a metaphor.

**Perception of causality**

Mimesis of patterns of human behaviour allows surprisingly complex statements to be made by very simple graphic elements, as responses to abstract animation are influenced by perceptions of causality and of animacy. In 1946, Albert Michotte demonstrated the perception of causality through timed projections that showed Object-1 moving up to Object-2, at which point Object-1 stopped and Object-2 started to move along the same trajectory. Individuals do not just perceive the visual events: that Object-1 moved and then stopped and Object-2 was static and then moved – Michotte demonstrated that this is perceived as one event, i.e. Object-1 is perceived to have caused Object-2 to move. He termed this demonstration the 'launching effect', and that noted that it implied a 'functional relationship' between the two objects (Michotte, 1963).

Michotte found that temporal match is vital, and that consistency of spatial relationships and compatibility of trajectories are necessary in order to perceive causality (Hill, 2013, 242). Michotte asserted that, given these factors, the perception of causality is automatic and ubiquitous, happening without higher-level interpretation, based on motion abstracted from previous lived experience that has been internalised. That is, the perception of causality is rooted in phenomenology.[11]

> Michotte developed a theory of the nature of causal perception, which emphasized its automaticity, its strict dependence on subtle display details, and its relative immunity from higher-level intentions and

[11] Michotte suggested that the analysis of input for perception causality is innate; its innateness versus perceptual nature is currently debated. Rebecca Saxe and Susan Carey conclude: 'representations with the content cause may be innate, but they may be part of a central conceptual system that integrates information from all three sources of evidence (contingency, direct perception of mechanical causality, sense of one's own causal effort and efficacy in the world) from the outset' (Saxe & Carey, 2006, 163).

> beliefs. Michotte analyzed the perception of causality in the launching effect as a conflict between the perception of two distinct objects, but one continuous motion.
> (Wagemans et al., 2006, 10)

Michotte’s theory has been used to explain how we perceive patterns of movement, abstracted from the agents performing that movement. As Ashok Basawapatna, theorist in educational computer science, states:

> [T]he success or failure of generic agents exhibiting a pattern depends on the ability of people to abstract out the agents of an interaction while preserving the interaction itself.
> (Basawapatna, 2016, 284)

Abstracting out the agents of the action whilst preserving the interaction or motion, recalls the animator Len Lye. He marvelled at little clouds scudding across the sky, which reminded him of Constable trying to show the movements of clouds in his sketches. This sparked an epiphany:

> [W]hy clouds, why not just motion? Why pretend they are moving, why not just move something? All of a sudden it hit me – if there was such a thing as composing music, there could be such a thing as composing motion. After all, there are melodic figures, why can’t there be figures of motion?
> (Lye, Curnow, & Horrocks, 1984, 31)

Basawapatna suggests that the schemata we use to make sense of the world we live in support our perception of causality in patterns of movement. The perception of causality is aided by innate processes such as avoiding visual ambiguity: ‘the hardwired tendency of the visual system to avoid certain types of coincidences when interpreting ambiguous visual input’ (Choi & Scholl, 2006, 388). Michotte asserted that our perception of causality underpins our understanding of not only our voluntary actions but also our emotions and motivation. He stated:

> The qualitative event – the emotion or motivational state – often precedes a physical action, e.g., of pulling something towards ourselves, taking it up, pushing it away, and so on, and is closely linked with the corresponding causal impression. Here, surely, is to be found the basic reason why people attribute a causal role to emotions or sentiments, some of which perhaps possess in themselves a character of immanent activity, but not of causality in the strict sense.

(Michotte, 1963, 260)

**Animacy**

'Animacy' is a form of anthropomorphism perceived in abstract animation, where the shapes appear to be animate, motivated or expressing emotion. Motion graphics relies heavily on engaging viewers via anthropomorphism. Animated geometric objects have been shown to be readily anthropomorphised, as demonstrated by Heider & Simmel (1944) (Figure 30).

> [I]t is reported typically that a pair of friends (the small triangle and the circle) are antagonised by a 'bully' (large triangle) who in failing to achieve his goal takes out his anger by destroying his home.
> (Marshall & Cohen, 1988, 99)

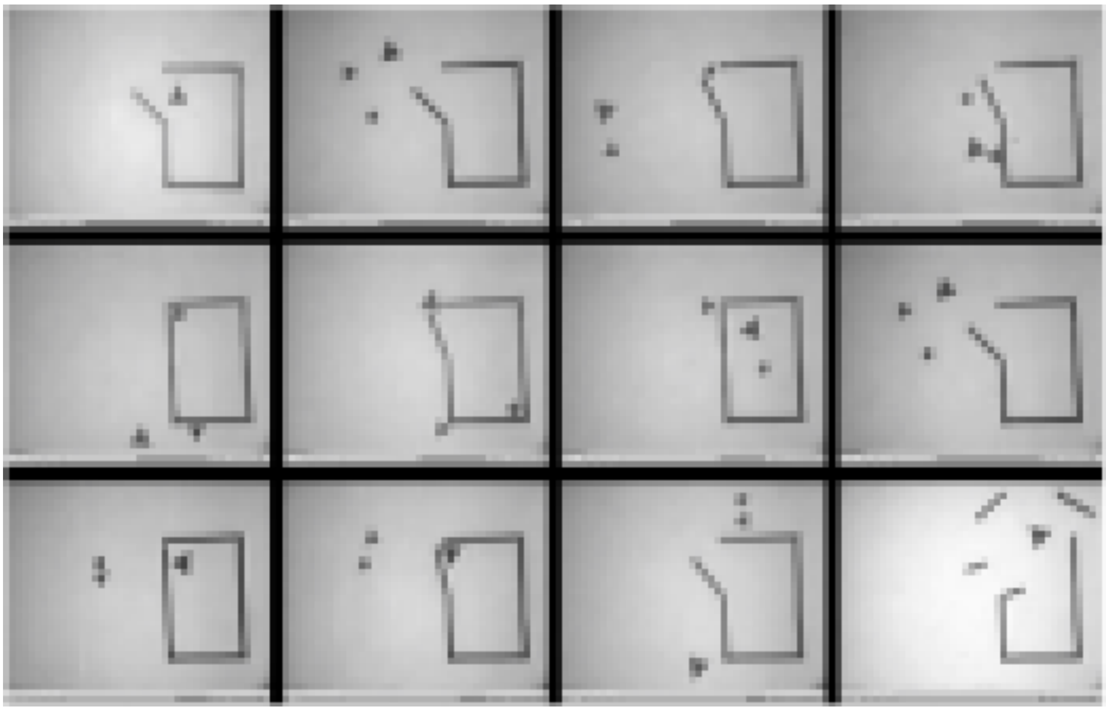


Figure 30. Stills from Heider and Simmel animation (Heider & Simmel, 1944)

Phillip McAleer and Frank Pollick found that 'perception of animacy can be powerfully determined by motion alone – even when the motions of real people are represented by single points' (McAleer & Pollick, 2008, 837). This is supported by Brian Scholl and Patrice Tremoulet's assertion:

> the combination of two extremely simple, highly perceptible motions (change in speed and change in direction) can produce an impression of animacy, even when presented in a featureless background.
> (Scholl & Tremoulet, 2000, 305)

The primate visual system processes colour separately from motion. The neurobiologist Margaret Livingstone names the two visual systems 'Where' and 'What' (Livingstone, 2002, 51). The 'Where System' processes motion perception, depth perception, spatial organisation and figure/ground segregation separately from the 'What System', which processes object recognition, face recognition and colour perception. The 'Where System' has developed to enable our negotiation through three-dimensional space and the flight or fight reflex. Response to abstract animation is affected by the basic level of response of the 'Where System'.[12] The visual system's processes underpinning both perception of causality and animacy appear to be automatic and highly stimulus-driven, although the resulting perceptions give the appearance of higher-level cognitive processing. As Scholl & Tremoulet state:

> [J]ust as the visual system works to recover the physical structure of the world by inferring properties such as 3-D shape, so too does it work to recover the causal and social structure of the world by inferring properties such as causality and animacy.
> (Scholl & Tremoulet, 2000, 299)

**Animation-tempo**

Norman McLaren's taxonomy of animation, which he comments on and demonstrates in *Animated Motion* (1976), is congruent with perception of both causality and animacy. The expressive quality of animation is dependent on animation-tempo and all tempi lie on a continuum (McLaren et al., 2002). The expressive quality of animation is constructed hierarchically: first, expression depends on animation-tempo and 'all change must have a tempo' (McLaren &

[12] Neuroscience is beyond the scope of this thesis but research into the mirror neuron system has shown that we can respond at a basic level to depicted motion. 'Recent studies in macaques and humans demonstrated that mirror neurons not only underpin action understanding but they are also involved in understanding the intentions that underlie action' (Freedberg & Gallese, 2007, 202). There is debate about whether embodied empathetic reactions are the same in response to art as they are in real life. Freedberg & Gallesse conclude: 'Automatic empathetic responses constitute a basic level of response to images and to works of art. Underlying such responses is the process of embodied simulation that enables the direct experiential understanding of the intentional and emotional contents of images' (ibid.).

Munro, 1976, DVD). Animation-tempo is intrinsic to expression in animation, whether of motion, or attributes i.e. colour, opacity and texture. Second, expression depends on the five qualities of motion: constant, accelerating, decelerating, zero and irregular. McLaren asserts: ‘by their skilful use [of animation-tempo and quality of motion] animators give life, meaning, character and spirit to no matter what they make’ (ibid.). Both gesture, for example, a punch or a gentle tap, and the physical world, including physics such as gravity (Figure 31) and distance or perspective (Figure 32), are expressed in this way.

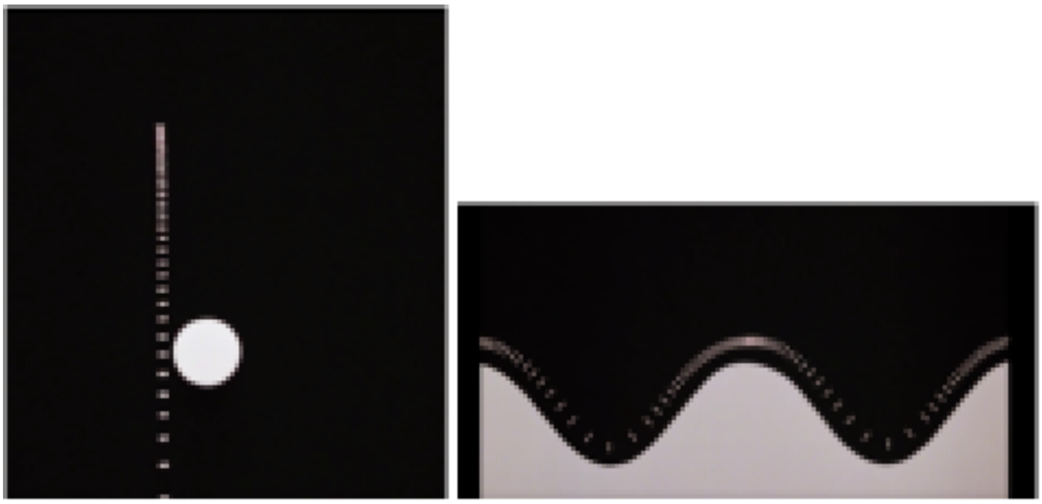


Figure 31. *Animated Motion: Gravity* (McLaren & Munro, 1976, DVD)

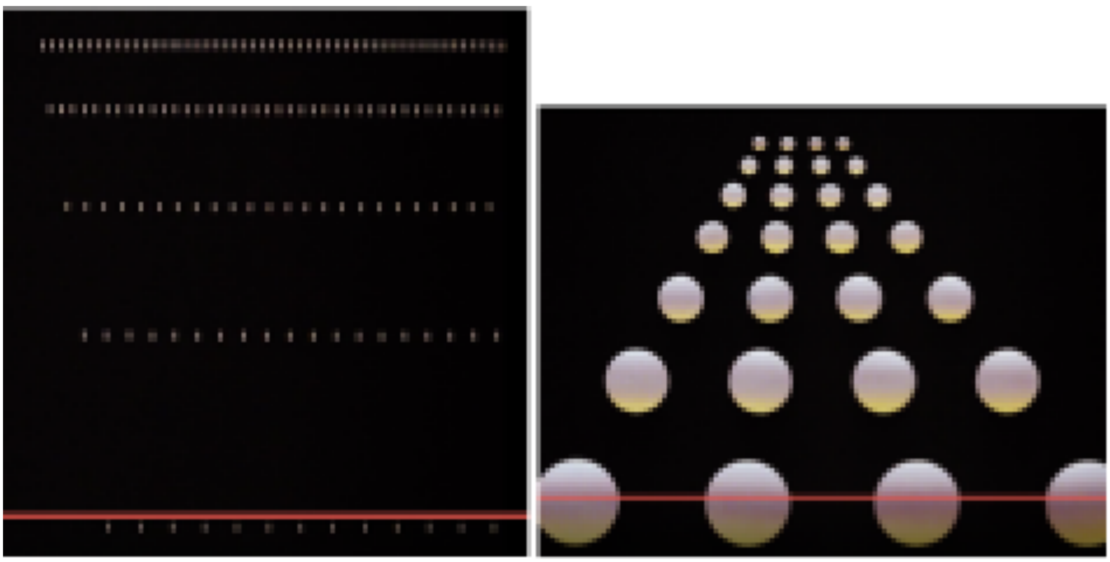


Figure 32. *Animated Motion: Perspective* – uniform speed with distant balls travelling more slowly (McLaren & Munro, 1976, DVD)

Animation-tempo and quality of motion are enough to define expression, for example McLaren says of irregular moves: ‘When it is impossible to predict the size of a move from preceding moves… [the object appears] erratic, capricious, nervous or even frightened’ (ibid.). Movement is expressed not only frame by frame but, crucially, in the movement between frames, as McLaren makes clear: ‘The size of the move is the animator’s chief concern, whether he is animating a cut-out, a substance, a person, or a series of drawings’ (ibid.).

The five qualities of motion can be used in an infinite number of permutations and combinations; some combinations join seamlessly to form one motion. For example: zero motion, a ‘hold’ is very important in defining motion; the hold can be made prominent by accelerating up to it, or it can appear to be a seamless part of the motion if there is deceleration before the hold.

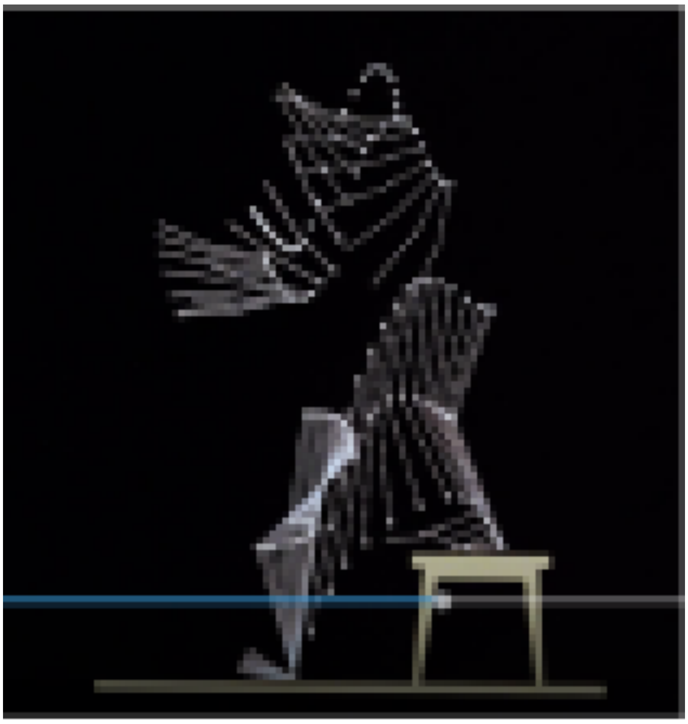


Figure 33. *Animated Motion:* man jumping off a stool (McLaren & Munro, 1976, DVD)

‘Compound motion’, i.e. the combining of different motions, is very common and is necessary to animate joints. McLaren states: ‘The jointing and pivoting of parts is of particular concern to the animator for it is the basis of most animal and human locomotion (ibid.).[13] A man jumping off a stool shows the nuances of accelerations, decelerations, constants, and, vitally, their interrelationship in a compound motion (Figure 33).

**Visual gestures and mimicry**

As our perception is embodied, so we are affected by human traces, such as gestures in dance and movement. 'A gesture is a movement of the body that contains information' (Kurtenbacn & Hulteen, 1990, 309). Affective responses to gesture may be accompanied by overt gestures, such as those used in music-making and tapping, swaying, dancing or marching. However, it should be noted that human physical actions and meaning do not have a one-to-one correlation:

> [T]here is no one-to-one correspondence between body movements and emotional states. A single emotion category can be connected to several body movements and vice versa.
> (Morita et al., 2013, 6)

The fluid and embodied nature of gesture is emphasised by Kimon Nicolaides:

> Gesture has no precise edges, no exact shape, no jelled form. The forms are in the act of changing. Gesture is movement in space. To be able to see gesture, you must be able to feel it in your own body.
> (Nicolaïdes, 2008, 15)

Gestures can be made visible in different ways. For example: if throwing glitter is a gesture, footage of the falling glitter shows the gesture; if a handheld camera is moved as a gesture, the resulting footage will capture the gesture. Action painting could be said to preserve gestures in a static form. The difference between the affect of the moving trace and the layered static trace highlights the heightened intensity of feeling the gesture in your own body – which is much easier if you see the movement. Hallgjerd Aksnes et al. define gestures that are affective as both movements and imagining movements of 'effort, velocity, impatience, unrest, calm, balance, elation, anger, etc., gestural images and concepts which are also encountered in

[13] Since the 1980s, 'compound motion' for jointed movement has been developed as the science of inverse kinematics, and, coupled with advances in motion capture, implemented in animation and robotics.

dance' (Aksnes et al., 2007, 1). These 'gestural images and concepts' are also encountered in animation and moving image. David Freedberg and Vittorio Gallese include affective response to images and works of art, which 'enables the direct experiential understanding of the intentional and emotional contents of images' (Freedberg & Gallese, 2007, 202).

The mimicry of moving image is not centred only on character, perception of causality, animacy or sound-shape but extends to light, colour, space and even temporal structures, as Eisenstein illuminated with viewers swaying to the rhythm of *Metric Montage* (Eisenstein, 1949). In the real world, we are conscious of the slow diurnal rhythm of the changing light and sensitive to rhythms of changing light up to a rapid flickering. We embody the rhythms of our own movements (Kozel, 2007) and perceive rhythms in movement, whether we ourselves or objects are moving – for example, looking at passing telegraph poles from a train window (Gregory, 1972). We see rhythms in the world around us (Edensor & Holloway, 2008). We make sense of the world through our own narrative and give this our own individuating rhythm.[14] We like patterns and we like to connect a series of events. The film theorist Jennifer Barker reflected on how we react bodily through skin, muscle and viscera:

> Mimicry is too complex to be only character centred. That is viewers' bodily responses to films might be mimicry… of the film itself. Perhaps viewers respond to whole cinematic structures – textural, spatial, or temporal structures, for example – that somehow resonate with their own textural, spatial, and temporal structures. It may be possible to reframe this reversible relationship between the viewer's body and the film's body in terms of mimesis… an activity whereby a subject perceives an object and represents (or expresses) that object back to itself.
> (Barker, 2009, 74)

[14] These underlying rhythms inform film and are used by cinematic writers, such as James Joyce. As Jeffrey Geiger writes of Joyce's *A Portrait of the Artist as a Young Man*: 'Just as Marey picked out his athletes' lines of muscular thrust in white, highlighting the integral rhythm of pure movement over individual shots of bodies, Joyce highlights particular motifs to foreground the distinctive rhythm of Stephen's developing consciousness through what he notices and recollects' (Geiger & Littau, 2015, 97).

**Conclusion**
Images of humans showing facial expression or postures of human motion, perception of causality and a sense of animacy in moving image are all affective. Gestures create responses in our embodied perception and animators have long used them to create engaging character animation. The expressive quality of movement is dependent on animation-tempo (see Key Terms). Abstract animation benefits from our perception of gestures, perception of causality and animacy. Change in speed and change in direction are enough to create animacy; there is no need for distinguishing features on the objects or in the background. The visual system infers causality and animacy in order to present the causal and social structure of the world. McLaren’s taxonomy of animation is supported by perception of causality and animacy. Embodied perception allows the mimicry of moving image, which extends to light, colour, space and even temporal structures. Human traces in relation to gesture have been examined from the point of view of an animator, with the aim of using these to aid making visual music that starts from the premise of expression and is affective. Animation-tempo will be central to the framework for composing visual music that is under development. Next, we will look at another vital human trace for creating expressivity – the voice.

## 2.3.3 Human traces: vocal expression

A key human trace for visual music is the human voice. Vocal expression, as a sound-making gesture, consists of timbre, prosodic, phonation type and non-phonetic vocalisation. The human voice has a unique power, as Walter Ong the historian and philosopher notes: ‘For man the paradigm of sound is voice… Voice is alive’ (Ong, 2001, 309). The importance of vocal expression both signalling and effecting emotions has long been studied; the founding father of evolutionary theory Charles Darwin highlighted the importance of the voice as the transmitter of emotion in animals and humans (Darwin, 1890).

Current neuroscientific research reveals that the auditory cortex has 'temporal voice areas' which 'respond more strongly to vocal sounds (speech or nonspeech)' (Latinus & Belin, 2011, 145). When speech stimuli are played both forwards and backwards, i.e. obliterating the linguistic content but leaving the voice timbre, the quality that differentiates one sound from another, even if the sounds have the same pitch and amplitude, is almost untouched. The response suggests that 'regions of higher-level auditory cortex might be more interested in the *vocal* nature of the speech stimulus that in its potential linguistic content' (ibid.). These areas appear in babies just a few months old and their presence in macaques points to an early development of this area specifically for voice processing. Therefore, the voice holds a privileged position in relation to other sounds, including other instruments with a wide timbral range.

Furthermore, as the tenor Kenneth Bozeman reminds us, the human sounds embodied in speech and singing are affective; these include breath, vocal expression and phonation type i.e. voice quality such as low and breathy or nasal or creaky (Bozeman, 2007). We all do something like singing when we make sounds and so, when we hear singing, consciously or unconsciously, we are aware that we embody the same type of instrument and in some sense sing along with the singer, in a way that is quite distinct from a non-violinist hearing a violinist play.[15] There is a strong sense of identification with the singer. Arnie Cox, a theorist of embodied cognition, explains how musical meaning is tacitly understood in an affective, embodied manner as the listener, often unconsciously, subvocalises the melody, imagining the muscle tension of the performer. Cox's 'mimetic hypothesis' (Cox, 2001) is corroborated by neurological studies.[16]

[15] Perceptual studies have confirmed that trained musicians are able to distinguish nuances of timbre and therefore expression in their instruments that are well beyond the capacity of the untrained (Chudy, 2016, 27).
[16] As in Gallese & Goldman (1998) and Footnote 9.

Many variables give recognisable uniqueness to human vocal expressions and this very uniqueness is a further humanising quality, increasing affect. This is true of speech and non-verbal vocalisations whether sung or spoken. Each person sounds unique as their sounds are shaped by their anatomy. The lungs push air through the vocal folds, which then resonates in the mouth and throat cavities (the vocal tract). The singers John Potter and Neil Sorrell liken this to a power supply, moving an oscillator and a resonator (Potter & Sorrell, 2012). Unlike other instruments, the lungs, vocal folds and vocal tract were not designed specifically to make music. Singers stretch the functionality of their vocal tract (primarily designed to prevent choking) in order to reach for the sounds they want to make. The particular qualities and shapes of the human flesh and bone of the singer, their tension or relaxation, plays a large part in determining the final sound. The singer’s mind and mood also affect their sound, their active, vocal gesture.

The voice has roles; it is individuating, socialising and communicating, even to oneself. As Schafer states: ‘Man likes to make sounds to remind himself he is not alone’ (Schafer, 1993, 256). It can also be revealing in a manner analogous to a cinematic close-up. As the soundscape composer Barry Truax notes, each vocal gesture both reveals the maker and, because we hear ourselves in a way in which we do not see ourselves, uniquely changes our self-image (Truax, 2001).

Vocalisations are a form of sound-making gesture, both in the sense that they are actions performed to convey feelings and in the sense of the composer Denis Smalley’s sound-making gesture:

> Sound-making gesture is concerned with human, physical activity which has spectromorphological consequences: a chain of activity links a cause to a source. A human *agent* produces spectromorphologies via the motion of gesture, using the sense of touch or an implement to apply *energy* to a *sounding body*. A gesture is therefore an *energy–motion trajectory* which excites the sounding body, creating spectromorphological life.
> (Smalley, 1997, 111)

Most sound has a strong forward impetus, a vectorisation, which means the sound cannot be reversed without changing. As Schafer elucidates, a gesture is a unique event; unlike a texture that is a fused aggregate of events, gestures cannot be built into textures and textures cannot be deconstructed into gestures, for example one drop of water falling layered over itself will not sound like a deluge and a deluge will not be deconstructed into one drop (Schafer, 1993, 15). Sounds have a shape-sound-symbolism, shape and structure, that changes slowly or rapidly and that carries symbolism and, when made by humans, emotion.

We listen for and relate to the emotions we perceive in others' vocal expressions and we remember emotional experiences more than non-emotional ones. Memories, the present context, reflective processes such as taking a perspective and imagination also play a part in forming feelings and emotions aroused by vocal expression (Shouse, 2005). This explains how different individuals can respond so differently to the same piece and how the same individual can respond differently on different occasions.

Vocal music clearly transmits gestural information. Sustained, sung notes are prolonged by breath; this elongates the gesture and makes the listener aware of every nuance of change. These notes afford the greatest development of variants, including tremolo (amplitude modulation) and vibrato (frequency modulation). As Trevor Wishart writes:

> vocal music where there is no socially-constructed mechanical intermediary – and particularly where performance practice has not become dominated by a notation-based system of theory – is the most sensitive carrier of gestural information. This reaches down to the level of timbre modulation, as well as amplitude and frequency modulation (vibrato and tremolo and *articulation* of all these) and up to all higher levels of sound ordering.
> (Wishart & Emmerson, 1996, 17–18)

Speaking voices usually range over about half an octave; dramatic speech can range over two octaves and vary in loudness from a whisper to a shout. Tempo ranges from slow to fast. Timbre ranges from expressive to dark or drab. The human voice has a particularly wide range of timbre that we intuitively understand at an affective level. Differences in timbre are vital for both perceiving and creating expressions of affect, so that different emotions, such as happiness and anger, can be communicated with similar amplitude, pitch and tempo (Patel, 2008, 350). Therefore, vocal expression has the potential to create more unanimity of affect than unanimity of emotion.

Mary Pietrowicz investigated vocal expression and nuanced understanding of emotion, finding that prosodic qualities of speech (intonation, stress, pitch, loudness, tempo, and rhythm) and non-verbal vocalisation (silence, sighs, groans or laughter) play a large part in what is perceived:

> Prosodic qualities are well-defined compared to many emotions, and may be useful in the recognition of emotion, given an improved understanding of the relationships among the classes of expressive elements in the voice.
> (Pietrowicz, 2017, 77)

Much of the gestural information is the phonation type, which creates repeated patterns. We pay a lot of attention to and give a lot of credence to phonation types,[17] which are so important to us that we discern them even if the speech is distorted through recording or playback. Phonation is ‘the first to be recognised and the last to be destroyed’ (Truax, 2001, 41). As Mary Pietrowicz articulates:

> Listeners also clearly hear the vocal qualities of effort levels, or phonation types, in the voice… whispering, breathiness, conversational speech, resonance, and creakiness... [and] nonverbal quality, such as laughter, expressive inhalation, sighs, groans, ‘um’ ‘ah’ filler, and silence. These elements, too, have relationships with emotions, voice quality, prosody, etc. which should be understood and exploited for the detection of nuanced emotion.
> (Pietrowicz, 2017, 77)

[17] The psychologist Albert Mehrabian found that, where the spoken words relating to feelings and attitudes were at variance with the facial expression and phonation-type messages, the words were not believed. The weightings given to facial expressions, phonation type and words were 55%, 38% and 7%, respectively (Mehrabian, 1971).

Given these prosodic and phonation-type features, sung sounds do not need words to generate affect and emotional meaning.

**Conclusion**
The power of the human voice to create embodied visceral affect is unique. This is both because we have specialised cerebral processing for vocal expression, separate even from linguistics, and because we, often unconsciously, mimic the muscle tension of a singer with a nuanced understanding not generally available for other musicians. Timbre is vital for both perceiving and creating expressions of affect, and the human voice is timbrally rich. The very uniqueness of individual voices further humanises the voice and makes it more affective. Vocal expression generates more unanimity of affect than of emotions. Vocalisations prolonged by breath demonstrate the most varied gestural information, which includes pitch, timbre, prosodic qualities and phonation type. For all these reasons, the sonic focus of this research is human non-verbal, vocalisation.

## 2.3.4 Does animation need to move?

As an animator, I face the vital question: how still can an animation be? This is broken down into several questions that underpin this section. Is the act of reading a painting a form of animation? What forms of dynamic expression can a viewer experience within a static image? Can a series of paintings be an animation? Is the recording of mark-making animation? Can a series of photographs of motion be regarded as a moving image? Why is slow meditative, contemplative looking engaging? In sum, what are some of the opportunities for composing visual music situated on the borders of the stasis and time-based or movement-based art?

**Is the act of reading a painting a form of animation?**
Paintings and photographs capture and privilege a moment in time. They are static and do not have the musical aspect of unfolding over time;

nevertheless, the viewer's gaze takes time to travel over the image. Elongated horizontal paintings, such as Robert Delaunay's *Windows Overlooking the City* (1912) (Figure 34), increase this temporal aspect. Paul Klee writes:

> Polyphonic painting is superior to music because its time is more spatial. The idea of simultaneity comes out more richly. The reflection in the side windows of a moving tram-car gives an idea of the backward movement I have in mind for music. Delaunay tries to follow the example of a fugue and put the pictorial accent on the time factor – this he does by choosing an immensely elongated format.
> (Klee, 1961, 520)

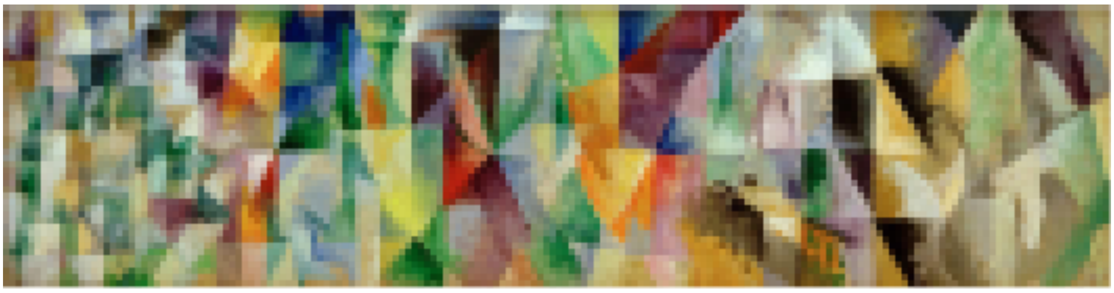


Figure 34. *Windows Overlooking the City* (Delaunay, 1912)

The elongated format allows the viewer to read the painting from left to right in a manner that foreshadows Viking Eggeling's scroll-drawings. In 1921, Eggeling created a scroll-painting, *Symphonie Diagonale* (Figure 35), a precursor to his film of 1923.

Figure 35. Part of the *Symphonie Diagonale* scroll (Eggeling, 1921)

Hans Richter describes the eye dynamically travelling over a scroll-painting produced with the contrast-analogy process, in which one part is balanced with another, a mode of looking that also becomes a satisfying feat of memory:

> [A]ttention from one detail, phase or sequence, to another that can be continued indefinitely. This is because the aesthetic theme is just that: the relationship between every part and the whole. In so following the creative process, the beholder experiences it as a process, not as a single fact. In this way, the eye is stimulated to an especially active

> participation, through the necessity of memorizing… the scroll, which offers sensations that the easel painting, by its very nature as a static form, cannot offer.
> (Richter, 1952, 81)

Creating abstract animation calls on the type of memorising and unusual imagination that Richter references in relation to beholding scroll-painting. Practising this type of viewing could aid both memory and imagination to support animation skills. Although scroll-paintings are not animated, beholding a scroll-painting may be an act of animation if viewed through an animator's eyes.

**What forms of dynamic expression can a viewer experience within a static image?**

First, an image can strongly imply movement, for example Paul Klee's *Fugue in Red* (1921). Second, an image can be clearly polyphonic, for example Klee's *Polyphonic Setting for White* (1930). Third, if the linear read of the image is removed by using a structure such as a spiral, the eye can be led in an infinite loop. In his watercolour *Fugue in Red* (Figure 36) Klee created a synthesis between art and music. He used his knowledge of musical polyphony – multiple harmonised voices – to structure the work. The work does not express a 1:1 relationship with music but rather his artistic response to music made visual. The forms range from those geometrically derived from rectangles, circles and triangles, to more figurative organic shapes, like buds and pods. Klee was a musician; here his visual response to music is to place forms so that they evoke musical notation. The vibrant, red, luminous forms seem to float out of the black, analogous to sounds appearing out of silence. These forms seem to be travelling, and are reminiscent of Klee's concept of form – form starting with a point that moves through space to create a line.

Each form in *Fugue in Red* has a trailing repetition, and each repetition is increasingly transparent, fading into the black background. All the trails fall to the left and behind the brightest forms. The brightest forms are also the smallest. The overall effect is analogous to overlapping notes gradually dying away and evokes musical polyphony and counterpoint. It is an exploration of relationships between time and space; both movement and time are implied within the space of the canvas. The work is in sympathy with early abstract films. Klee knew Walter Ruttmann (who created *Lichtspiel Opus I* in 1921) and would have seen abstract forms moving to music. He would also have been aware of Ludwig Hirschfield Mack's display of light and colour at the Bauhaus Week 1923. He met Eggeling and Richter, pioneers of abstract films created by painters who wanted to explore movement over time.

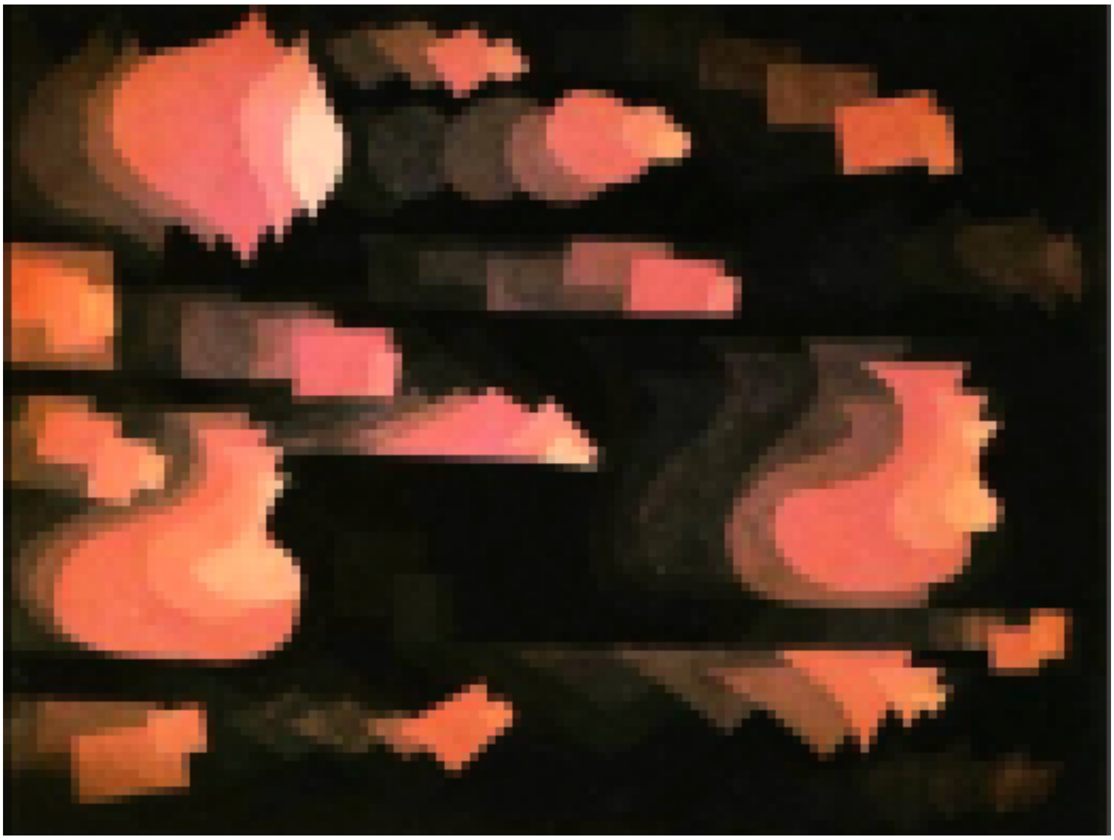


Figure 36. *Fugue in Red* (Klee, 1921)

Following *Fugue in Red,* Klee continued to explore polyphony and space in painting; an exemplar is his *Polyphonic Setting for White* (1930) (Figure 37). The overlaid rectangles spiral in and out, creating complex patterns. Although the watercolour is subtractive, the veil-effect of layers of transparent colour creates a luminous image that vibrates on the eye. The composition is analogous to hearing many voices simultaneously, to polyphony. Its subtle, overlaid repetitions and visual echoes are redolent with sound. Klee noted that temporal sequences could be analogous to the reading of lines of music or poetry. This linearity could be applied to the picture-plane but desire to avoid eyes leaping from the end of one line to the beginning of the next needs a solution, such as a spiral.

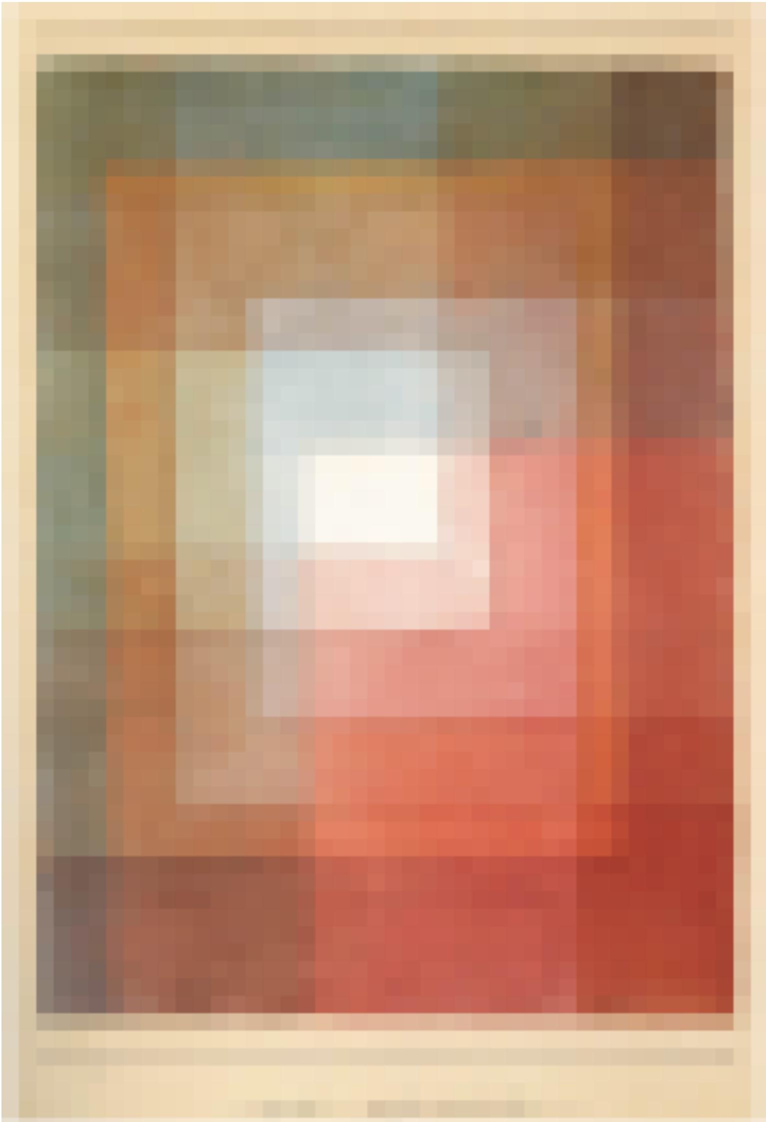


Figure 37. *Polyphonic Setting for White* (Klee, 1930)

In *Helix* (1932) (Figure 38), Klee proved his theory by creating a beautiful 2D-3D exploration using spiralling forms. These alternative solutions to creating dynamic expression – strongly implying movement, creating polyphonic images and using non-linear structures such as spirals – can also be applied to almost-still time-based imagery.

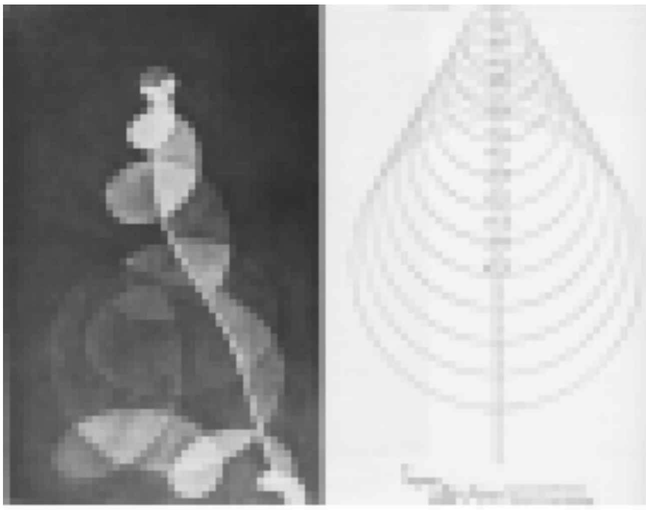


Figure 38. *Helix* (Klee, 1932) and *Progression* (Klee, nd) in (Klee, 1992, 82)

**Can a series of paintings be an animation?**

The painter Léopold Survage imagined his still images in movement. Arguably, he was the first to attempt to make an abstract film. Survage agreed with Kandinsky (and others) that all arts aspire to be like music: pure form unhindered by referential associations to the figurative.[18] Non-mimetic art could reveal another reality, based on supra-rational experience. Cinema was the apex of the visual arts because it could show rhythm in time as well as space, and rhythm exemplifies non-referential pattern (Figure 39).

Figure 39. *Coloured Rhythm: Study for the Film* (Survage, 1913)

[18] 'Painting today is still almost entirely dependent upon natural forms, upon forms borrowed from nature' (Lindsay and Vergo, 1994, 155).

Survage did not aim to create films to illustrate music:

> Coloured rhythm is in no way an illustration or interpretation of a musical work. It is an art unto itself, even if it is based on the same psychological phenomena as music.
> (Survage quoted in Russett & Starr, 1988, 36)

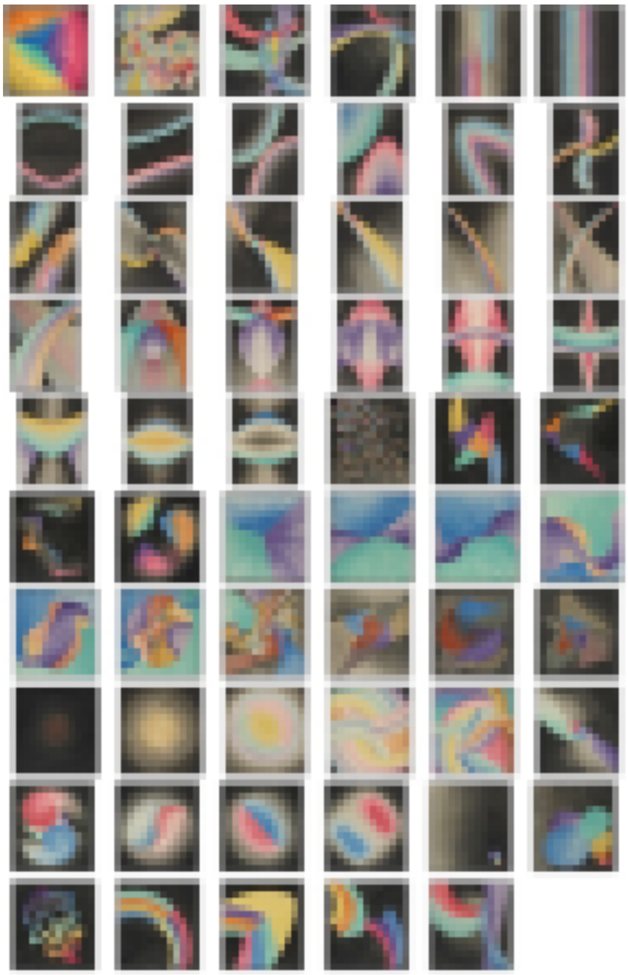


Figure 40. *Coloured Rhythm: Study for the Film* (Survage, 1913): 59 images placed in order to make possibilities for animation more apparent

Originally, Survage created over one hundred images, with the idea that technicians would animate them; he knew he was not an animator. Nevertheless, the images form a series, with some shapes recognisably morphing from the previous shape and providing visual surprises; some are like cuts and others involve a change in scale or perspective. They are tantalising in that it is possible to arrange them (Figure 40) and mentally animate them into a cohesive sequence if one fills in the gaps by imagining the motion that could enable one image to transform into another. However, no one will ever know if their own imagining conjures up what Survage had in mind, as the First World War began and the film was never made. In 1914, Gulliame Apolinaire praised Survage for creating a new artform, separate from static painting and from cinema:

> One can compare Colored Rhythm to music, but the analogies are superficial and it really is an independent art having infinitely varied resources of its own. It draws its origin from fireworks, fountains, electric signs and those fairy-tale palaces, which at every amusement park accustom the eyes to enjoy kaleidoscopic changes in hue. [It] will render its followers infinitely sensitive to the movement of colors, to the interpenetration, to their fast or slow changes, to their convergence and to their flight, etc.
> (Apolinaire quoted in Russett & Starr, 1988, 38)

David Hockney (2001) has written about any drawing always being more like another drawing than the depicted object. This holds true for Survage's images; they are undeniably more about abstract painting than about animation, even though they foreshadow abstract animation. They show some use of sequence and some understanding of the use of continual change of shape and colours out of black that McLaren uses to such effect to create surprises in *Blinkity Blank* (1955). But they lack the element of surprise that an animator can create through timing.

**Is the recording of mark-making animation?**

Painterly animation can incorporate painterly gestures by recording the mark-making, as in David Hockney's time-lapse i-Pad paintings (Figure 41). These show meaningful movement, not only of Hockney's characteristic marks but of how the artist looks, how his gaze alights on different elements within the scene and how he layers and builds up the work. This image sequence recalls Klee's emphasis on process over finished form (Section 2.3.1). It shows how flexible Hockney's process is, how he responds by emphasising different nuances of the scene and how he responds to the light changing as he paints. It is fascinating to see; even Hockney himself was surprised to see his own act of painting revealed over time (Hockney, 2017). The time-lapse recording makes concrete the enormous differences between photographic-looking and painterly-looking. However, the animated marks describe the painting of objects without animating the objects or the scene.

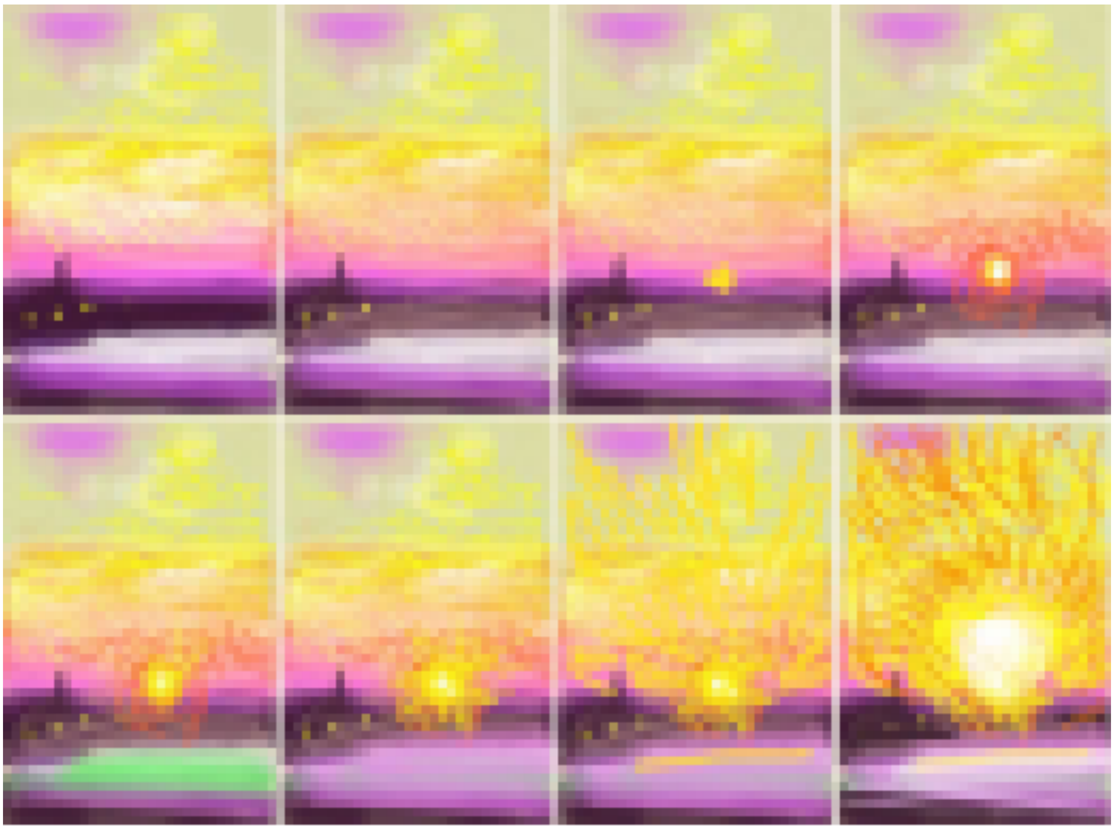


Figure 41. Stills from *Sunrise* (Hockney, 2009)

The time-lapse is not created as animation per se but as an archive of process that both delineates and signifies the process of looking and painting. Action painting, as performed by Jackson Pollock or the Belgian artist Henri Michaux, creates a static trace of gesture. Given the universality of the perception of causality and animacy, the desire to create a universal language from signs based on gesture seems apt. Michaux had this aim:

> Michaux wanted to produce graphic signs indexing the tempo and quality of the body's movements. The conceit was that these signs, based on human gestures, would be legible to all. In this dream of a common language, inscription would be an emanation of the organic body; signs would be motivated, registering types and quantities of physical force.
> (Noland & Ness, 2008, 134)

However, as Michaux found, the possibilities of creating a language were subsumed by his mark-making.

> Michaux, in movement, has not rediscovered some originary, essential way of moving, but only a way of moving *as a body that inscribes*. The movements that define him are still those associated specifically with the gestural routine of inscription, and further, the dimensions of the page continue to circumscribe the space within which this self can be performed.
> (Noland & Ness, 2008, 175 [original emphasis])

To sum up, whereas, gesture will give a form significant movement and bring a form to life, correlating the process of drawing or painting to animation is problematical.

**Can a series of photographs of motion be regarded as moving image?**
The French scientist and chronophotographer Étienne-Jules Marey wrote that recreating movement as we perceived it: 'would be attended by all the uncertainties that embarrass the observation of the actual movement' (Marey cited in Braun, 1994, 174).[19] Marey did not anticipate how powerful cinema would become. Frozen moments of movement caught over time allude to motion but remain fragmentary, unlike time-based imagery. Deleuze notes: 'Marey's graphic recordings and Muybridge's equidistant snapshots, which relate the organised whole of the canter to any-point-whatever' (Deleuze, 2005a, 6). In film, unlike painting or photography, the subject is described not in a unique, privileged moment or pose but in the continuity of their movement, which has its own cohesion. Time-based screen images, film-images, are temporal, perceived in time and evanescent. Film-images can manipulate time: slow motion filmed at high speed or created in post slows down time, whereas frame-by-frame, time-lapse or reducing the number of frames through cutting or merging in post speeds up time. However, film-images can never freeze an instant, a fraction of a second, for ever, in the way that photography does. Movement is not added to still-frames to create moving image – time-based images are a different type of image altogether. A

[19] Marey to Demeny, 29 March 1889, Cinematheque Francaise. Demeny however, grasped and tried to exploit the commercial opportunities of nascent cinematography.

‘movement-image’ is fluidly created as it is perceived and never has a frozen, concrete form. As Deleuze states:

> cinema does not give us an image to which movement is added, it immediately gives us a movement-image. It does give us a section, but a section which is mobile, not an immobile section + abstract movement.
> (Deleuze, 2005a, 2-3)

In 1927, Moholy-Nagy, who experimented across diverse media including paint, photography and film, also built sculptures to research moving light, photogram, photomontage and photo-sculpture. He debated whether static painting was still necessary, considering the effect of time-based images on the observer who no longer has the luxury of contemplation but:

> [I]s forced almost to double his efforts immediately in order to be able simultaneously to comprehend and to participate in the optical events. Kinetic composition so to speak enables the observer’s desire to seize instantly upon new moments of vital insight, whereas the static image generates these reactions slowly. This indicates that there can be no doubt about the justification of both forms of creation.
> (Moholy-Nagy, 1987, 23)

He further contextualised his conclusion that moving and static are both justified, just as printed literature and radio/talking-film/theatre are justified (Moholy-Nagy, 1987).

Although time-based imagery and static imagery are distinct, almost-still fixed-media time-based imagery can benefit from an understanding of viewing still images. Frame-aspect ratio and resolution could be regarded in relation to the effect of viewing scroll-painting. My first encounter, at the International Broadcasting Convention, with high-definition widescreen felt as though it freed my eyes to move around the screen and enjoy the details of the footage at my own leisure. It felt like a new viewing experience. As high definition evolves and screens expand, the technology needed to refresh the eye in this way seems always to be the technology at the cutting edge. For example, a perceptibly brighter screen or a higher-resolution display than is currently the norm will always seem refreshing.[20]

**Why is slow, meditative, contemplative looking engaging?**

Time-based imagery can change so slowly that it is impossible to perceive as it happens. Think of a very slowly darkening sky. You know that it has changed after fifteen minutes or so but moment to moment nothing seems to change. You sense that the sky is transforming but you cannot catch the moment of change. You become aware of time as an entity. The artist Andy Warhol used this to great effect in *Empire* (1964), a film created in order ‘to see time go by’ (Warhol quoted in Angell, 1994, 3).

Figure 42. *Empire* (Warhol, 1964)

Warhol filmed the Empire State Building in 1964 from 8.06pm on 25 July to 2.42am on 26 July, using a 16mm Auricon camera mounted on a tripod in a room on the 44th floor of in the Time-Life building looking directly at the

[20] Works created using a great variety of techniques, processes and technologies – from watercolour paintings to i-Pad paintings – have been discussed. Ever-evolving technology offers opportunities and challenges for producing creative works and changes our view of pioneering works. See Sherwin on film versus video (Lumière, 2011), and Kuivila for strategies for using technology (Kuivila & Behrman, 1998, 13).

building. The film consists of one, mute, stationery shot (Figure 42). He started filming just before sunset and filmed into the night. He used ten reels of 1200ft ASA 400 Tri-X stock, push-processed to ASA 1000 to allow for the dark sky (Angell, 1994, 15–18).

As P. Adams Sitney proposes, the slowness of Warhol's silent films made in 1963 and 1964 is to:

> outlast [the] viewer's initial state of perception [so that] by sheer dint of waiting, the persistent viewer would alter his experience before the sameness of the cinematic image.
> (Sitney, 2002, 351)

This degree of push-processing resulted in graininess that highlights the medium, film, as the film is projected. Warhol lengthened the duration of film on projection; he filmed at 24 frames per second, then he projected the film at 16 frames per second. In the first reel, the sun slowly sets, then the building's floodlights are turned on, transforming the scene. Then little else happens until the floodlights are switched off, plunging the building into darkness in the penultimate reel. The sense of time passing is marked by a light on the Metropolitan Life Insurance Company tower, in the far distance, that flashes every 15 minutes in real time and one third slower when *Empire* is projected. It also flashes the hours (nine flashes for nine o'clock, etc.), marking the progression through the night. As Angell notes 'it is therefore possible to follow the exact time of shooting throughout the entire film and, quite literally, "see time go by"'(Angell, 1994, 16).[21]

The cameraman for *Empire*, Jonas Mekas observed:

> Empire is an experience, there are many things that happen. At first, when watching the film with other people, everybody's sort of sceptical, they think: this will be so boring, that they will be leaving soon... And then, as time goes by, they begin to relax, to enjoy, to just watch the

[21] In diametric contrast, Christian Marclay's *The Clock* (2010) constantly reminds the beholder of the time through constructing one 24-hour film from about 12,000 moments from diverse films. *The Clock* is played in sync with the actual time of day. The soundtrack, created from interweaving the clips, is vital to creating cohesion. The audience comes and goes freely during the performance.

> screen when nothing really much happens. There's some dust, and then, one hour or so into the film, the light comes up! This huge, incredible event happens when the building lights up. So, of course, everybody applauds, it's a great moment. And then, again, you relax, and you watch, there's some light activity, the building is there, it becomes like a meditation.
> (Mekas quoted in Flanagan, 2012, 52)

Mekas, in Sitney's terms, 'altered his experience' as he waited while he watched *Empire*. Mekas' glowing description clearly states the new experiential possibilities that the non-narrative, durational, 'slow-cinema' style of *Empire* enabled. Slow cinema is:

> the application of the long take, an undramatic narrative or non-narrative structure, a tendency toward realist or hyperrealist representation, and a pronounced stillness of composition and visual content.
> (Flanagan, 2012, 2)

However, at the time, Warhol's reduction of events aroused criticism; *Empire* was not well understood or well received. Warhol was puzzled by the public response, as his films were his response to his own fascination with the visual. As Ronald Tavel observed to David James:

> [Warhol] would sit and watch [his own films] for endless hours… and he was puzzled why the public wasn't equally fascinated… He said to me 'why don't they come in droves to see *Empire*?' So we should not think that these films were not interesting to him or that he didn't want them to be interesting. As with any visual artist, the entire visual world was fascinating to him.
> (Tavel quoted in James, 1995, 51)

*Empire* and Michael Snow's *Wavelength* (Snow, 1967), a 45-minute long zoom from a wide of a NY loft space to a close-up of a photo on the far wall, influenced the artist Anthony McCall:

> [*Empire* and *Wavelength*] seemed to relate to the way that I was already approaching performance, where duration was largely determined by the time taken to realize the unfolding of a set of rules. What I ultimately admired about each of these films was their conceptual clarity.
> (McCall, 2003, 59)

This slow, meditative, contemplative form of looking allows repetition to be a source of fascination. John Cage said:

> Andy has fought by repetition to show us that there is no repetition really, that everything we look at is worthy of our attention. That's been a major direction for the twentieth century, it seems to me.
> (Cage quoted in McShine & Rosenblum, 1989, 13)

Warhol was familiar with and influenced by the work of John Cage (Warhol et al., 2008) before he attended *Vexations* directed by Cage at the Pocket Theatre in New York. Erik Satie composed *Vexations* (1893) as a chordal passage of about 80 seconds to be slowly and very softly repeated 840 times. On 9 and 10 September 1963, the recital lasted 18 hours and 40 minutes; Warhol stated that he heard all of it. This use of repetition influenced Warhol's film *Sleep* (1963), which he created from loops of film of the poet John Giorno sleeping. He restructured the loops to evoke the poet breathing and created a film lasting six hours. The understanding that the repetition of an event is viewed differently on each repetition could be said to stem from Heraclitus (544BC): 'you cannot step twice into the same river'.[22] The slow, contemplative looking that helps each repetition to be perceived differently recalls the psychologist Stephen Kaplan's description of 'soft fascination' in nature:

> Many of the fascinations afforded by the natural setting might be called 'soft fascination.' Clouds, sunsets, snow patterns, the motion of the leaves in a breeze – these readily hold the attention, but in an undramatic fashion. Attending to these patterns is effortless, and they leave ample opportunity for thinking about other things.
> (Kaplan, 1992, 81)[23]

Deleuze describes the type of 'time-image' that can be read as 'empty', which enables a particular form of re-linking to knowledge, memory and imagination that give the image that is being read 'fullness'.

---

[22] There is scholarly disagreement on whether both the person and the river have changed and whether the river is a case of unity of opposites – flowing on, changing – but being the same river (https://plato.stanford.edu/entries/heraclitus/).

[23] There is a growing literature on enhancing and restoring positive psychological states through nature to counter the stress of urban living. Studies such as Herzog & Strevey (2008) find that, unlike urban settings, natural settings and visual simulation of natural settings improve mood and reduce autonomic arousal.

> An empty space, without characters (or in which the characters themselves show the void) has a fullness in which there is nothing missing. Disconnected, unlinked fragments of space are the object of a specific relinkage over the gap: the absence of match is only the appearance of a linking-up which can take place in an infinite number of ways.
> (Deleuze, 2005b, 235)

This reading of the visual image endows the image with a new character:

> [T]he visual image for its part reveals an archaeology or a stratigraphy, that is, a reading which concerns it in its entirety, and concerns it uniquely. The aesthetic of the visual image therefore takes on a new character: its pictorial or sculptural qualities depend on a geological, tectonic power as in Cezanne's mountains.
> (ibid., 236-7)

Deleuze's revelation of 'time-image's stratigraphy' links the cinematic image back to the pictorial image. 'Empty' 'time-images' become as rich and full as static images. Slow, meditative, contemplative looking supports this aspect of phenomenological perception.

**Conclusion**

A series of paintings can allude to animation, can prompt the imagination to conceive of how they might flow together. However, a critical aspect of animation – surprise – is lacking. Similarly, a series of photographs of motion only alludes to motion. The recording of drawing and painting is a useful archive process but is not synonymous with animation of gestures.
However, there are many opportunities for composing visual music situated on the borders of the pictorial and the cinematic. Dynamic expression, through strongly implied movement, polyphonic images and using non-linear structures such as spirals, can enable a viewer to experience movement in a static image. Almost-still, fixed-media, time-based imagery can let the beholder's gaze travel over the image, as if looking at a painting. Slow meditative, contemplative looking is engaging because the viewer becomes aware of time as an entity; the viewer changes their own experience before the almost-still cinematic image, and repetition becomes a source of

fascination. The richness of a pictorial image can be found in a cinematic image via both soft fascination and re-linking the empty image, making it full.

## 2.4 Adding sound – audio-visual structures

The relationship between audio and visuals and our perception of this relationship is key to creating engaging visual music. That sonic elements and visual elements can be created separately and then merged together in innumerable ways is taken for granted. As Walter Murch states of film:

> the possibility of re-association of image and sound is the fundamental stone upon which the rest of the edifice of film sound is built, and without which it would collapse.
> (Murch quoted in Chion et al., 1994, xix)

Re-association of image and sound is easy to achieve but, paradoxically, the consequences are nothing less than highly complex. In this section, we consider visual music in terms of how sound and image relate together across: audio-visual perception, rhythm and audio-visual synchronisation, mapping, and composing visual music.

### 2.4.1 Perception of sound, visuals and audio-visuals

Visual musicians, exemplified by seminal artists such as Jordan Belson, have the ambition to communicate in a similar manner to musicians.

> I don't want there to be any ideas connected to my images, and if there are any there, if anybody sees any, those are entirely in the eyes of the beholder… Actually, the films are not meant to be explained, analyzed, or understood. They are more experiential, more like listening to music.
> (Belson in Brougher et al., 2005, 148).

One concept of treating light, form, colour and motion as if it were music was realised by Wilfred (Section 2.2.4). However, his solution was mute. Creating a satisfactory unity between light, form, colour and motion and music, is fundamental to composing visual music. How best to achieve this? In 1930, the theorist Adrian Klein posited:

> [S]omehow or other, we have got to treat light, form and movement, as *sound* has already been treated. A satisfactory unity will never be found between these expressive media until they are reduced to the same terms.
> (Klein cited in Sykes, 2015, 148)

The idea of reduction is contrary to the thrust of this thesis. In order to understand how much 'light, form and movement' would need to be 'reduced' in order to treat it on the same terms as sound, or how much sound would need to be 'reduced' to treat it on the same terms as 'light, form and movement', we will examine our physiological, cognitive and emotional responses to visuals and sound.

**Hearing and sight**

Hearing and sight function very differently; we process acoustic waves into a perception of sound in a completely different way from how we process electromagnetic waves into vision. Our visual perception system allows us to see details at a distance and the whole image appears at once. We turn our heads and sweep our vision around and to discern the surroundings from all directions; we gaze again to discern more details. Hearing arrives from all directions at once, and, because the acoustic data do not arrive simultaneously at our two ears, we gain spatial information. We can control how we listen; we tend to listen for change. According to Truax, in a passive listening state no sound is focused on and the emotional effect of the general soundscape is absorbed (Truax, 2001). It is very difficult to create a passive looking state; arguably, some of James Turrell's work allows this; Kaplan's soft fascination also allows a flux between focused and passive viewing. We cannot differentiate events in low frequencies of sound, below 20–25Hz. In this infrasonic range, vibrations are not heard but felt as a rhythmic pulse. There is no visual equivalent to this. Some perceptions are unique to eye or ear: whereas colour is experienced only visually, for example, pitches and the interrelationships between pitches are experienced only auditorially.

However, there are some similarities between perception of vision and sound, as noted by Schafer (1993, 12). Perception of rhythm, texture and material affect both senses. It is possible to reverse figure and ground; in audio, Truax (2001) terms this the 'cocktail-party effect' which allows listeners to foreground different voices. It is impossible in vision and in sound for something to be both figure and ground simultaneously. Listening, like viewing (Section 2.2.2), can be affective. Music can create physiological and psychological responses to modes, percussive quality and tempo (van der Zwaag et al., 2011). Music can also provoke emotions causing a reinforcing cycle: the listener attends to both the music and their own reaction more closely. Generally, this process is implicit: 'Our own mind seems to react automatically to music. We sense no effort; music is re-creation, but yet it is the listener's re-creation' (Grewe et al., 2007, 313). Similarly, though it is proposed that images do not have such a direct effect on emotions as music (Chion et al., 1994), when images do provoke emotions, we view the image and our own reaction more closely. Emotional responses to music and images are influenced by individual hinterlands, prior experiences, expectations, memories, associations and the context of the sound or image.

**Perception of audio-visual works**

When viewing audio-visual works, physiological, perceptual, cognitive and emotional effects are intertwined. Audio-visual pieces have a different effect from audio or visual pieces alone, as the seminal editor Walter Murch points out: 'We never see the same thing when we also hear; we don't hear the same thing when we see as well' (Murch in Chion et al., 1994, xxii). Audio greatly affects what we see on many levels including animacy. Animacy is affected by the relationship of the visuals to a soundtrack, as demonstrated by two key studies. Thayer & Levenson (1983) used Heider and Simmel's visuals and compared and contrasted an allegro and an adagio movement from Prokofiev's fifth symphony as the soundtrack. They demonstrated a relationship between the connotations of the soundtrack and audience interpretations of the animation. The perception of speed within a moving image, and therefore also expressive quality, is thus affected by music and sounds, which underscores dynamism and motion as well as creating a more dance-like stylisation (Arnheim, 2007, 187). Marshall & Cohen (1988) found that music seems to do more than provide mood for the visual scene:

> [C]hanging the meaning of the film and its components on the activity dimension does not depend upon changing the overall salience of that

> dimension in the background music. Changed meaning however, may depend upon perceived temporal congruence between music and the film… [C]ongruence between internal structure of film and music alters the attentional strategy to and subsequent encoding of information in the film... the pattern of attention to music alone or film alone is altered under conjoint presentation.
> (Marshall & Cohen, 1988, 110)

We tend to make the vision the figure and audio the ground in audio-visual pieces; we watch audio-visual works and appreciate their sound, for the most part, visually. Rudolf Arnheim suggests: 'the ear is the tool of reasoning; it is best suited to receive material that has been given shape by man already – whereas seeing is a direct experience, the gathering of sensory raw material' (Arnheim, 2007, 195). However, sound generally has more of a direct physiological effect than vision, for example film viewers' breathing can be changed by the breathing noises on the soundtrack of a film. The direct effect of sound may be due to how sound is experienced; sound is in the air, surrounding viewers. In contrast, screen-based images are localised to the screen. As the theorist and composer Michel Chion observes: 'sound more than image has the ability to saturate and short-circuit our perception' (Chion et al., 1994, 33). Unlike the eye that points outwards, the ear has no lids and sucks in information (Schafer, 1993, 2).

Given that, as discussed in Section 2.2.1, synaesthesia is not ubiquitous and synaesthetic mappings tend to be individual, the more immersive quality of audio-visuals is trans-sensorial in nature (Chion et al., 1994). Although some perceptions such as colour and pitch are unique to the eye or ear, the majority of perceptions, including perception of rhythm, texture, and material, affect both senses. Jean Mitry, the film theorist and co-founder of the Cinémathèque Française quotes Eisenstein:

> [M]usical and visual 'imagery' are not actually commensurable through 'representational' elements… genuine and profound correspondences and proportions between music and image it can only be with reference to the relationships between the fundamental movements of the music and the image, i.e. between the compositional and structural elements
> (Eisentstien quoted in Mitry, 1997, 260)

and disagreed with him. Mitry argued that literal translation, for example ‘associating a descending scale with a character walking down a staircase’ (Mitry, 1997, 260) does not add to the viewers’ experience. He also noted that the same was true of illustrating music with literal images. His solution was to start with the music and

> [A]ccompany music with abstract drawings… punctuating the music [in the manner of Fischinger or MacLaren]… [or the] representational forms are sufficiently vague to be evocative in their own right, extending the musical impressions without ever ‘illustrating’ them.
> (Mitry, 1997, 264)

And, indeed, ‘extending the musical impressions’ without ‘illustrating’ them is one of the main challenges facing composers of visual music.

### ***Acousmêtre***

For this reason, acousmatic sounds and the faceless ‘*acousmêtre*’ feature in this research. Acousmatic sounds are defined by Pierre Schaeffer as ‘sounds one hears without seeing their originating cause’ (Schaeffer quoted in Chion et al., 1994, 71). When the originating cause of the sound remains hidden, the source remains mysterious; ‘the cause is heard on the soundtrack while its consequences shimmer in the image’ (Chion et al., 1994, 60). Often, acousmatic ‘active offscreen sound’ (ibid., 85) is used to introduce a character and then the perceiver sees the character. In contrast, there is a special personified instance of acousmatic sounds defined by Chion as:

> [An] acousmatic character whose relationship to the screen involves a specific kind of ambiguity and oscillation… We may define it as neither inside nor outside the image. It is not inside, because the image of the voice's source – the body, the mouth – is not included. Nor is it outside, since it is not clearly positioned offscreen.
> (Chion et al., 1994,129)

The omniscience of the powerful *acousmêtre*, ‘neither inside nor outside the image’ allows a special relationship between the audio and the image. There is an individuating voice but no individual face to embody and humanise the voice. This gives the voice a special power and creates an audio-visual relationship that has strong bonds: bonds in which the sync is not tied to lip-movements, and can be much freer. Thus, using an *acousmêtre* adds to the unique power of the human voice (Section 2.3.3).

**Metaphoric use of sound**

Forms such as music, radio and silent film are less sensorially complete than audio-visuals and so allow members of the audience to engage their imaginations to fill the sensory gaps. The equivalent mode of engaging the audience in an audio-visual work is the metaphoric use of sound, i.e. re-associating less-expected sounds with images to enrich their relationship by adding a measure of ambiguity.

> [T]o create a purposeful and fruitful tension between what is on the screen and what is kindled in the mind of the audience – what Chion calls sound *en creux* (sound 'in the gap')… the metaphoric use of sound is one of the most fruitful, flexible, and inexpensive means: by choosing carefully what to eliminate, and then re-associating different sounds that seem at first hearing to be somewhat at odds with the accompanying image, the filmmaker can open up a perceptual vacuum into which the mind of the audience must inevitably rush.
> (Murch in Chion et al., 1994, xx)

To make this metaphoric use of sound possible, the viewer must accept Chion's 'audio-visual contract': 'the elements of sound and image to be participating in one and the same entity or world' (Chion et al., 1994, 222). Clearly, this is predicated on the viewer being able to bridge the gap between the 're-associated' sounds and images. This leads to an examination of the relationship between similarity and difference that is at the core of audio-visual media. The musicologist Nicholas Cook analyses the relationship of vision and audio in this way:

> The pre-condition of metaphor – and if I am right, of cross-media interaction – is what I shall call an enabling similarity… Rather than simply representing or reproducing an existing meaning, it participates in the creation of a new one.
> (Cook, 2000, 70)

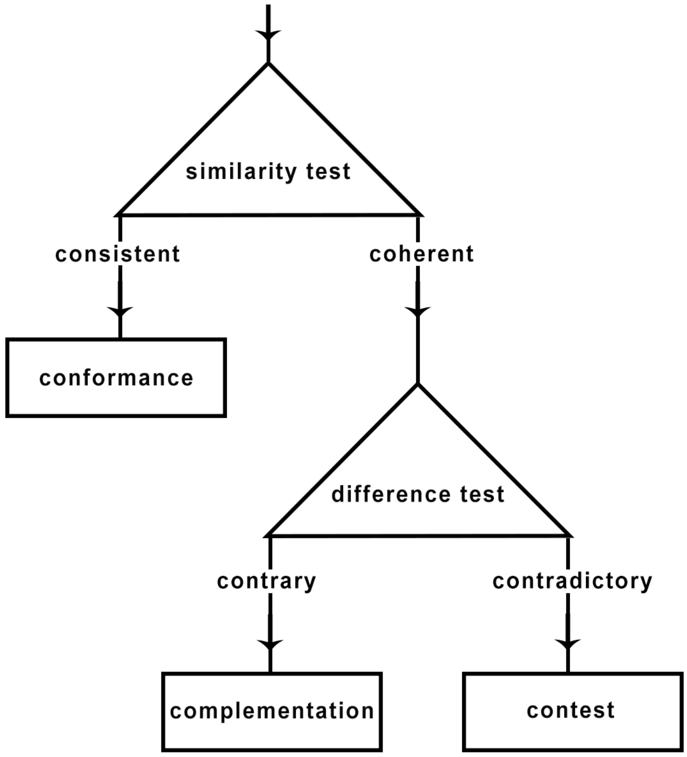



Figure 43. Relationship of vision and audio (based on Cook, 2000, 99)

What Cook's diagram (Figure 43) means is that when the images and audio are not so similar as to be redundant, nor so different as to be contradictory and in contest with each other, the images and audio dynamically complement each other and thus a new meaning is constructed. Each audio-visual work needs moments of conformance, complementation and even contest. If the sounds support the images, the audience will remember the images more readily and understand the images more rapidly; this enables a faster and deeper immersion in the work. This research aspires to create work that allows sensory gaps that maximise the audience's imagination.

The artist Anthony McCall takes a different, and subtle, approach to sound; he records his digital imagery back onto film in order to use an older, mechanical means of projection, a 16mm projector, to provide meaningful, unobtrusive sound based on process. Additionally, this sub-audible soundtrack frees the spectator-participants to add random sounds by talking to each other. As he observes:

> Digital projectors operate in sepulchral silence. It may seem incidental, but I think that the rhythmic whirring sound of a film projector is important… there's a kind of cover that I think gives individuals some privacy but at the same time allows them to keep in contact.
> (McCall cited in Walley, 2004, 74)

Given the challenges outlined above and the opportunities afforded by visual music being 'typically non-narrative and non-representational' (Evans, 2005, 11) different approaches, such as McCall's, could open up new avenues of composition.

**Conclusion**

Creating unity between visuals and sound poses fundamental challenges because our physiological, cognitive and emotional responses to visuals and sound are very different. However, there are some similarities between perception of vision and sound, and perception of rhythm, texture, and material affect both senses. We are subject to intertwined physiological, perceptual, cognitive and emotional effects when we view audio-visual works and what we hear changes what we see. In audio-visual pieces, vision tends to be the figure, and audio the ground. Nevertheless, sound generally has more of a direct physiological effect than vision; sound is in the air, surrounding viewers, unlike localised screen-based images. The immersive effect of audio-visuals is not due to synaesthesia but is trans-sensorial.

When sounds support images, there is a faster and deeper immersion in the work. A major challenge for composers of visual music is to extend musical impressions without 'illustrating' them. Using acousmatic sounds and an *acousmêtre* support this aim. For audio-visuals to create new meaning, there needs to be a balance between the images and audio so that they dynamically complement each other and are neither redundant nor in contest for too long. Audio-visuals are more sensorially complete than audio or vision alone. Viewers' imaginations fill sensory gaps such as those created by the metaphoric use of sound in audio-visuals. This research aspires to create work that allows sensory gaps that maximise the audience's imagination.

### 2.4.2 Rhythm and audio-visual synchronisation

Rhythm plays an essential part in the work of visual artists as diverse as Turner, Pollock and Klee. Klee not only used visual rhythms in his work but also proposed how rhythmic dividual elements could be synthesised with other elements in his visual framework (Section 2.3.3). Perception of rhythm affects both vision and hearing and, therefore, creates a tangible link between audio and visuals. Rhythm is a vital component in creating a meaningful synthesis of vision and audio. The visual music instrument designer and composer Fred Collopy concludes that:

> Rhythm has played a particularly important role in the thinking of painters who have been interested in the relationship of music to their work. There is a rhythmic element to each of the three dimensions. The changing of colors is rhythmic, the ways in which forms are arranged (even in static images) is often described in terms of rhythm, and movement in time is inherently rhythmic. This suggests that rhythm constitutes a particularly rich point of entry for the design of instruments and for the development of technique for playing visuals in performance with music.
> (Collopy, 2000: 360)

In non-representative work, the role of rhythm is crucial in determining whether the result of Cook's difference test is 'contrary' resulting in 'complementation', or 'contradictory' resulting in 'contest'. Completely arrhythmic, asynchronous audio-visuals are likely to be contradictory and result in contest. However, completely synchronous work is likely to conform too much, and to feel over-predictable, with too much redundancy. Guy Sherwin is known for his simple but effective experiments physically treating celluloid to explore audio-visual sync. Sherwin's *Phase Loop* (1971) cycles through the results defined by Cook. *Phase Loop* was made without a camera. Sherwin punched a hole every $24^{th}$ frame and made a single scratch in the soundtrack every $26^{th}$ frame; the result is 12 evenly spaced flashes of light with 11 tapping sounds gradually falling out of sync and then (because the piece is looped) catching up. Every 12 seconds, the piece begins with absolute audio-visual synchronisation that is gradually lost (Figure 44).

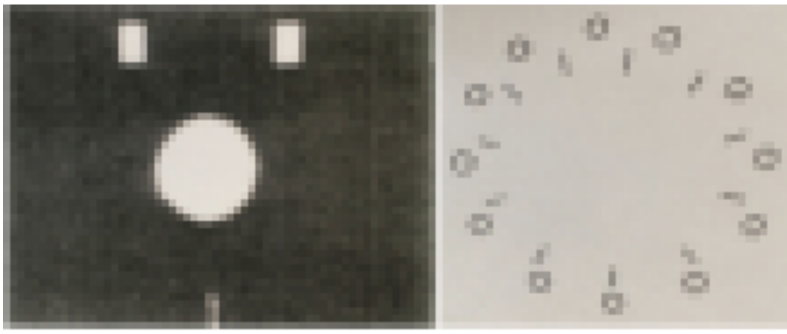


Figure 44. *Phase Loop*: a single frame with a hole punched and a diagram showing the audio-visual sync (Sherwin et al., 2007, 11)

Sherwin elucidates:

> Contained in this simple loop, divided between the senses of sound and sight, is a microcosm of film's temporal experience: synchronization and its loss, repetition, reflection, syncopation, anticipation, resolution.
> (Sherwin et al., 2007, 11)

*Phase Loop* has an elegant simplicity in its construction but appears as a complex audio-visual rhythm. It demonstrates how easy it is to dis-unify the senses of sound and sight through audio-visuals.

Perception of musical rhythm has been extensively researched. Musical timing and tempo rely on the individual listener's perception and cognition: the listener organises their understanding of a rhythm. Generally, rhythm helps to organise the whole, from the unimaginably vast to a brief instant, by dividing it into parts (Schafer, 1993, 18). As Henkjan Honing, the Dutch theorist of music cognition concludes: 'A listener does not perceive rhythm as an abstract unity, as is notated in a score, nor as a continuum in the way that physicists describe time' (Honing, 2013, 380). The Flemish musicologist Mark Leman has found physiological correlations for rhythm, looking at the effects of embodied phenomena, such as walking speed and heart rate, on the perception of pulse and tempo (Leman, 2008). Our bodily experience of our own heartbeat and breathing appears to affect how we experience rhythm, and our sense of musical tempo – fast, medium or slow – is based on a resting heart rate (Iwanaga, 1995). Just as visual scale relates to the human body, as Klee asserted (Section 2.3.1), so the human body provides a measuring scale for rhythm. Fast and slow, agitated and relaxed are measured against breathing, with a normal three-to-five-second cycle and a resting heartbeat of around 70 beats per minute. Waves at about seven seconds per cycle are felt to be similar to a calm breathing rate. The pulse is identified by Smalley (1997) as the smallest rhythmic structure in tonal music. Absolutely regular rhythm is only mechanical; we always slightly vary.

Listeners categorise metres and rhythmic genres from their remembered experiences (Snyder, 2000) and form expectations of both. This applies to periodic temporal structures and changing temporal structures such as a bouncing ball, or speech. ‘We actually tend to hear rhythm and timing in what one might call “clumps”’ (Honing, 2013, 380). Putting the beat into the hierarchy of a rhythm structure may be (statistically) learned. We favour the rhythms we know best, and have an innate skill to find a musical pulse when listening to a varying rhythm (Honing, 2012). We are particularly attuned to listening for the onset of beats, as, in evolutionary terms, prediction is a powerful tool (Huron, 2007): so the onset, the very start of the beat, garners most attention.

Audio-visual rhythm has some similar effects:

> Rhythm is an element of film vocabulary that is neither specifically auditory nor visual… the phenomenon strikes us in some region of the brain connected to the motor functions and it is solely at this level that it is decoded as rhythm.
> (Chion et al., 1994, 136)

Audio-visual synchronisation relies on the coincidence of action in the image with an auditory emphasis such as a beat to create ‘sync points’. Chion defines these as: ‘Audio-visually salient synchronous meeting of a sound event and a sight event’ (Chion et al., 1994, 233). Synchronous points are similar to a musical chord in that they vertically divide the audio-visual flow, shaping it and creating phrases. Audio-visual phrasing of the sequence involves determining and using ‘the primary synch points that are crucial for meaning and dynamics’ (Chion et al., 1994, 190). Moreover, each sync point emphasises a point in time and imprints an audio-visual moment more heavily in our memories.

There are different types of audio-visual synchronisation; none can be more accurate than the frame-rate of the visuals but some types of audio-visual synchronisation have more impact. The most obvious audio-visual synchronisation is at the level of a pulse, an image event coinciding with a short-duration audio event. A 'percussive synchronisation point', is a sync point on percussive audio, often with high-contrast visuals, resulting in a particularly strong audio-visual bond and embodied visceral affect (my own term). This is because the energy in the percussive audio, which might be the onset of an accented beat or the slam of a door, gives impetus to the simultaneous visual change. Visual coincidences include: a flash frame or a cut, or the movement of the subject in the frame, especially at the height of the action (for example a punch making contact), or used  ly (for example the gunshots exactly on the beat in Edgar Wright's *Baby Driver* (2017)), or movement of the camera (whether the camera is real or virtual). I would argue that we see so much moving image constructed with percussive synchronisation points that we also have statistically learned expectations that are consistently being fulfilled. However, the fulfilment of expectations does not become boring because we are given very different opportunities of association with the audio-visuals, there are endless nuances in the execution and there are many possible variations.

**Synchresis, asynchronicity, metaphorical sync**

Viewers generally expect to see the causes of the sound in the images on screen; this is how synchronisation and synthesis, in Chion's term 'synchresis' (Chion et al., 1994), occurs and the images gain 'added value', added emotion or information, from sound. The degree of realism in the match of sound and image in moments of 'synchresis' also affects our sense of audio-visual synchronicity. If the audio appears naturalistic, we foreground the visuals (Section 2.4.1). If the audio creates, in Chion's terms a 'gap' (Chion et al., 1994), and if we can bridge the metaphor, this bridging emphasises the moment. If the gap is too wide the audio-visuals become asynchronous. Guy Sherwin & Lynn Loo's *Vowels and Consonants* (2005) was created as a seven-minute performance using three 16mm projectors showing vowel letterforms and three 16mm projectors showing consonant letterforms with the letterforms printed onto the optical track. The audio outputs from the projectors were mixed live, some letter sounds were spoken and musicians improvised between these sonic elements. Looking at a recording of the performance,[24] although the audio-visual sync is variable, the optical 'O' sounds and 'E' sounds are clearly distinguishable in the mix. However, there is little for the audience to anticipate because of the looseness of the sync. This degree of asynchronicity and lack of anticipation would appear to require quite a specialised or knowledgeable audience to appreciate the performance.

Asynchronicity emphasises the distinct media within the audio-visual work; it gives a much greater recognition of audio appealing to our auditory senses and images appealing to our visual sense as the two media pull apart. As Honing (2012) argues, to a great extent synchronicity is subjective. We favour synchronicity over asynchronicity; we like synchronous works more and we often perceive non-synchronised or randomly synchronised stimuli as synchronous, we create 'metaphorical sync'. For example, when turning on music and windscreen wipers in a car, we feel that the music and motion of the wipers coincide. We are wired for apophenia[25] – to see patterns and create connections from unconnected events. As Chion asserts:

> [D]isorder with no apparent goal is intolerable for human beings. We cannot resist giving it structure and form, a teleology, a shape and direction, even when it itself has none.[26]

---

[24] Available at https://expcinema.org/site/en/videos/guy-sherwin-lynn-loo-vowels-and-consonants-2005

[25] The psychiatrist Klaus Conrad initially coined the term 'apophany' in the 1950s, from the Greek *apo* (away from) and *phaenein* (to show) to emphasise that delusion can appear to be revelatory to schizophrenics. Over time, the meaning of apophany has changed to: propensity for seeing connections between unrelated phenomena.

[26] Psychology is beyond the scope of this thesis but this echoes the Gestalt psychologist Max Wertheimer's assertion that the perception and

> (Chion et al., 1994, 211)

This results in a continuum of synchronised points from percussive to metaphorical.

As Huron argues, ‘It is easier to process, code, or manipulate representations when they are mentally attached to events or objects’ (Huron, 2007, 124). ‘Event-related binding’ (Huron’s term) refers to how we unify phenomenal experiences: in vision we bind shape, colour and object recognition; in audition we bind timbre, pitch, loudness and location. Additionally, we seek to lighten our cognitive task by: tackling the relationship between a small number of elements, discerning neighbouring relationships (this uses less short-term memory than distant relationships), and discerning the amount of change (rather than a meta-level change in the rate of change). We are limited by the resolving power of our sense receptors (Schafer 1993, 18); at 16–20 cycles a second, discrete images and sounds played in a series will fuse together to give the impression of flow. All these perceptual tendencies inform our appreciation of visual music.

**An animator’s view**

Audio-visual synchronisation is linked to anticipation:

> [T]he listener’s anticipation of the cadence comes to subtend his/her perception. Likewise, a camera movement, a sound rhythm, or a change in an actor’s behaviour can put the spectator in a state of anticipation.
> (Chion et al., 1994, 58)

There is a tension around anticipation of audio, visual and audio-visual events; we derive pleasure from predicting events. As Huron states, in relation to music: ‘Pleasantness is directly correlated with predictability’ (Huron, 2007, 173). But we also like some surprise. Repeated listening changes the experience; the listener expects to hear the surprises of the first listening repeated. Yet:

---

interpretation of incomplete or contradictory images is always into the simplest form, the ‘Law of *Pragnanz*’ (Wertheimer, 1938: 71–88).

> repeated listening makes the music more predictable. Veridical memories for music hold an extraordinarily refined level of detail. Listeners are highly sensitive to the slightest changes from familiar renditions.
> (Huron, 2007, 241)

Because we are wired for speech, the ear processes faster than the eye (Chion et al., 1994). Therefore, replaying a rapid image sequence will not allow the viewer to distinguish more. However, this does not take into account an animator's intensive viewing. When I am working as an animator, I view sequences that I am working on numerous times, mute and with audio, in real time and frame by frame. I view sequences just looking at the foreground or subject, or concentrating on the background, or just as transitions, fragmenting the sequence to see the details ever more clearly. This intensive repeated viewing has a similar effect on me as the repeated listening cited above. I build an extraordinarily in-depth, detailed memory of the audio-visual piece; when it is played, I anticipate every moment and if even one frame is altered it jumps out, even though the piece is playing in real time at 25 frames per second. This ability to re-mix and review is very much a product of our digital technology.

When audio and visual elements are created separately, one must follow the rhythm of the other and usually the images follow the music. As an editor and an animator, I am accustomed to working *to* the rhythm of music. This approach originates in how strongly we embody the audio's rhythm, our strong anticipation that the visuals will follow audio sync, and is supported by the practice of editing. This has been justified by images having greater 'plasticity' than musical rhythm:

> Since it is impossible to relate musical rhythm and visual rhythm, all one can do is subordinate one to the other… visible forms change with the speed of light, possessing an almost infinite plasticity, in which they differ from musical forms which are constantly on the point of overflowing the narrow framework given to them and are slow to move…it is easier to make the rhythm of the image fit that of the music than the other way around.
> (Roland-Manuel quoted in Mitry, 1997, 254)

We are saturated with audio-visuals, and our tendency is to watch audio-visual works and appreciate their sound, for the most part, visually (Section 2.4.1). When composing, i.e. beyond the practice of editing, musical rhythm could be treated as having great 'plasticity' and could be subordinated to visual rhythm. As audio is vital but mainly subsumed into the viewing, anything that calls attention to the two media being separate, such as anticipation of sync, albeit subliminal, being unfulfilled, lessens the immersion and engagement with the piece. Much visual music follows the norm of working *to* the rhythm of music; going against this norm adds another key challenge to composers of visual music as they strive to create a meaningful and equal synthesis of visuals and sound (Section 2.1). Given that, in Strand 1-A, visual structure informs the composition of both image and sound, this research investigates this challenge.

**Conclusion**

Rhythm is vital in determining whether the result of Cook's audio-visual difference test is contrary, resulting in complementation, or contradictory, resulting in contest, and this impacts degree of engagement. Research into the perception of musical rhythm reveals that there are physiological correlations for rhythm and highlights our desire to be able to predict rhythm, whilst also wanting some surprise. Like the perception of auditory rhythm, the perception of audio-visual rhythm is constructed by the individual and is underpinned by anticipation. Audio-visual rhythm relies on sync points vertically aligning the sounds and visuals. Sync points range from the percussive to the metaphorical. We are wired to perceive patterns and we prefer synchronous works. The emphasis provided by sync points makes us remember the moment more. Asynchronous works tend to make us perceive two separate media, to separate the audio from the visual. Contrary to Chion, as an animator I do perceive more on repeated viewings of a sequence. The norm is to animate *to* music, to align the visuals to musical structures and phrasing. Going against this norm is a key challenge investigated in this research.

### 2.4.3 Mapping

Any piece of visual music may have thousands of potential audio-visual sync points, and each audio-visual event may have many possibilities for timing, giving a vast number of choices. An artist's aesthetic can give cohesion to these choices. Another approach however is to map sound to image or image to sound, using a cohesive set of rules. Rules focus on the conceptual links of how sound and image relate together. A 1:1 mapping has been considered the purest strand of visual music (Section 2.1.1). The audio and visuals are consistent and this results in conformance (Section 2.4.1). Many artists have sought absolute audio-visual synchronisation. This is in sympathy with our liking for synchronous events and event-related binding. This section is dedicated to the mapping of the aural and the visual: how sound can be made visual and how images can make sound and visualisation of the voice. Exploring different approaches to this multi-disciplinary work highlights fundamental opportunities and challenges of mapping the aural and the visual in visual music.

There have been many attempts to make music visible. These include: musical notation that mainly describes pitch against time and is prescriptive; acoustics describing the mechanics of waves and vibrations that have occurred in the environment; and phonetics, which also describes sounds that have occurred, but here the focal point is the lips of the speaker. The vocabulary of music is visual: high or low pitch, thick or thin harmony, and so on (Schafer, 1993, 9). Since the 20th century, it has been possible to make precise measurements of sounds' parameters – time, frequency or pitch and amplitude or intensity. However there is no universally accepted visualisation of sound. Waveforms of sounds are ubiquitous; these normally chart amplitude on the y-axis against time on the x-axis. This leaves out pitch. As all three parameters constantly interact with each other (for example a high note sounds louder than a low note), all three need to be visualised simultaneously. Sound has been visualised in three-dimensional space, with each parameter on a separate axis; however, three-dimensional visuals, even for single sounds, are not easy to read – as the visualisation evokes a geographer's view of a solid hill rather than the fluidity of a sound. Perfectly pure sound is impossible, so both the acoustic setting and sounding materials could be described to add information. As Schafer explains, 'distortion results the moment a sound is produced' (Schafer, 1993, 261) and this is compounded both by the setting and by our ears. Additionally, music is created with other parameters, such as musical expression, which are not usually fully visualised. As Trevor Wishart writes of singing: **'**Gestural structure is the most immediate and yet notationally the most elusive aspect of musical communication' (Wishart & Emmerson, 1996, 18). Visually responding to the 'most elusive aspect' of vocal communication, the gesture of the human voice, is key to this research.

**Graphical Sound**
Absolute 1:1 mapping was explored through developments in Graphical Sound, which encompasses various methods of creating sound through drawn sound shapes. Rudolf Pfenninger, an animator and engineer, pioneered '*Tönende Handschrift*' (sounding handwriting). He studied the visual patterns of specific sounds using an oscilloscope, analysing the image of the waveform for each tone, and copying each one onto paper by hand. He photographed the curves into the optical track, later hearing the sound via selenium cell as the film was projected. His scientific methodology included developing templates to produce sounds that were repeatable, discrete units that could be combined with each other, through a framework of rules to produce sounds in a linguistic manner.

Pfenninger's synthetic generation of sound based on acoustics foreshadows electronic music. His system was limited – it did not incorporate overtones – which gave it flexibility across many tonal systems. In the 1930s, he used his explorations to create a completely synthetic soundtrack for his own animation *Pitsch und Patsch* (1932). He had complete control over the visuals and the music. Pfenninger's premiere exhibiting his technique and work in 1932 astounded the audience with its technical feat, but was poorly received as music and as art. One reviewer exclaimed:

> Was this still music?… rarely have we felt so clearly the inner difference between live art and technological construct. One heard piano and xylophone-like sounds, others which seemed to come out of a steam whistle – all of them crafted together with great precision, much as if someone were to build a tree out of a thousand pieces of wood, which can look deceptively real and yet will never bloom!… Film has finally succeeded in creating a new 'technological art'.
> (Prévot quoted in Levin, 2003, 55)

This research incorporates the voice as the sonic element, avoiding the problems Prévot found in 'technological art' and recognising the privileged position of the voice (Section 2.3.3).

It is possible that Pfenninger's innovations inspired Oskar Fischinger. Fischinger was interested in drawing music because it gave him ultimate aesthetic control over the sound composition of his animations, just as, as an animator, he had complete control over the visual elements. In 1932 he wrote:

> The potential in this area is unlimited…[the composer] can produce his creative expression in an indelible direct graphic which will be definitive in that he shall not be dependent on any reproduction by foreign hands, since his creation, his work, can speak for itself directly through the film projector.
> (Fischinger quoted in Moritz, 2004, 180-181)

However, their aims and approaches were very different; Fischinger pursued pure artistic creation. His ornamental patterns are not based on an analysis of sound; he composed sounds visually, by creating graphics. Then he listened to the sounds his ornamental patterns produced and took an iterative, experimental, artistic approach. Fischinger's graphic curve-elements were continuous, unlike Pfenninger's discrete units, i.e. unlike Pfenninger's drawings, Fischinger's graphics were not designed to be combined with each other to produce sounds in a linguistic manner.

Other pioneers created other forms of Graphical Sound. Boris Yankovsky sought to synthesise the nuances of the human voice. His system had enough variables to create truly nuanced audio but the whole system was impractical before the advent of computers. Avraamov researched harmony in microtonal 'Ultrachromatic' music and championed it as a new form of expression. Like Eggeling and Richter with their Absolute animation, Avraamov aimed to create a new universal language. Contemporaneously, Moholy-Nagy's experiment *The Sound A B C* (1933) highlights that the perception of audio and image are entirely different and that there is no easy correlation, that the significance imbuded to an image is in no way carried over into its audio conversion. Currently, Sherwin continues to experiment with optical sound, using analogue film, controlling sound through image composition and post-production as well as camera-less techniques, such as Graphical Sound.

Norman McLaren explored and became the master of making sound by creating images in the visual optical soundtrack in sound film. He used several means: manually painting or scratching individual frames, stretched over a wooden frame so he could compose a section at a time, or running through a Moviola so he could work freely as the film played. He had separate control of pitch (the number of shape divisions), tone (shape), and volume (thickness). He was influenced by seeing Pfenninger's film, as a student at the Glasgow School of Art:

> [A] film called Tonal Handwriting made by a German engineer from Munich – Rudolph Pfenninger. He had evolved a system. First of all, the film consisted of a documentary showing how he did it. He had a library of cards and a camera. He'd pull out a card, film a frame and so on, and then at the end of that he had a little cartoon. He had music with this, quite lively, not distinguished, but very lively. This is the basis on which I developed my card system.
> (McLaren quoted in Levin, 2003, 65)

With Evelyn Lambert, McLaren created a card system of shapes to photograph onto the optical soundtrack. The card system had similarities to a keyboard and, like Pfenninger's system, the sounds were repeatable, discrete units that could be combined with each other. His *Synchromy* (1971) is widely regarded as the greatest masterpiece using optical soundtrack in sound film. He began by composing the music, 'perpetualmotion' (Miller, 1970), on the piano. There are three parts: mid-pitch, later joined by a treble part and finally by a bass part. Using his card system, he photographed the exact pitches and mapped the sounds to sound film: ‘hard-edge black-and-white stripes, corresponding acoustically to square-wave sound’ (McLaren et al., 2002, 57). Then he used same shapes to create the visuals, giving close to a 1:1 mapping of sound and shape (Figure 45). The piece starts by introducing each note-shape singly. Viewing the start, it feels as if a new language is being created, each note and shape perfectly aligned. The event-related binding is absolutely evident in the direct translation from audio and visuals in McLaren’s work, the piano-sounds’ pitch and duration is experienced as both audio and visual simultaneously. It is utterly engaging at the start, fascinating to see the abstract patterns that are producing the sound; it feels like experiencing a new language, although it could not be said to be equivalent to synaesthesia.

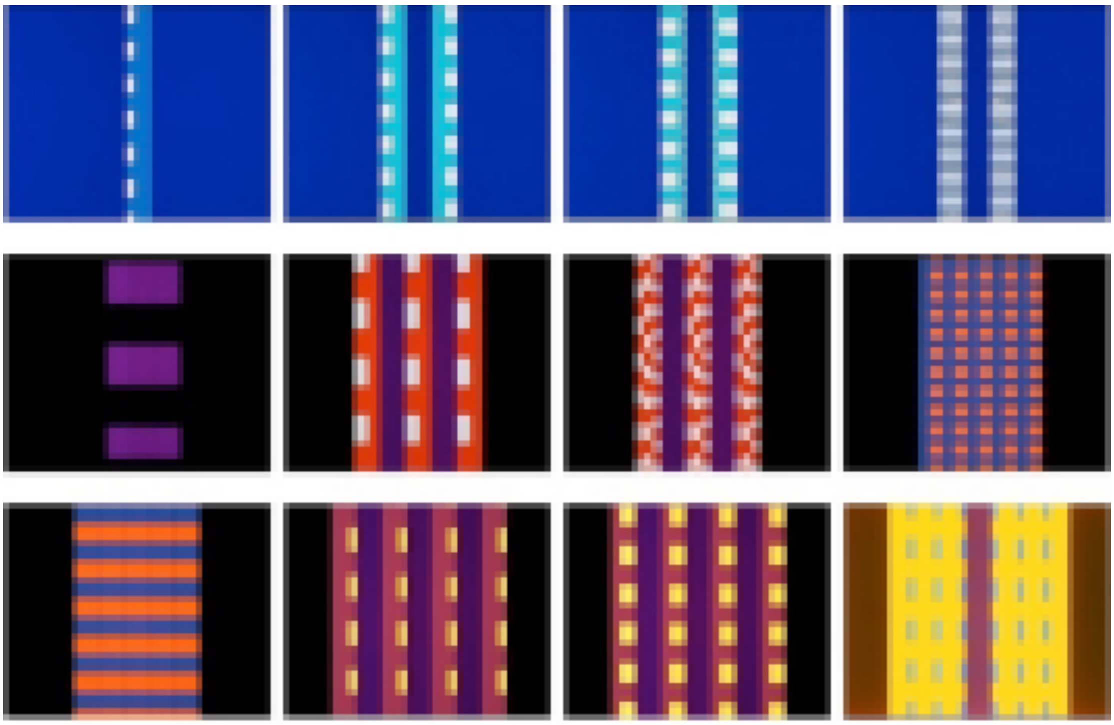


Figure 45. Stills from *Synchromy* (McLaren, 1970)

Then the piece builds in complexity. McLaren fills the rectangular shape of the visual frame by repeating the long narrow column of the soundtrack several times in vision, he also adds colour variation – all with the intention of making the visuals more interesting over the seven-minute duration of the film. However, for the viewer, these additions have no discernible correlation to the sounds and the sense of absolute alignment between audio and image weakens into a rhythmic pulsing. Schafer asserts that: ‘All ordered language systems require redundancy’ (Schafer, 1993, 113). However, as time passes the level of redundancy in *Synchromy* rises, the visuals become overly predictable and repetitive and the variations do not add interest, because they weaken rather than add to the sensation of sound being created as you watch. Each beat is mapped visually, causing pulsing and flickering, which becomes physically tiring to watch.

> [I]f one tries to translate each beat of sound with a visual beat (as McLaren tries to do), the speed of the movement becomes such that in spite of the schematic or linear appearance of the graphics, the sequence of images creates a series of shocks which the eye finds difficulty in tolerating for longer than a few minutes.
> (Mitry, 1997, 256)

When *Synchromy* was made in 1971, it was a technical feat. Besides creating each pitch optically and filming them in sequence on to the soundtrack, it required 20 optical passes to achieve the colourful, multi-layered visuals. *Synchromy* both pushes the boundaries and shows the limitations of the methodology and technology. The card-animated music did not encompass spectral analysis and so the music lacks overtones; it has a digitally limited quality, like an early synthesiser. Use of only the shapes that make the sounds gives the strong correlation that is like an epiphany when first encountered but equally limits the visuals of the piece, and forces repetition as the piece grows in duration.

**Algorithmic mapping**

The search for solutions to mapping continues today using computers. *Photosounder* (Rouzic, 2008) is a current software that can transform images into sounds and sounds into images. Its creator, Michel Rouzic, described it as: ‘Lossless processing of sounds based on images, so that real sounds can be transformed by transforming their image’ (Rouzic, 2008). The detail of both the analysis and the mapping vary across programs. *Paint2sound* (Singh, 2012) and *SonicPhoto* (White, 2011) only transform images into sounds. *Photosounder* also transforms sounds into images and includes spectral analysis of sounds. A typical mapping is: time from left to right on the x-axis, pitch on the y-axis and using brightness or contrast of the image for amplitude.[27] These programs are exponentially faster to use than the pioneers' methods, which allows flexibility and encourages creative play – trying out different intuitive solutions suggested by the composition as it progresses, with mappings. Their speed is tempting for a visual musician. However, this approach suffers from the computer's insensibility to what is being mapped. This means that the artist must create their own code or rely on someone else's code, with little chance of knowing the rules that underpin it, which leaves them vulnerable to working to the code's affordances rather than to their own creativity.

The affordances and limitations of *Photosounder* are shown through a simple experiment. Jack Howard opened a recording of his voice saying his name and an image of his name in *Photosounder*, and screen-captured *Photosounder* as the software 'read' the image from left to right, giving the audio at the top of the screen. The result shows that the visual waveform of the audio of Jack speaking his name is repeated in audio – the top portion shows the resulting waveform, and that the writing of the name has produced completely different audio. The non-correspondence of images producing sounds, as exposed by Moholy-Nagy, remains true (Figure 46).

[27] This has similarities with Avraamov's definition of audio-visual space: 'Musical sounds are distinguished by pitch, intensity, duration and timbre. How could we translate this into a language of visual forms? When a sound object approaches the spectator from the depths of the screen in the direction of horizontal coordinate 'z', the intensity of the sound increases. Movement in the vertical direction 'y' corresponds to the pitch of a sound. Movement in the horizontal coordinate from left to right and back 'x' corresponds to the duration of sound. The change of the form of the sounding object itself corresponds to the change of the timbre or tone colour' (Smirnov, 2013, 169).


Figure 46. *How my voice looks and my writing sounds* (Howard, 2011)

In a manner analogous to the pioneering work, these programs analyse and map individual elements without consideration for the whole sound. They map note by note, just as McLaren mapped *Synchromy* note by note. Mapping endows creative control; Pfenninger, Fischinger and McLaren had complete control over the audio and visuals.[28] Yankovsky's system and programs such as *Photosounder* seek to allow nuanced, unmediated control to one creative. However, a general limitation of these programs is that 'they do not consider emotion when generating the music' (Sergio et al., 2015, 213).

There is a continuum in acoustic communication that ranges from speech to music to soundscape (Truax, 2001). There are only about 40 phonemes in English that make up speech, very many more musical sounds and vastly more sounds from the environment. Taken as a whole, rules for language are clearer than rules for all of music. The philosopher Susanne Langer proposes that music expresses emotions more clearly, precisely because its meaning is imprecise (Langer, 1993). Speech has about five phonemes per second and in two seconds the listener can discern a lot of information; music needs more time to reveal key facets of a musical piece and even more time is needed to learn about a sound environment.

Vocal parameters, such as pitch, amplitude and phonetic quality that pertain to both speech and non-verbal vocalisations carry much of this information.

[28] Avraamov also sought control over the audio and visuals through defining his audio-visual space.

Currently there is much research into voice visualisation, which is fitting as the voice is such an important transmitter of emotion (Section 2.3.3). Mary Pietrowicz and Karrie Karahalios studied the interpretability of voice visualisations that mapped vocal parameters: pitch, amplitude and phonetic quality (Figure 47).

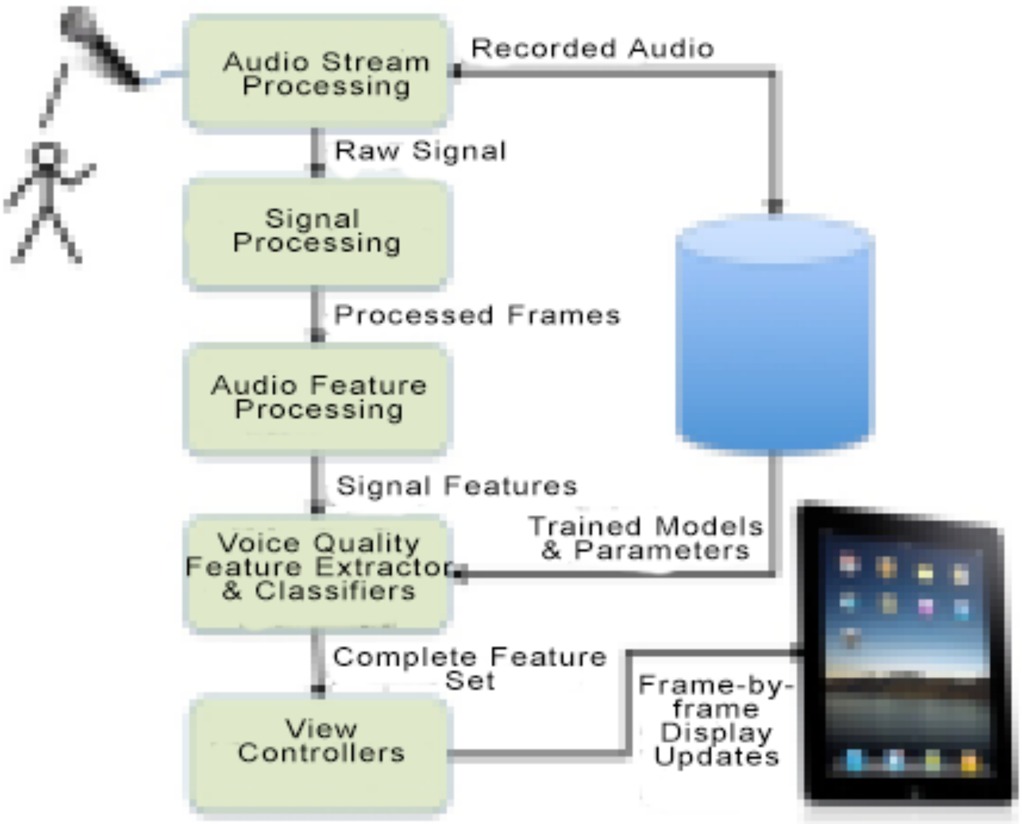



Figure 47. A system for visualisation of the voice (based on Pietrowicz & Karahalios, 2014, 1371)

Pitch changes mark changes in intonation; for example, pitch is raised when asking questions. Additionally, pitch changes are exaggerated for emphatic effect. Pitch was mapped to position (up or down) and amplitude was mapped to size. Phonetic quality, or vocal colour, was mapped to colour hue and saturation. Phonetic quality was defined in terms of phonetic classes: i.e. vowels or sonorants, or obstruents, and noisiness. Noisiness of speech was defined as exaggerated breaths or consonants; in aspirations, as breathiness or sighs or whispering.

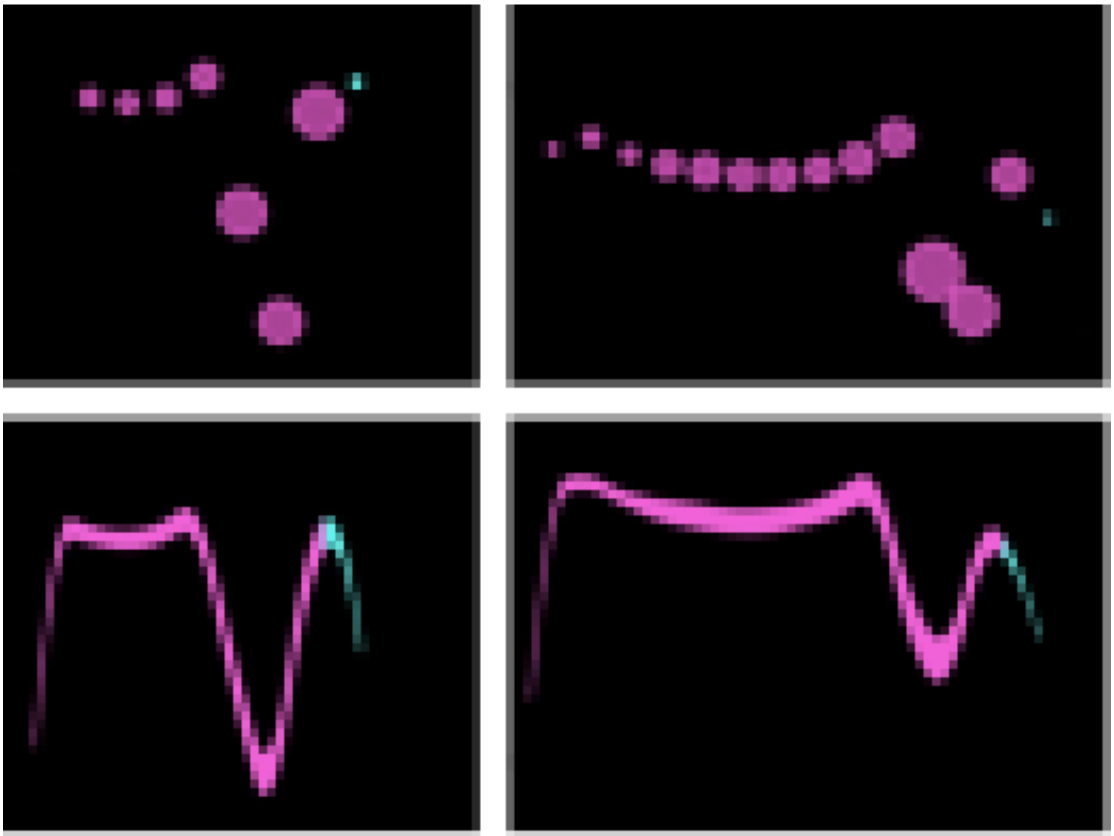


Figure 48. Visualising the voice as bubbles or ribbons (Pietrowicz & Karahalios, 2014, 1373)

The speech was mapped to bubbles and to continuous ribbons (Figure 48). The bubbles worked well for voiced consonants such as ‘zh’, and also showed the breaks in sound clearly. They noted the continuous ribbons created a good match for: ‘the force of the human breath that drives the voice, and its likeness to writing, where the energy and quality of the voice controls the pen.’ (Pietrowicz & Karahalios, 2014, 1371). Participants liked seeing that their speech was closely tracked, and liked transparency in the bubbles, as they could see layers of sound.

Pietrowicz and Karahalios wondered what users would create as visualisations of their vocalisations if they were given the choice, and why. It was felt by almost all the participants that the quality of speech should be reflected across several attributes, for example monotone speech should be in muter colours, have minimal inflections and be smaller, whether the speech was louder or quieter (Pietrowicz & Karahalios, 2014, 1374). This indicates that, as well as the quality of speech revealing the emotions of the speaker in an expressive exchange, the speech itself has qualities of animacy; it is almost personified by those who hear it. This is supported by a sense of animacy having been identified within music, almost personifying the music to the extent that music becomes a ‘virtual person’(Juslin & Laukka, 2003). Therefore, in animating visuals to vocalisations as a whole, the system would need to define a ‘monotone’ voice as ‘monotone’ and apply visually understood characteristics of ‘monotone’ across all the attributes. Rather than mapping amplitude, pitch and quality as separate entities, this could create more effective matches that are easier to interpret. The emotion of the voice would be emphasised.

**Shape-sound symbolism**

Given that there is now agreement that cross-modal interactions of multisensory processes effects perception (Bremner et al., 2013), shape-sound-symbolism, and especially the ‘Bouba-Kiki effect’, is more relevant than ever to visual music composers.[29] In the Bouba-Kiki effect, non-words are matched to abstract shapes. It has been overwhelmingly found (up to 98% agree) that ‘Bouba’ is associated with rounded shapes and ‘Kiki’ with angular shapes (ibid.). Abstract shapes (Figure 49) were first created and tested against non-words by the German-American psychologist Wolfgang Köhler (Köhler, 1929; 1947) and have been much researched ever since.

Figure 49. Shapes of ‘Kiki’ (left) and ‘Bouba’ (right) (Ramachandran & Hubbard, 2001, 19)

[29] The debate as to whether shape-sound symbolism effects have a have a phylogenetic basis or a cultural basis is beyond the scope of this thesis.

The Bouba-Kiki effect is especially striking as it appears to be robust and universal (Bremner et al., 2013). This mapping appears to be caused by the different mouth shapes and tongue positions when saying the sounds that are sharper, as opposed to more rounded, added to which is the sharpness or roundedness of the phonemic inflections. This links vocal gesture and abstract forms.

> The reason is that the sharp changes in visual direction of the lines in the right-hand figure mimics the sharp phonemic inflections of the sound kiki, as well as the sharp inflection of the tongue on the palate. The bouba/kiki example provides our first vital clue for understanding the origins of proto-language, for it suggests that there may be natural constraints on the ways in which sounds are mapped on to objects.
> (Ramachandran & Hubbard, 2001, 19)

'Mirror neurons' (Freedberg & Gallese, 2007; Rizzolatti et al., 2001) may facilitate an internal simulation of the vocal actions needed to say the words; the perceiver may synaesthetically mimetic the auditory stimulus, much like dance movements 'where the rhythm of movements synaesthetically mimics the auditory rhythm' (Ramachandran & Hubbard, 2001, 19).

Christine Cuskley et al. propose that literate participants also map the letter shapes of the non-words to the abstract shapes: 'B' on to the rounded shape and 'K' on to the spiky shape (Cuskley et al., 2017) (Figure 50). They devised scalar tests, rather than the traditional forced-choice task. They found that when literate adults match sound to shape:

> the curvature of letters in a non-word's written form strongly influences associations between non-words and abstract shapes among literate adults. Non-words with curved orthography tended to be rated more highly with rounded shapes, and non-words with angular orthography tend to be rated highly with spiky shapes.
> (Cuskley et al., 2017, 127)

Orthographic characters themselves are based on how we speak, for example rounded sounds are formed through two rounded lips and a round mouth shape and the orthographic characters tend to be round (Koriat & Levy, 1977). Orthographic-abstract shape-matching does not entirely preclude the phonological effects. Cuskley et al. found that, along with, and lesser than, the influence of the orthography:

> There was also some phonological influence: rounded shapes were matched more strongly with voiced consonants and spiky shapes with voiceless consonants, while stop consonants were rated more highly with spiky shapes.
> (Cuskley et al., 2017, 127)

Therefore, this could also be a linkage between vocal gesture, aided by phonaesthesia,[30] and abstract shapes.


Figure 50. Mapping letter shapes of non-words to abstract shapes (Cuskley, et al., 2017, 121)

This research is tantalising. If the Bouba-Kiki effect affords the possibility of mapping non-verbal vocalisations to animating shapes, it would be possible to create ‘audio-visual objects’ that might be universally understood – echoing the aim to create a universal language that inspired pioneers such as Eggeling, Richter and Araamov. However, as research continues, the number of variables grows and just how all of these variables interrelate and the extent of linguistic and cultural variation, is, as yet, unclear.

**Conclusion**
1:1 mapping highlights fundamental opportunities and challenges of visual music. The diverse pioneering analogue processes used to create different forms of Graphical Sound give each form limitations, which result in a degree

[30] Phonaesthesia is sound symbolism that links sounds to meanings, especially clusters of consonants, without imitating the sound as in onomatopoeia.

of aesthetic cohesion. Pfenninger's work was hailed as a new technological art, with emphasis on the technological. Similarly, McLaren's *Synchromy* is limited. Mapping endows creative control: Pfenninger, Fischinger and McLaren had complete control over the audio and visuals. Yankovsky and programs such as *Photosounder* seek to allow nuanced, unmediated control to one creative. Today's computers are exponentially faster than these pioneering analogue methods but are insensible of what they are mapping, making the user reliant on the sensibilities of the coder. Most programs map note by note, with no consideration of the emotion of the music. Visualisations of voice, particularly to discern emotions, are prevalent. The widespread feeling that the quality of speech should be reflected across several attributes indicates that speech itself has qualities of animacy. The Bouba-Kiki effect, in which the mapping links to vocal gesture, appears to be robust and universal and might afford the possibility of mapping non-verbal vocalisations to animating shapes – if further research can fully define the many variables involved and construct a taxonomy and useable framework.

Having looked at the extreme of 1:1 mapping, we will now turn to different approaches for composing visual music pieces using broader frameworks.

## 2.4.4 Composing visual music

Composition can mean many things: a visual music composer can define the situation or the tools to use, rather than the piece. Just as the sound artist Ron Kuivila writes of John Cage's *Variations* series serving as tools and the performer realising the piece:

> Having defined the situation, the composer can allow the performer free rein without worrying too much about the identity of the piece. This is an example of staying 'above' the technology – conceiving of music as a practice rather than a collection of sound objects allows one to adapt to new technological situations and to describe a work 'tactically' rather than 'literally.'

(Kuivila & Behrman, 1998, 14)[31]

In this research, visual music composition is defined as organising the audio-visual elements; this supposes that the purpose of visual music is to communicate and that organising audio-visual elements into a piece will allow clearer communication. As the design theorist John Bowers explains:

> This arrangement can be both visually pleasing but, more importantly, used to convey specific information and meaning… we seek harmony… a grouping of related components that make sense together. While harmony can involve some degree of discord or tension that attracts us, it is balanced by an overall appearance of continuity, of organized visual movement.
> (Bowers, 1999, 69)

At the very least, the beholders of visual music with ‘overall appearance of continuity, of organised [audio-]visual movement’ will have the sensation that it is cohesive and therefore, in some way ‘right’. ‘One of the basic visual experiences is that of right and wrong’ (Arnheim, quoted in Kepes, 1966, 218) and this is also true of audio-visual compositions.

Several approaches to composing visual music will be considered in this section. First, we highlight key aspects of the visual music of several seminal or pioneering artists. Second, we consider the creation of surprising events in a cohesive world, as exemplified by McLaren’s *Blinkity Blank*. Third, we look at using mathematics in different ways to compose visual music, as exemplified by Golan Levin, John Whitney and Guy Sherwin. Fourth, we consider Sergei Eisenstein’s modes of montage in relation to composing

[31] Some have rejected the concept of composing altogether. For example, philosopher Christoph Cox rejects musical notation, musical representation and the idea of a composer, a conscious agent in favour of a Deleuzian ‘materialist model of force, flow and capture’ (Cox, 2011, 157). As Deleuze states: ’One can… conceive of a continuous acoustic flow… that traverses the world and that even encompasses silence’ and ’A musician is someone who appropriates something from this flow’ (Deleuze in Cox, 2011, 155). Cox points out that this is similar to John Cage’s view of composers being curators (not creators) of sonic flux. However, Luc Döbereiner posits that Cox’s criticism from a materialist standpoint results in ‘the reenchantment of nature or vital matter-energy as creative force [and] ultimately de-materializes matter by spiritualizing it’ (Döbereiner, 2014, 3).

visual music, and, fifth, we reflect on mapping, audio-visual granularity and texture.

**Pioneering practitioners**

The German artists Hans Richter, Oskar Fischinger and Walter Ruttmann, and Swedish artist Viking Eggeling, all turned from painting to making avant-garde films.[32] Their work is iconic and informs the rest of the canon of visual music. Much of the theoretical and practical research into visual music starts with these pieces. There is a clear link between modern art and early abstract film, as Hans Richter asserts:

> Problems in modern art lead directly into the film. Organization and orchestration of form, color, the dynamics of motion, simultaneity, were a problem with which Cezanne, the cubists and the futurists had to deal. (Richter, 1951, 160).

A number of artists explored relationships between light, colour and movement:

> It was the search for a kinetics as properly visual art, which raised – even in the silent cinema – the problem of a relationship between the movement-image, colour and music.
> (Deleuze, 2005a, 44)

An underlying principle behind these new forms could be defined as truth to material: creating abstract work would allow these works to become their own unique forms, rather than a depiction of literature or theatre.

Artists were inspired by the freedom of exploring and creating a new form of expression. This resulted in the production of new processes and new forms of art; prototype-abstract-films (scrolls) the Absolute film movement and non-narrative films such as Man Ray's *Le Retour à la raison (Return to Reason)* 1923. Cross-modal innovation abounded; for example, Man Ray used 'rayographs' to create frame-by-frame animation in his film and, arguably, the

[32] These films are also known as Absolute Films. At the *Berlin Absolute Film Show* (3 May 1925), Ruttmann, Richter and Eggeling showed their films alongside Hirschfeld-Mack's light show *Colour Sonata in Three Movements* using the *Reflecting Colour Instrument* he had made at the Bauhaus (Moritz, 1989).

influence of *Lightplay* and light-projection experiments at the Bauhaus (Section 2.2.4) can be seen in the early abstract films produced by contemporary artists such as Hans Richter. At the same time, there was aesthetic cohesion driven by a combination of their artistic aesthetics, 'truth to materials' and their analogue materials and processes imposing limitations.

The French painter Léopold Survage was drawn to creating a new language influenced by the cinema (Section 2.3.4). In 1920, Eggeling and Richter also sought to create a new 'universal language'[33] from abstract forms. Hans Richter remembered:

> The overwhelming freedom which the 'abstract', 'pure', 'absolute', 'non-objective', 'concrete' and 'universal' form offered (which indeed was thrust upon us) carried responsibilities. The 'heap of fragments' left to us by the cubists did not offer us an over-all principle. Such a principle was needed to save us from the limitless horizons of possible form-combinations, so that we might attain a sovereignty over this new matter and justify this new freedom.
> (Richter, 1952, 78)

Laszlo Moholy-Nagy (1987) observed that Viking Eggeling's work changed the extant aesthetic. Richter wrote of Eggeling's methodical, analytical work:

> He tried to discover which 'expressions' a form would and could take under the various influences of 'opposites': little against big, light against dark, one against many, top against bottom, and so forth. By connecting ('equilibrating') the strongest contrasts of the most varied order intimately with their opposites through similarities, which he termed 'analogies,' he could control an unlimited multiplicity of relationships.
> (Richter, 1952, 79)

Richter and Eggeling united in this constructivist approach, seeing the opportunity to forge a system that went beyond individual artists' innate sense of composition, to create a universal language. Moholy-Nagy (1987) observed that Eggeling scientifically investigated animation by building up a sequence of animations developed from very simple linear elements. Eggeling explored parameters such as relative size and tempo, the use of repetition and use of discontinuity. He started to animate with reference to musical timing,

---

[33] They published their results in their pamphlet *Universelle Sprache* in 1920.

controlling the vision using a musical pulse, and used ideas from musical composition. However, he became more interested in how to articulate space in motion and studying the effects of animation, as vision in time. He was the first to discover the importance of the aesthetic of timing within film. He developed his perception and use of optical timing.

Contemporaneously, Richter also explored visual rhythm through visual counterpoint:

> The simple square of the movie screen could easily be divided and ‘orchestrated’. These divisions or parts could then be orchestrated in time by accepting the rectangle of the ‘movie-canvas’ as the form element. Thus it became possible to relate (in contrast-analogy) the various movements on this ‘movie-canvas’ to each other – in a formal as well as a temporal sense… I found a new sensation: rhythm – which is, I still think, the chief sensation of any expression of movement. (Richter, 1952, 81)

Figure 51 shows a still from every animated move of *Rhythmus 21* laid out into a grid on a grey background. Richter writes about wanting order, turning away from spontaneous expression in 1913–18, to gain control over the opposites of white-black, positive-negative space. Seeing these 290 frames laid out in chronological order highlights Richter’s rigour; how mathematically and consistently he divided up his ‘movie-canvas’. Like Eggeling and Klee, Richter was also working with opposites: black and white, vertical and horizontal, and so on, and there are hide-and-seek surprises in the interrelationships of image-planes, which recall early cubist collages. He creates weights of visual tone, in a manner similar to Paul Klee’s use of tone as weight (Section 2.3.1). Richter used clearly defined tones, mainly black out of white and white out of black, with a limited number of grey tones, and created visual rhythm through repetition of movement combined with the use of tone as weight.

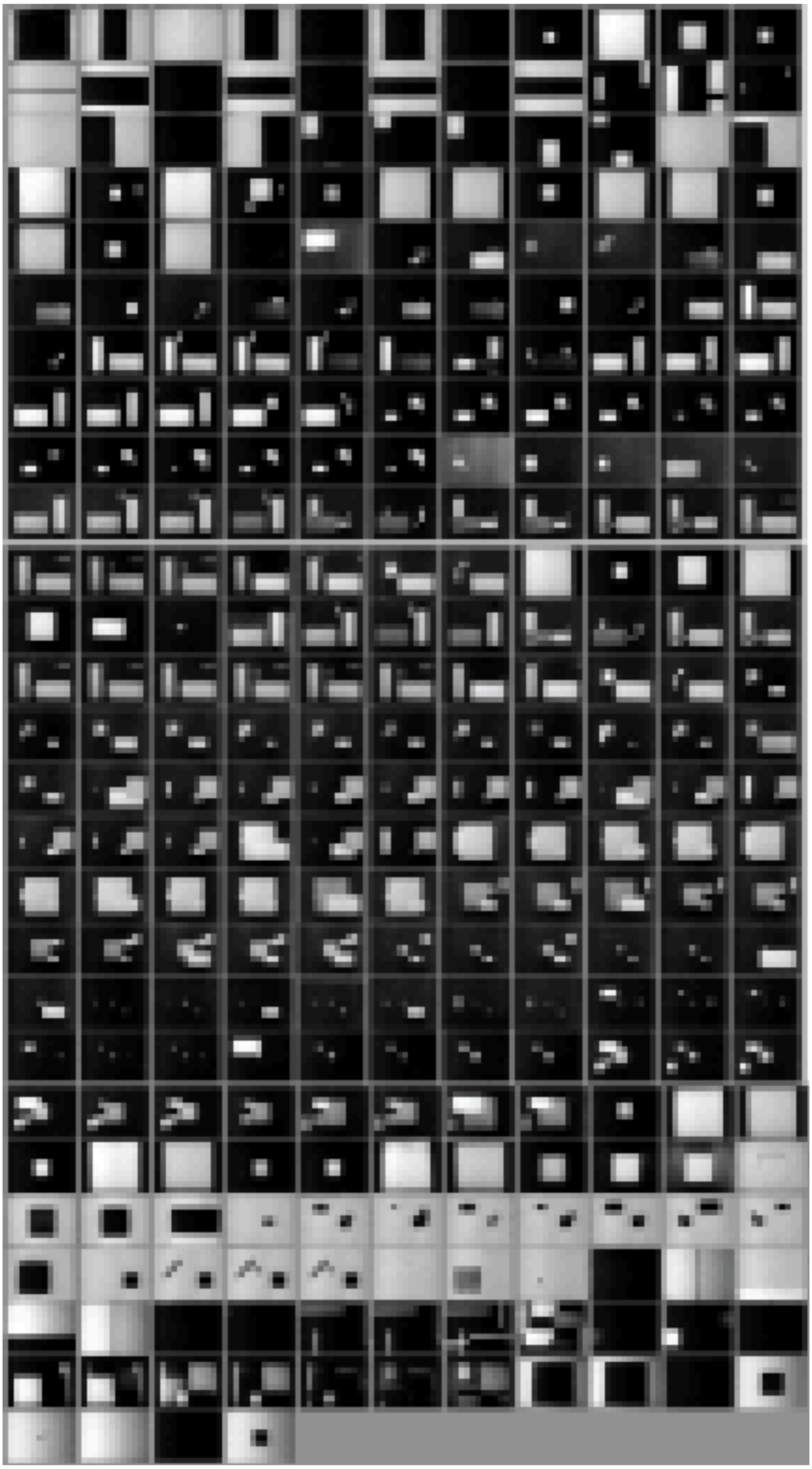


Figure 51. Stills from *Rhythmus 21* (Richter, 1921)

The movie-canvas is the shape of the screen and may be either foreground or background; it is treated like a painter's canvas. At the start, the movie-canvas is animated from totally black to totally white, it is never divided into more than three areas, enabling a forceful play on the illusion of positive and negative (or foreground and background) space. As the film progresses, the rhythm becomes more complex as the movie-canvas becomes more and more divided; more and more rectangles come into play and the animation gets faster. The negative-positive space is further complicated as depth is created by occlusion, when shapes overlap each other pushing one into the background as the other is seen in front of it.

*Rhythmus 21* begins with a horizontal wipe in and then out and out again, a square scaling smaller and smaller, also repeated, then a vertical wipe closing and then opening, opening and opening again. This animated move-counter-move that progresses into repetition-but-with-a-difference creates a strong visual rhythm. As the film progresses, many of the same movements are repeated but with different sizes of shapes and more shapes, building more complex patterns. The reverse-engineered storyboard (Figure 51) highlights that *Rhythmus 21* maintains excellent stylistic cohesion. It shows that Richter started from the simplest of beginnings and introduced the viewer to his, in Salda's term, 'alphabet', then very carefully, stage by stage, added nuanced levels of complexity that keep to what appear to be the rules of the composition. The only quirk is the sudden and brief use of diagonals. Arguably, this breaks the formidable visual rhythm that is built up.

Viewers can experience a strong rhythm in this work, especially if they are attuned to perceiving visual rhythms. Jean Mitry, the film theorist and film-maker, dismissed the mute, purely visual rhythm of these ground-breaking films thus:

> Ritchter's and Ruttmann's experimentation came to a dead end. It drew attention to the duration value of the image and contributed to a definition of a basic film metric structure, but the predicted rhythm did not materialize. Rhythm is always rhythm of something; it can never be gratuitous.

(Mitry, 1997, 255).

Mitry suggests that, whereas geometrical objects and painted lines can be animated to follow every beat of the music, pure visuals are not intrinsically rhythmic. He could find no perceptible visual relationships that might be used as a unit of measurement in order to build rhythm and no logic to the order of the shots, no overall development. In contrast, he continues, images that are mimetic are imbued with the emotional quality of what they represent, and this can be ordered to build meaning (Mitry, 1997). Mitry's view is both very limited and limiting to visual expression. We encounter visual rhythms in the world and – to a degree – we make sense of the world through visual rhythms (Section 2.3.2).

In 1944, the Guggenheim curator Hilla Rebay requested a religious, non-objective film from Oskar Fischinger. His reply demonstrates that he, like Rebay, found visual rhythm to be self-sufficient for non-objective films, that music is not needed to create a beautiful, affecting film. He rejects sound on the basis that: as no objects will be shown, sound, which helps to describe the form of objects, will not be necessary. Given that he also rejects perspective for non-objective films, the visual rhythm will be expressed in colour and light.

> Your idea about the production of a religious non-objective film ought to be done… [film] can be even more beautiful without music… The optical part, the form and motion, is visualized through the visual imagination – through the phantasy of the eye. Light is the same as sound; they are waves of different length that tell us something about the inner and outer structure of things. Non-objective expressions need no perspective. Sound is mostly an effect of the inner plastic structure of things, and also not needed for non-objective expressions. (Fischinger quoted in Moritz, 2004, 113)

Other forms of audience engagement, such as perception of causality and animacy (Section 2.3.2), are emergent in pioneering films such as *Rhythmus 21.* Arguably, these are developed through visual imagination and create non-objective expression. The perception of causality, animacy and surprise opens up possibilities for an impressionistic narrative, like *Blinkity Blank*, to form in the mind of the beholder. As William Moritz observed of another pioneer's work:

> Even a single still from Ruttmann's Opus No. 1 can tell us that one of his concerns in this film (and a major one, as it turns out) is an encounter between hard-edged geometric shapes and softer, supple organic forms. So the film can be described as a story about that encounter – as well as a rhythmic musical structure or a painterly balance of colors and figures.
> (Mortiz, 1988, Center for Visual Music website)

The pioneers' visual music and their visually based research remains seminal: it is both much researched and highly influential on later visual music. The pioneers' rigorous intellectual approach was diametrically opposite to Turner's expressive 'catastrophes'. Their approach produced ordered, almost rule-based animation, exemplified by *Rhythmus 21*, which both foreshadows and has considerably influenced computer animation. Later seminal practitioners referenced the pioneers; for example John Whitney writes of his, and his brother James' awareness of the early pioneers as they began their process-based exploration (Whitney, 1980). The pioneers explored but did not succeed in creating a new universal language. But, by avoiding dialogue and foregrounding visuals, these pioneering avant-garde films are international (Rees, 2011). Experimental film and video, made outside the mainstream by committed individuals, has influenced mainstream culture, although the influence is often unacknowledged. Richter made commercials himself and later Saul Bass created seminal motion graphics for film titles and advertising based on the movie-canvas,[34] perception of causality and animacy. Additionally, the influence of cinema itself cut across the Apollonian avant-garde based on Pythagorean principles (e.g. De Stijl Constructivism, Minimalism) and the Dionysian avant-garde (e.g. Futurist, Dadaist, Surrealist).

[34] Edward Zajec also used a movie-canvas for his Orphics, fractal-based colour patterns set to music, he wrote: 'by blurring the distinction between figure and background and by opting for color progression as a forming principle, it becomes possible to orchestrate large numbers of elements, each of which can be individually controlled like the notes in a musical composition' (Zajec, 1988, 112).

Composing mute visual music based on the movie-canvas, perception of causality and animacy fulfils Strand 1-A: using visual structures to inform the composition of both image and sound. However, it forgoes the power of vocal human traces and is a limited answer to going beyond the duality of eye and ear.

The normal mode of animating is to animate *to* music. Often, music underpins the structure, the mood and the meaning of abstract animation. The abstract animation films Fischinger made in the 1930s, such as *An Optical Poem* (1937) are rooted in abstract art (Lund & Lund, 2009, 153) (Figure 52).

Figure 52. Still from *An Optical Poem* (Fischinger, 1937)

Fischinger did not create a new repeatable audio-visual syntax; instead, he turned to music to structure his abstract films. For *An Optical Poem* he used Franz Liszt's *Second Hungarian Rhapsody* (1846–53). He animated in response to the structure of the musical piece and to its musical rhythm, which gave a readily understandable impetus to the motion of the abstract forms. Moreover, the mood of the music, combined with his colour palette, created the mood of the pieces. Some, such as Mitry, valued Fischinger's work much more highly than mute abstract animation precisely because Fischinger imbued his work not only with musical structure and rhythm but also with the meaning conferred by the music.

> He [Oskar Fischinger] used music to give meaning to these patterns, variations of lines, circles, square, and ovals. What in Ruttmann was merely empty form and gratuitous cadence became rhythm through the musical content with which the forms were associated.
> (Mitry, 1997, 256)

This mode of composition is defined as Strand 3-A, moving image created to pre-existing music (Section 2.1). Its strength is that the structure and mood are both given by the music. Ideally, the images would take on the rhythm of the music whilst evoking something more, to:

> associate images and music by developing throughout the same rhythmic structure; without the images being forced to 'illustrate' something but evoke and suggest it like a poem.
> (Mitry, 1997, 264)

The weakness of this approach is that, often, as seen in *An Optical Poem,* the visual images mainly illustrate the music.

**Surprising events in a cohesive world**

In this thesis, surprise is considered in terms of survival – failed expectations and how we grade information – and this is linked to the sublime. In Survage's still images, a critical factor for surprise – timing – is missing. Nevertheless, Klee creates visual surprises through 2D-3D illusions. Richter's *Rhythmus 21*, like cubist collages, creates surprises in foreground-background reversal. Surprise has been considered in relation to rhythm and our liking for predictability with some surprise. We now turn to how Norman McLaren's *Blinkity Blank* (1955) fulfils his aim of balancing the forces of cohesion and surprise in a work of art:

> A work of art has to have cohesiveness and consistency but not so much cohesiveness and consistency as to become boring and not so much non-cohesiveness as to fall apart. It has to be organically linked and yet it must have surprises in it... surprises that are relevant to the whole work.
> (McLaren quoted in Rees, 2011, 48)

Figure 53. Still from *Blinkity Blank* (McLaren, 1955)

In *Blinkity Blank* (Figure 53), the narrative is impressionistic, the characters are not individualised, and, in a dream-like way, the bird-like-creatures are continually changing, morphing from a feather to a blob of colour or sweeping lines or a geometric shape or a skeleton. There are also flash frames of images, such as a birdcage, umbrella, pineapple, palm tree and hearts, which also continually change. These events spring out of blackness; it is like seeing a stream of magician's tricks combined with fireworks. There are black gaps between the events, which leaves the viewer free to link events in their own way and to form their own impression of the whole. Viewers' impressions include:

- there are pink and blue bird-like creatures that interact, they have momentous fights, they intertwine together and eggs arrive
- the film is about fighting and creation
- there is a pink tribe and a blue tribe and they fight over and over again

- the geometric symbols allude to lost civilisations such as the Incas and Aztecs and the rebirth at the end symbolises hope
- the black gaps show time passing and the film is about evolution
- the blue and pink are two sides of one creature
- the action shows creation comes out of conflict and is cyclical.

There is some degree of agreement among these impressions but no agreed narrative. Not only are different aspects emphasised but possible symbolism is also added or detracted.

Viewing *Blinkity Blank* is not the same as following a film narrative, which is dependent on its narrative coherence: being able to identify what happens, and where, when and why it happens. Viewers develop a framework, or schemata, for understanding narrative, which enables them to follow and remember narratives. They continuously revise their framework, making it more sophisticated and becoming more tolerant of ambiguity. The most memorable narratives are goal-driven because this makes the causal connections clear. Causal connections are so expected by the viewer that they are often invented if they are missing.

As the film theorist David Bordwell states, the viewer may judge content by its: relevance to plot, 'compositional motivation', by how credible it seems, 'realistic motivation', or by genre expectations, 'transtextual motivation'. Or, the viewer may decide that the content itself is the motivation, 'artistic motivation' (Bordwell, 1985). The first three motivations work together to forward the narrative. If they don't apply, artistic motivation is assumed because the content stands out from the narrative and highlights the form of the artwork. For this reason, artistic motivation is rare. Narratives both provoke and constrain making predications and forming hypotheses, on both the micro-level of individual events and the macro-level of the whole narrative. There is a sense of reward when anticipation is first met, whereas, when events continue to confirm a hypothesis about the narrative, the level of anticipation lessens. Surprise arises when there is a build of expectation that is defeated; expectations are readjusted and the beholder will continue to anticipate and extrapolate. Anticipation, curiosity, suspense and surprise and their affects are all achieved through the timing of the reveal of information.

> [T]he mixture of anticipation, fulfilment, and blocked or retarded or twisted consequences can exercise great emotional power. The formal processes of perception and cognition – as Eisenstein well knew – can trigger affect.
> (Bordwell, 1985, 40).

In *Blinkity Blank*, at the micro-level of individual events, causal connections are perceived as the bird-like creatures interact with each other. However, some viewers see some events, especially the sudden arrival of extra symbols, such as umbrellas, as superfluous to the narrative, as just for artistic motivation. At the macro-level of the whole narrative, how these short-term events might be pieced together to form a whole is perceived with a good deal of variation. This impressionistic narrative provokes making connections between events more than it provokes making predictions because of the continual change and surprise. It offers little constraint to forming hypothesises. This openness to interpretation and the charm of the style and animacy are engaging. The film is highly memorable as an overall impression but very difficult to remember in its entirety. *Blinkity Blank* remains surprising on repeat viewing.

The series of surprises that is *Blinkity Blank* forms an impressionistic narrative because the world of *Blinkity Blank* is cohesive in terms of the events that occur. However incredible the moment-by-moment continual change, its very rapidity keeps it in the world of *Blinkity Blank.* The animacy embedded in the movement of the bird-like creatures gives their action a consistency, and causality is perceived.

> He [McLaren] would invent a new world… most people would pretend to invent a new world and then put in the same events that would belong to this world, just the same old drama, he visualised what would be the kind of event that would only happen in that world and then dramatized that.
> (Tom Daly, quoted in McWilliams, 1990)

*Blinkity Blank* is also stylistically strongly cohesive. McLaren was trained at Glasgow Art School to be able to see anything in the three-dimensional world as abstract forms. This vision gives him the flexibility to thoroughly integrate the abstract and more mimetic imagery. His artistic style is aided by indirect inspiration from another master at mixing the abstract and the mimetic, Paul Klee.

> As a painter, one of your trainings is to see a thing as an abstract thing. When you look at a group of objects, it's not just this object and that object, it's also the relationship between the two, the shading, etc… the painter automatically sees a scene as an abstraction – even in the process of doing a painting that is completely realistic. In art, you want to stress some things, which you feel are important… Paul Klee strips away the solidity of the object… and deals with just line. Now I see a relationship with Blinkity Blank. It's kind of Paul Klee-esque.
> (McLaren et al., 2002, 43)

The technical limitations of drawing into the black celluloid film also give the film cohesion, a unifying aesthetic of process and material, and the very limitations spurred McLaren to push his innovation and creativity.

> In my case, the technical and thematic limitations favour creativity. The more limits there are to the way of working, the more the final result is likely to be good and original.
> (McLaren quoted in Dobson, 1994, 190)

McLaren made the images burst out of the blackness, like fireworks, by animating only intermittent frames.

> [O]n the blackness and blankness of the outstretched strip of celluloid on my table top, I would engrave a frame here and a frame there, leaving many frames untouched and blank – sprinkling, as it were, the images on the empty band of time; but sprinkling carefully – in relation to each other, to the spaces between, to the music, and to the idea that emerged as I engraved. On the majority of the frames there is nothing at all.
> (McLaren et al., 2002, 88)

The effect of working to ideas that emerged as he worked gives the whole film a fluid form; no overall framework is being followed. The 'sprinkling' of images creates surprise in the overall timing and from event to event, making *Blinkity Blank* continually surprising. McLaren also causes surprise at the micro level of a group of three or more frames: ‘frame-clusters’. He animated the ‘frame-clusters’ knowing the effect that each frame would have due to its placement in the ‘frame-cluster’ and its duration. He said:

> [T]he four frames the image would change a little bit or they might be completely different but when it went on the screen, you saw a sudden burst of image that gave you an overall impression, a subliminal impression. The last frame of the frame cluster was the most important; it lingered longer in the eye than the others. The first frame lingered next, and the in-between frames were almost lost.
> (McLaren quoted in Miller, 1970)

The use of frame-clusters creates an animated analogy to collage (Section 2.3.1). The use of black background and gaps, and elimination of anything extraneous, makes the animated images resonate even more strongly. McLaren performs a delicate balancing act between the visuals and the music, allowing the music to support the visuals rather than animating *to* music. *Blinkity Blank* demonstrates a possible mode of visual music composition as a finely tuned balance between music and animation, driving the mood and meaning.

*Blinkity Blank* can be enjoyed on the level of colourful fireworks, pure colour, motion and sound, and of perceiving micro-level causality, or animacy, or metaphor and constructing and reconstructing an impressionistic narrative, and also alternating between viewing one surprise after another and hypothesising on a narrative. The affective, visceral nature of the surprises in *Blinkity Blank* reaches beyond the duality of eye and ear. The creation of a cohesive world balanced with surprise, the use of gaps between events and perceived causality at the micro-level will all be key elements in my animation, my practice and my developing framework.

**Using mathematics**

The desire to create moving pattern and pitches using mathematical ratios has a long history. Elder (2010, 19) writes of a belief that ‘sacred geometry’ unified the universe, and the concept of geometry and Pythagorean mathematics provided principles for both visual proportions and musical analogies to them (Section 2.1).

One approach to mapping sound to image using human traces is to translate gestural image into sound using mathematical models. Golan Levin created several interactive software systems for a colour-music performance system based on a painterly interface metaphor. The performance of mark-making controlled both image and audio creation via gesture capture and computational augmentation such as signal processing. The gestural input, via a computer-mouse, could be sampled at such a high resolution that it became ‘a spreadable, audiovisual substance’ (Levin, 1994, 57); ‘At the limit of granularity: objects become substance; sampling becomes synthesis’ (ibid.) (Figure 54).

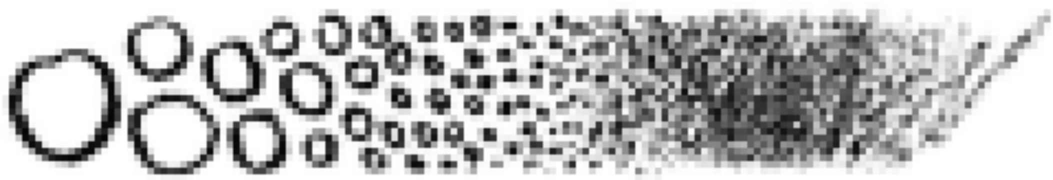


Figure 54. Granularity (Levin, 1994, 57)

Levin references Klee as a major influence on his work, and the granular pattern becoming ‘spreadable’ is reminiscent of Klee’s dividual repeating structures becoming so small that they eventually blur together like Klee’s tiny dividual dots becoming an atmospheric haze (Section 2.3.1). To map mark-making gesture into sound created by computer-mouse clicking and computer-mouse movement, Levin used mathematically based mappings:

> [W]hich are more directly based on more perceptually meaningful properties of animated marks, such as their velocity, orientation, and curvature… One mapping is quite specific: where possible, I have tried to map the left/right spatial position of a mark to its location in the stereo field. The other mapping is more abstract: where possible, I have attempted to match high-frequency content in the gesture domains, to high-frequency content in the visual and aural domains. (Levin, 1994, 122)

Using synthesised graphics and synthesised sound gave Levin the ability to treat visuals and audio with commensurate malleability. The learnability – predictability of output to gesture and expressiveness of his five systems – was variable. Since 1994, more sophisticated input devices have been created that give far more freedom to the user and capture nuances of expression in ways a computer-mouse could not; however, the central premise of mapping image-making movements to sound remains problematic as mark-making movements are not synonymous with gesture.

John Whitney turned to the universal language of mathematics, and comprehensively investigated mapping Pythagorean musical harmony to images in order to create visual music:

> This hypothesis assumes the existence of a new foundation for a new art. It assumes a broader context in which Pythagorean laws of harmony operate. . . In other words, the hypothesis assumes that the attractive and repulsive forces of harmony's consonant/dissonant patterns function outside the dominion of music.
> (Whitney, 1980, 5)

John Whitney did not use 1:1 mappings (Section 2.4.3), but developed 'differential dynamics', i.e. linked nested, or interrelated motion paths, the result of which is that shapes are overlaid, creating harmonic visual patterns via computer algorithms.[35] This was a result of noting that rhythm in music and rhythm in vision are very different:

> [O]ften referred to as the drive of a piece of music, [rhythm] is almost automatically enhanced with metrical or cyclical consistency and repetition. Rock musicians know this – perhaps too well. On the other hand, the most difficult visual quality to compose into a composition, as every abstract filmmaker may know, is the same driving propulsive thrust with a visually rhythmic metrical cycle.
> (Whitney, 1980, 69)

Whitney advocated that animation should not directly represent music but demonstrate 'complementarity', to be more expressive and respond more

[35] In contrast, Thomas Wilfred's Lumia and James Turrell's artworks eschew audio-visual synchronisation; they are mute. This increases their sense of being timeless and having open-ended (perhaps vast) scale. Light is the key character and is worked with directly.

aesthetically and less mechanically to tension and resolution, indeed emotions, within music (Whitney, 1994). Although Whitney created highly innovative computer-animated mathematical patterns, he did not find harmonic interrelationships that could be applied to both sound and image.

Sherwin's *Sound Shapes* (1972) was an experiment in audio-visual rhythm, based on a mathematical musical structure. Each bar of 24 frames (one second) was divided into 2, 3, 4, or 6 audio and visual events (Figure 55).

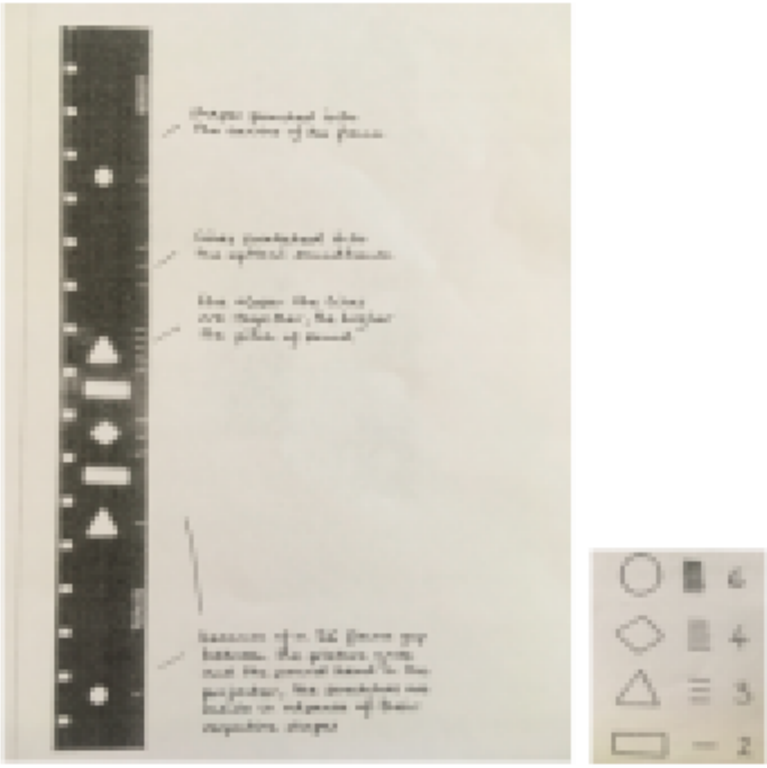



Figure 55. Rhythms of picture and sound in beats per second (Sherwin et al., 2007, 12–13)

These combined to make rhythmic patterns, e.g. 2-3, 3-4, 3-4-6, 2-3-6. Both the visuals and the audio were very simple. Geometries such as triangles, rectangles and circles were punched in the celluloid film, giving white out of black. The optical audio was formed from scratches of approximately the same width, or volume. Their pitch was determined by density of scratching, e.g. twelve scratches per frame made a high-pitched sound, three scratches a low sound and one scratch a percussive sound.

A huge number of combinations of rhythms could be formed from these simple elements. Sherwin established arbitrary relationships between image, sound and beats per second, for example: a circle might have 12 scratches per frame at 6 beats per second, and a triangle 1 scratch per frame at 3 beats per second. These relationships were stable for a section of the film, then changed. Each frame is hand-crafted, at three minutes, or 4,320 frames. This was labour intensive and there was no flexibility in the making, i.e. once a hole was punched, or the optical track was scratched, the mark could not be undone. This lack of flexibility is the diametric opposite of working digitally; the lack of flexibility aids completing a piece and imposes some aesthetic cohesion, but can hinder creative play. Considering all the limitations of materials and processes, *Sound Shapes* is surprisingly complex to the viewer. The patterns seem as if they will be simple enough to distinguish as it runs, but cohesively pinning down the changing audio-visual pattern whilst viewing slips out of one's grasp, leaving the simple shapes and clicks to start to form another pattern, until that too slips. This sense of slipping and being aware of trying and failing to make patterns from very simple elements that encourage event-related binding (Section 2.4.2), is heightened by the arbitrary relationships between image, sound and beats per second.

This mode of composing fulfils Strand 1-A: using visual structures to inform the composition of both image and sound. However, in *Sound Shapes*, similarly to *Phase Loop*, Sherwin emphasises the duality of eye and ear when experiencing audio-visuals; he splits perception of the audio and the visual 'divided between the senses of sound and sight', giving the viewer a heightened awareness of their perception of 'synchronization and its loss, repetition, reflection, syncopation, anticipation, resolution.' This is the opposite of what I want to achieve.

**Montage**

Instead of using musical or mathematical structures, it is possible to compose visual music by editing, by constructing shots into scenes and scenes into sequences. The materials need to be planned in advance of the editing but much of the composing is at the stage of editing. A definition of montage is the juxtaposition of two shots to create a third impression. According to the pioneering film director and theorist Sergei Eisenstein, ‘To determine the nature of montage is to solve the specific problem of cinema.’ He defines five modes of montage: metric, rhythmic, tonal, overtonal, and intellectual. Brian Evans suggests that three levels of montage – metric, rhythmic and tonal – would be most applicable to visual music:

> First is metric montage, which deals with the simple duration of shots. This is expanded to rhythmic montage, in which the duration of cells supports the plastic elements in motion within the shot. Lastly, the graphic elements such as color, line, and shape and the dominant expression of the shot build phrases in tonal montage. Each shot or phrase articulates cadences through a construct of tension/release. Phrases are combined and grow to a larger form through repetition, contrast, and variation.
> (Evans, 2005, 21)

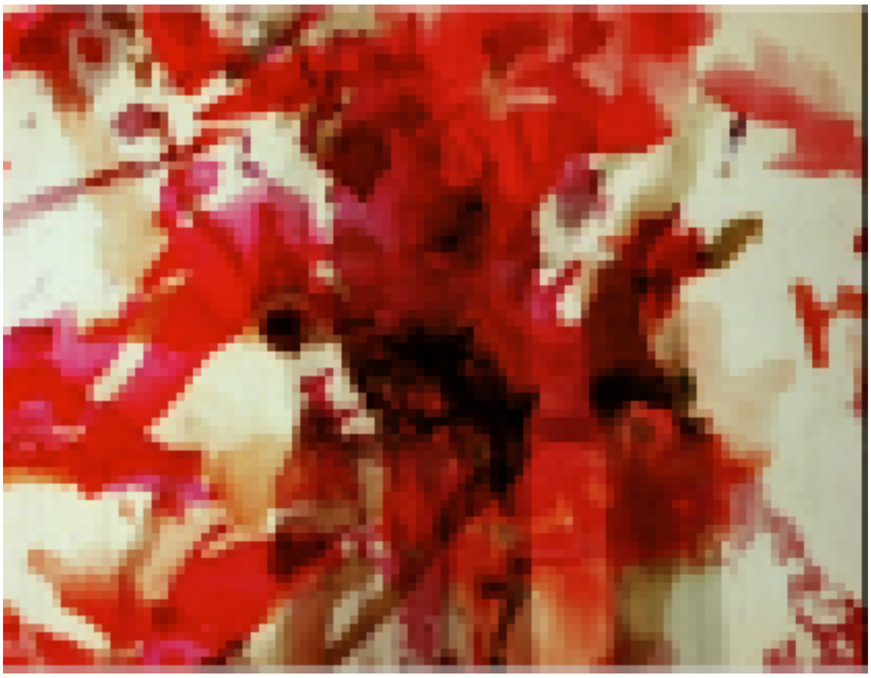


Figure 56. Still from *Begone Dull Care* (McLaren & Lambert, 1949)

As an example of metric montage, Evans (2005) cites *Begone Dull Care* (1949) by Norman McLaren and Eve Lambert (Figure 56). The animation was created directly on the celluloid film by painting, dyeing, spraying, printing textures and scratching. The filmstrips were cut into ‘absolute lengths’, governed by the soundtrack, which was measured first of all (Russett & Starr, 1988). And indeed, the use of filmstrips with different patterns is apparent in the work. The regular changes in the style of animation help to keep it driving forward with the music. Arguably, the whole form or composition is a kind of macro metric montage. It is divided into three parts: three minutes of busy colourful animation, two minutes of sparsely drawn white lines out of black, and two minutes of increasingly frenetic colourful animation. The form is matched to the music at this macro-level.

However, this work, in which there is no traditional narrative, also demonstrates the difficulty of applying Eisenstein's theory to visual music. What is most striking about the film is that the music drives both the movement of the animation and changes of colour at a frame-accurate level for extended periods. Also, the abstract animations allude to the music. For example: with the piano trills, shapes like crude rakes appear, evoking fingers in a movement over the piano; a thump of the drum has more angular shapes. Therefore, whereas the concept of metric montage is useful for emphasising part of the practice used to form *Begone Dull Care*, overtonal montage arguably describes the levels of metaphorical synaesthesia (see Key Terms) that have been achieved. Overtonal montage would appear to be an appropriate mode of montage for visual music.

**Mapping, granularity and texture**

The false premise of being able to perceive sound and colour as equivalent has caught the imagination of composers for more than a century and provoked immense creativity: 'The seductive, if essentially false, notion of physical equivalence between light and sound sparked the advent of kinetic light art' (Brougher et al., 2005, 82). Current technology, coding and processes allow much greater artistic freedom and flexibility than the original analogue, optical methods used by animators and film-makers such as McLaren and Sherwin to map audio and visuals. Today's digital processes offer much greater speed, ease and flexibility (Section 2.4.3).

> One characteristic of technology is its capacity to incorporate other forms and to be linked in a hybrid way with them… Numbers representing the colour values of pixels in an image may be as easily output in a form which made sounds as in a form which made pictures. Computer data is easily translated as well as transformed.
> (Le Grice, 2009, 268)

As technology has exponentially increased in power, it has allowed current composers of visual music, such as Bret Battey, to create much more complex patterns and more complex links between audio and vision than 1:1 mappings by using algorithms to create both sound and to manipulate images. His work falls under Strand-1-B, in which musical structure informs the composition of both sound and image. It does not fulfil Strand 1-A, using visual structures to inform the composition of both image and sound. However, composers, such as Battey, working within this strand, face many of the same mapping problems and so their approaches, reflections and evaluations are valuable for Strand 1-A, which is the focus of this research.

There are other types of audio-visual synchronisation beyond matching audio beats, for example the widely perceived feeling that higher-pitched notes and brighter tones, and lower notes and darker tones, match each other better. Similarly, 'higher in screen' correlates with higher notes, and ascending motion and ascending musical pitches match, while lower or descending have the same audio-visual match. As previously discussed, Eisenstein (1942) and Mitry (1997) concur with this correlation, in fact Mitry warns against literal translation causing redundancy rather than engagement (Section 2.4.1).

As Bret Battey and the conductor and composer Rajmil Fischman elucidate (in Kaduri, 2016, 61–82), there is a continuum of methodologies that range from artistic interpretation to a close mapping of the audio and visual. Neither extremity makes a pleasing work. If the audio and visual elements have no mapping and remain separate, the work will fail to be a coherent piece of visual music. But if the audio-visual mapping is too close, the piece will generate uninteresting perceptual relationships and at best mediocre aesthetic relationships. As visual music is time-based, correlations need to be considered across a range of time from absolute simultaneous synchronisation, to events, gestures, phrases, sections or the whole work. Battey & Fischman (in Kaduri, 2016, 73) recommend using both clearly recognisable local mapping and a 'higher order intuitive alignment'. The sonic artist Diego Garro (2005) also recommends using a mix of mapping methodologies. Garro scrutinised audio-visual mappings in visual music using Denis Smalley's Spectromorphology as a starting point for looking at audio-visual gesture. Garro links '*objets sonores*' to audio-visual composition:

> Depending on the compositional strategies, digital artists can explore the relationships between the phenomenology of the *objet sonore* and that of the moving image, towards the definition of what we could may call *objet audiovisuelle.*
> (Garro, 2005, 1)

Garro draws on Smalley's terminology, which references spectral typologies, morphological types, spatial properties and behavioural motion in time, to create a list of 'time-varying phenomenological attributes' (Garro, 2005, 3) of *objets audiovisuelle* in relation to image, sound and cinema: '[C]olor, shapes or "forms", surface texture, granularity of the geometries, spatial attributes and perhaps others' (ibid.). Garro found linkages between sound shapes and geometrical shapes, between how sounds evolve and motion of shapes, as well as concurring that timbre and visual tone are linked – bright sounds and bright colours and rising pitch with rising position on screen (ibid.). This could result in a close mapping but he found that redundancy is caused by too great a degree of correspondence and, therefore, did not try to map everything.

Garro composed *Patah* (2010) (Figure 57) informed by Electroacoustic Music traditions and as an investigation into spectro-morphologies.

> *Patah* is an investigation into (mainly abstract) spectro-morphologies articulated in both the audio and the visual domains. A possible viewing strategy, which is somewhat in line with the composer's design, may consider the role of the sonic material in permeating the 'fractures' ('patah' in Indonesian) of the streaked visual textures and the dramatic effect that results from such interaction. (Garro, 2010, Vimeo)

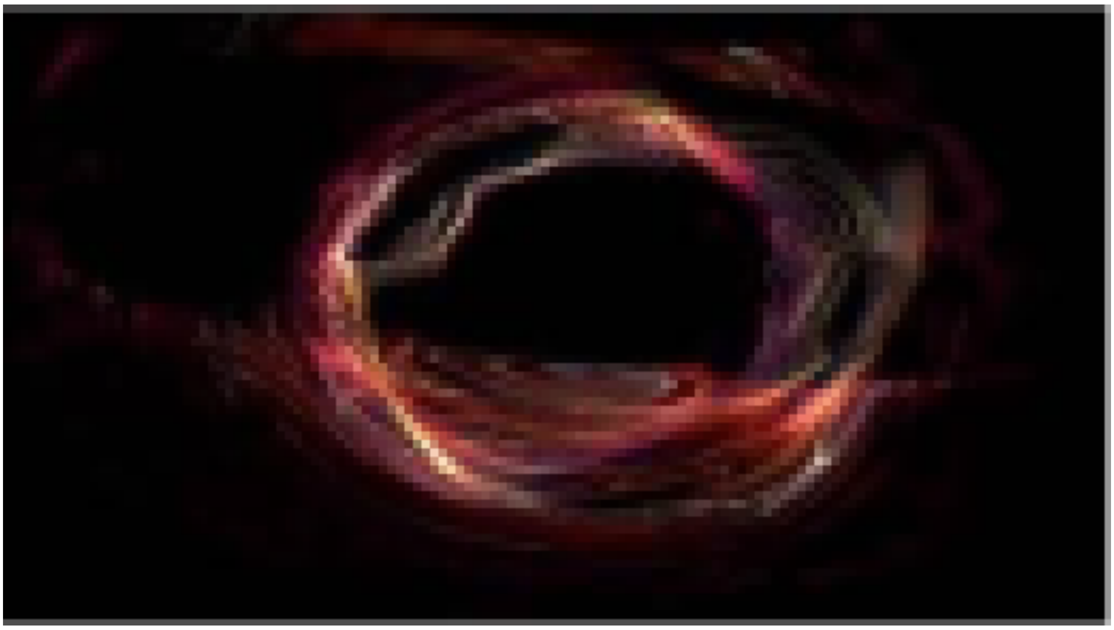


Figure 57. Still from *Patah* (Garro, 2010)

In *Patah*, the dramatic interaction and detail of the streaked visual textures is impressive, and the local matching of sync without redundancy is effective. These aspects are more obvious than the use of '*objets audiovisuelle*'.

Garro went on to explore structuring visual music via gestural mimetic material, creating *Dammtor* (2013). This has a parallel in this research project, as it incorporates human traces and gestures into visual music.

> [M]imetic Visual Music continuously struggles to escape the gravitational pull of narrative. It has to do so, as its purpose of existence lies in the artistic cracks found within the established language of cinematography… certainly in the case of my work Dammtor, the viewer is allowed to recognise, hidden behind the mist of granulated audio and video, the anecdotes portrayed or implied by the materials.
> (Garro, 2014, 14)

Garro's framework for the *objet audiovisuelle* is an ambitious attempt to articulate time, supported by his extension of musical structures into the audio-visual domain. He wrote, of composers of electroacoustic music:

> [T]heir experience in articulating satisfactory musical structures can help them understand the creative and perceptual implications of any time-based expressive media, including the moving image… whether it is an audible signal or a visible one, the act of composing is a, perhaps

> ambitious, attempt to articulate not just a particular medium and its constituent materials but, chiefly, the most elusive and immaterial element of all: time.
> (Garro, 2014, 9)

As an animator, I take a different approach and rely on animation-tempo (see Key Terms) – the key expressive tool of an animator – and other linkages in animation, especially perception of causality and animacy, rather than extended musical structures. The differences between sound and vision present a conundrum raised by relying on musical structures in the audio-visual domain. As Schafer notes, in sound a gesture is a unique event and textures cannot be deconstructed into gestures (Section 2.3.3). In vision, however, the texture of water falling can be zoomed into to reveal 'one drop of water', i.e. the background smear can become a foreground individual element and vice versa.

In a manner similar to the proposal in this research to broaden inspirations feeding into visual music, Garro widened his inspirations to include experimental cinema:

> I noticed parallels between some modern strains of Visual Music and the heritage of certain strands of experimental cinema. These two worlds are perhaps more contiguous than any practitioner on either side would care to admit. Bridging the distance between them may be useful as a further analytical perspective.
> (Garro, 2014, 9)

In slow cinema (Section 2.3.4), slow, meditative, contemplative looking links the cinematic image back to the pictorial image (see Key Terms). This is aided by avoiding cuts. In visual work such as James Turrell's, the evolving shifts in colour are foregrounded – without cuts, giving one long shot. The use of one long continuous shot is more widespread since its extension by both compositing and CGI. For example, music videos and commercials completely seamlessly join one shot to the next; the transition is invisible as one shot becomes the next through compositing the in-coming shot into the background of the out-going shot. In CGI, extended shots are created that have physically impossible camera moves, made possible with virtual cameras in 3D space. As Leon Gurevitch, the theorist on computer-generated culture, writes:

> Animated algorithms provide the spaces, objects and even ‘camera’ with a set of behaviours consistent with the physics of the real world at the same time as they allow for a plasticity in such rules only possible with animation. Consequently, the experience of the spectator is that of viewing an impossibly continuous, impossibly complex world that nevertheless appears to adhere to the laws of physics.
> (Gurevitch, 2012, 134)

Composing with one long shot avoids the metric effect of cuts, allowing the sound and visuals to run in parallel without being, in Cook’s term, in contest with each other (Section 2.4.1). Beholding one long shot emphasises the animation-tempo of the action within the shot, and highlights shifts of texture and colour.

There is a continuum of visual granularity. In James Turrell’s work (Section 2.5.1), the whole environment colour-shifts and there are no objects; this exemplifies the level of smear and blur. Then there are very small particles forming textures; there is granularity but far too many objects to count and they are not individually identifiable, i.e. the overall texture shifts like fog. Group behaviour allows very many to be observed as one and individuals to be subsumed within too-many-to-count, like ripples of water. When the group elements are larger, individual behaviour is observable. For example, it is possible to pick out the path of one falling raindrop on a window pane. Just as foreground and background cannot be seen as both simultaneously, the individual drop and the rest of the drops on the pane cannot be seen with equal attention simultaneously; one needs to switch concentration, as with selective listening exemplified by the cocktail-party effect (Section 2.4.1). At the other end of the continuum, there are one or more discrete objects. Norman McLaren’s *Blinkity Blank* epitomises this end of the continuum with the objects, two birds, appearing intermittently, out of blackness (Section 2.4.4). There is a continuum between animating a smear, in Golan’s term, or Klee’s dividual elements that have become so small they are a blur, and individual objects (Section 2.3.1). Having an awareness of this continuum of visual granularity could be one element in a new framework for composing visual music.

An approach to achieving equality between audio and visuals, underpinned by a nuanced awareness of granularity, is demonstrated by a composer whose approach coincides with the conclusions of Battey, Fischman and Garro, i.e. that a mix of mappings is needed (Section 2.4.4). Sven Ingo Koch wrote *Barabande* (2007) for Walter Ruttmann's *Opus IV* (1925) – the original score had been lost. Koch aimed:

> [O]n the one hand to do justice to the film – and thus also to its musicality – and, on the other, to distance myself from its dynamics and its dominating rhythm at least to the extent that the music does not accompany and reproduce, but rather it interprets, so that the cinematic and the musical compositions can interact with one other. I tried to achieve this 'equality' by switching between meticulous matching and a distancing from and reinterpreting of this matching. (Koch in Lund & Lund, 2009, 260)

Koch achieves cinematic and musical 'equality'. There is some 'meticulous matching' of sync (i.e. local sync) but it is not ubiquitous. The repetition of audio-visual synchronisations form associations but the overall impression is that Koch composed *to* visuals without illustrating them. There are the surprises of the music dying away – the film is silent for 20 seconds – balanced by 20 seconds of music at the end after the image fades to black. These strengthen the sense of the piece as one in which the music and visuals run in parallel. Although there are visual cuts and there is some local matching of sync, in one sense the visuals are seen as a whole and the sound responds to that totality – giving the largest granularity, unity, by the composer responding to *Opus IV* as if it was one long shot.

The tensions highlighted here between one long shot and local moments of sync extend to silent works. Silent audio-visual structure can be understood as rhythm or metre, duration, scale, tonal weights and swapping of positive and negative space. Absolute films, such as Richter's *Rhythmus 21,* featured constructed geometries that emphasise the rhythm. In contrast, Thomas

Wilfred’s lumia were structured like one flowing shot, a dance of abstract compositions, fluidly evolving through organic, continuous transitions, with accents or crescendos of brightness (Section 2.2.4).

Visual music composers, with a background in music, who have been influenced by electroacoustic composers, such as Trevor Wishart, concentrate on textural shifts in the audio-visual domain. Wishart writes: ‘Conventional music theory (at least in the West) deals almost exclusively with the properties of sounds on a lattice’ (Wishart & Emmerson, 1996, 17), referring to staff notation of pitch over time. He goes on to explain that shifts over time, i.e. how the texture and timbre changes, have become much more important than metric structures. These shifts are affective. We hear timbre changes in vocal expression acutely, and are affected by every nuance of change (Section 2.3.3). The visual music composer Joseph Hyde works with ‘*video concrète’*, focusing his compositions on ‘the development and transformation of material rather than the original material itself’ (Hyde, 2012, 172). Hyde continues that his *Zoetrope* (1998) was heavily influenced by Trevor Wishart’s *Tongues of Fire* (1994) and that he treats his video clips as analogous with Schaeffer’s ‘*objets sonores*’. The composer Barry Truax advises working with evolving visual textures as they can be very sonic, or stills, and using minimal or maximal audio with visuals, because visuals tend to take over (Truax, 2017).

**Conclusion**

Survage, Eggeling and Richter composed on the basis of truth to material, to create new unique forms. *Rhythmus 21* illuminates the opportunities, i.e. creating a visual rhythm using a movie-canvas and the limitations of the process help to maintain strict stylistic cohesion. Silent visual rhythm fulfils Strand 1-A of visual music but forgoes the power of vocal human traces and is a limited answer to going beyond the duality of eye and ear. Mitry denied the power of visual rhythms, relegating them to metric measures. However, visual rhythms inform our daily life, and film.

In *Blinkity Blank,* the sonic elements are thoroughly integrated but do not lead the action. This fulfils Strand 1-A. Norman McLaren's continual change, or morphing, of the characters, the gaps of black and how the events spring out of blackness all make the narrative full of surprises and impressionistic. *Blinkity Blank* provokes the viewer into making connections between events more than it provokes making predictions because of the continual change and surprise. It offers little constraint to seeing metaphors and forming hypotheses of the overall story. This freedom and the charm of McLaren's use of animacy are engaging. The technical limitations of the mode of production contribute positively to the cohesiveness and inventiveness of the style. *Blinkity Blank* can be enjoyed as viewing one surprise after another and/or through constructing an impressionistic narrative. *Blinkity Blank* balances the forces of cohesion and surprise in a work of art, providing a useful example for my practice and my framework of visual music.

In contrast, mathematically based composition, as exemplified in the diverse work of Whitney, Golan and Sherwin, does not provide solutions for Strand 1-A of visual music. The conceptual linking of sound and image can produce beautiful results (Whitney) and results that highlight perceptual responses (Sherwin). However, mathematical links generate audio-image patterns that tend not to affect at the pre-reflective level, unlike perceived causality or animacy. Additionally, mathematically based linkages such as Sherwin's result in patterns that are hard to predict and so do not give the satisfaction of being predictable (Huron).

Within the context of editing, Eisenstein's 'overtonal montage' would appear to be an appropriate mode of montage for visual music. However, timbre and textural changes have become more important than metric structures (Wishart & Emmerson, 1996). Timbre changes are affective and a prime signal of emotions, especially if the composition is structured as one long shot.

Audio-visuals are more effective when either the visuals or audio are complex. Audio-visual synchronisation is multifaceted and there is a continuum from artistic interpretation to a 1:1 mapping of the audio and visual. Koch achieves cinematic and musical 'equality' by composing *to* visual work as a whole, with some moments of local mapping. Given that anything can be mapped to anything else, the crucial element is the composer's sensibility, both in relation to the overall structure and in creating local events. Garro's *objets audiovisuelle* are one definition of gestural audio-visual 'time-varying phenomenological attributes'. However, from an animator's point of view, they have limitations. There are visual continuums of granularity (Klee, Levin, Garro) that could be a component of a framework for composing visual music.

This research focuses on creating visual music driven by artistic expression, moving away from the technical and towards more emphasis on the experience of visual music. In the next section, we focus on the experience of the perceiver.

## 2.5 Adding immersion – spectator to participant

This research into visual music seeks to return the expressive to visual music by placing visual music in wider artistic contexts. Turner sought to immerse viewers, to make them feel the sea, rather than seeing the sea from outside as a separate view, however emotionally powerful (Section 2.2.2). His expressive and affective legacy is more apposite than ever for visual music as expectations and technology tend more and more towards the immersive and the interactive. So often, visual music is seen on the fixed-screen on the wall in front of you rather than being an immersive experience. Whereas artists such as James Turrell, Anthony Gormley and United Visual Artists are making installations, there is not enough consideration of immersion in the discourse of visual music.

For this research, being immersed is defined as: when someone is completely involved in an activity to the extent that they lack awareness of the world outside the activity and lack awareness of time passing. Immersion is much more intense than engaging with an experience, and more intense than becoming engrossed. It is when the participant's emotions are affected by the experience and they somewhat disengage from the world outside the activity. Immersive experiences may overlap with 'flow', for example having no sense of self-consciousness, a distorted sense of time and finding the experience itself rewarding. Other aspects of flow experiences, as defined by Mihaly Csikszentmihalyi, are clear goals, intense concentration, a sense of personal control and a finely balanced level of challenge with intense interactive feedback (Csikszentmihalyi & Robinson, 1990). These aspects may all be lacking without diminishing the experience of immersion. Naomi Haywood and Paul Cairns found that, in museum exhibits, participants were more likely to become immersed if they were introduced to the interactive environment in progressive steps, so that they could develop their understanding and responses of their own ideas (Haywood & Cairns, 2006). The attitudes and tendencies of the participant are also important in immersion. As James Turrell observes, participants 'self-select' whether they will stay in his work, and more generally immersion is affected by how open participants are to new experiences and how rapidly they become cognitively absorbed.

In this section, key aspects of the experience of the beholder and immersion will be discussed through looking at aspects of display. We consider: the work of James Turrell and *Ganzfeld* (Section 2.5.1), projections in a constructed environment (2.5.2), how the spectator can become a participant inside the work (2.5.3) and open-ended performances (2.5.4). Finally, we look at whether the workings of a display are visible or hidden (2.5.5).

### 2.5.1 *Ganzfeld* and James Turrell's work

Artist James Turrell's work epitomises metaphorical synaesthesia (Section 2.2.1, Key Terms), something akin to wordless thought. In his *Ganzfeld Pieces* (Turrell, 1976), the viewer is in a space flooded with homogenous light. Coloured light fills the beholder's vision. The coloured light appears to change. After some minutes, it appears to fade. Another change occurs when looking at a new colour as the after-image of the previous colour is still present for a while and mixes with the new colour. This effect of internal and external mixing of colours is startling and one experiences disequilibrium. Self-experience is made chaotic, leaving the beholder in a pre-emotional, a-subjective state. Accepting this chaos allows all senses to be subsumed into the experience of colour: seeing, breathing, tasting and hearing colour. This state of quasi-synaesthesia could be said to have resonances with transcendental experiences or experiences of the sublime (Section 2.2.2).

*Ganzfeld* provides an extreme example of entering into an immersive state. When we cannot see, for example in profound darkness or glaring white light, we lose our sense of space and of where we are in space. Homogeneous luminance creates a *Ganzfeld* 'total field of vision' environment. In the 1930s, the psychologist Wolfgang Metzger attempted to isolate physiological vision in a pure state by exploring the simplest case of light on retina, i.e. flooding the retina with white light. There would be no object to see and, with nothing to see in the white light, the participants would experience pure vision. *Ganzfeld* provides no visual array, no retinal image; the light is un-focusable. The idea behind the research was to explore more complex cases after evaluating the results. However, the researchers' expectations were confounded. As Massumi states:

> *Nothing*, no content, no structure, *is given to vision*. Nothing except the event of its reiterative renewal. The only 'given' is the transformational *process* that is vision-becoming.
> (Massumi, 2002, 280)

Some subjects experienced a blank vision, or layers of nothing. After ten or twenty minutes, some subjects could not tell if their eyes were open or closed. Some subjects lost their sense of proprioception, and literally felt lost, without any orientation. The *Ganzfeld* caused the subjects' eyes to strain to try and make out objects that were not there. These subjects had individual experiences of form, motion and spatiality because each responded to their own individual endogenous retinal firings coupled with their own individual eye jitter. The after-effects included:

> fatigue and a feeling of great lightness of body. Motor coordination was reportedly poor, and observers had difficulty maintaining balance. Time perception was disturbed. Subjects often complained of dizziness and sometimes appeared to be intoxicated. One observer experienced temporary states of depersonalisation.
> (Avant, 1965, 247)

The results were all the more surprising to the researchers because they had not imagined just how chaotic and discombobulating this pure vision would be. As Massumi states: 'Pure vision, the simplest fullest empirical conditions of vision, is *visual chaos*' (Massumi, 2002, 146). Having no relationship to objects around us, because we cannot discern any objects, is disorientating; it destabilises our body-awareness. This is a different encounter with the physical experience of space, a sensual encounter, a kinaesthetic experience that is affecting. The sense of aloneness, being in the eternal present moment, and one's senses overriding one's intellect can be either disquieting or refreshing and renewing.

James Turrell's works require the viewer's presence, and the experience is an individual response to an immersive setting. Descriptions, video or photographs are removed and cannot convey the work's quality. It is important to surrender to the experience, to allow oneself to bathe in the light or darkness presented and to give one's eyes time to adjust. James Turrell discusses his works with Guggenheim curators Carmen Giménez and Nat Trotman:

> It is like stepping into the painting. It might take 10 minutes of sitting in a darkened room until you can see. Not everybody has the patience for that, so it is self-selecting. I don't mind that.
> (Turrell, 2013, Guggenheim website)

Turrell's work can be seen as scientific (as an experiment in perception), educational (as an instructive demonstration), artistic (as an aesthetic light-colour practice) and social (as an invitation to experience a different state of mind).

> His work can be interpreted in various ways: as aesthetically motivated; as a carefully calculated demonstration of certain laws as they apply to human perception and cognition; as a demystifying process leading to a clearer understanding of man's working relationship with his environment; as an instigator of subtly transcendental or metaphysical states of mind.
> (Wolff in Adcock & Turrell, 1990, 216)

He creates his art in and with light. We are fundamentally affected by light, as Arnheim notes (Section 2.2.4). Perhaps from nature, we have expectations of the appearance of pure light, and somehow Turrell's work fulfils these.

> Turrell's light images seem grounded in a foreknowledge of the way we expect pure light to look. Perhaps it is this inexplicable verity within the light itself that gives Turrell's works their deepest fascination. Turrell's art encompasses both art and nature, and within that multiplicity, there is room to attach any number of symbolisms or mysticisms.
> (Adcock & Turrell, 1990, 215)

Whether the 'self-selecting' beholder finds them mystical or not, Turrell creates immersive experiences. The artist Chuck Close states of Turrell:

> He’s an orchestrator of experience, not a creator of cheap effects. And every artist knows how cheap an effect is, and how revolutionary an experience. (quoted in Hylton, 2013, NYTimes online)

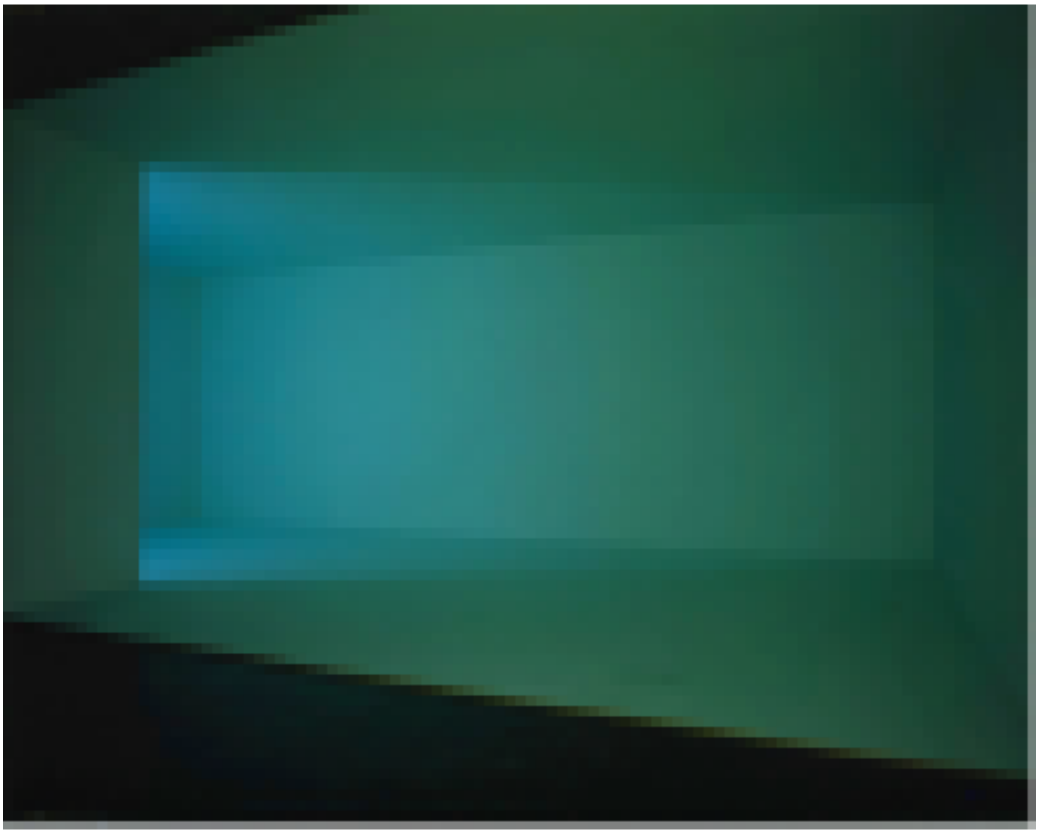


Figure 58. *Wedgework iii* (Turrell, 1974)

I first saw James Turrell’s work at the Hayward Gallery in London in 1993. That exhibition, *James Turrell, Air Mass* hugely affected how I perceive light and how I conceive of light. My memories of my encounter with Turrell’s *Wedgework iii* (Figure 58) are still vivid. I enter through a pitch-black corridor. I run my hand along the wall to keep my balance as I walk into the utter darkness. Then suddenly the wall ends and I stand before an astonishing, luminous, form in turquoise. It is a perceptual paradox that makes my senses vibrate. I stand close enough to fill my field of vision and the colour is infinite. There seems to be a glowing rectangular screen at the front but I can put my hand right into it; it is illusory, a space, in a volume made of light. The space is empty but the light itself has volume; it occupies space. The containing walls are so perfectly finished that they fuse with and are indistinguishable from the colours suspended in space. As I look from left to right across the glassy ‘screen’ the light changes from transparent to translucent. As I change position in the room, the depth of the projected planes, the thickness of the light, and its colours appear to shift and change. The work is never stable. It changes over time as my eyes adjust to the colour and luminosity, seeming to pulse and to almost breathe as I breathe. It is ever-changing; vibrantly alive.

Being in the experience allows an intense form of seeing; a seeing that is dream-like. James Turrell states:

> First, I am dealing with no object. Perception is the object. Secondly, I am dealing with no image, because I want to avoid associative, symbolic thought. Thirdly, I am dealing with no focus or particular place to look. With no object, no image and no focus, what are you looking at? You are looking at you looking. This is in response to your seeing and the self-reflexive act of seeing yourself see. You can extend feeling out through the eyes to touch with seeing.
> (Turrell & Holborn, 1993, 26)

This concept of haptic vision is reminiscent of Henri Maldiney:

> [I]n the spatial zone of closeness, the sense of sight behaves just like the sense of touch, experiencing the presence of the form and the ground *at the same place*
> (Maldiney quoted in Deleuze, Smith, & Conley, 2005, 163)

‘Haptic vision’, i.e. viewing with a sense of depth and contour but without discerning any perspective, in which eyes are in a haptic rather than optic mode, is key to a close-up mode of viewing. Turrell’s work compounds perspectival and illusory vision, allowing no experiential distinction between them. It is impossible to determine or fix the paradoxical shapes created in Turrell’s light pieces. The forms produced are indivisible; they give the experience of evanescent chroma made visual and even tactile in light. This light that is not made to illuminate objects feels like a boundless pure light. The experience of the work is different for each individual; it is formless enough to be shaped by an individual’s thoughts and desires, memories and dreams, degree of surrender to oblivion and physiology. As the art curator, Daniel Birnbaum writes:

> As an accomplished aviator, Turrell has experienced this light and these spaces at the altitude of several thousand feet and in extreme landscapes. However, all of us have at some point had intense

> sensations of the same kind: when confronted with open spaces, skyscapes and seascapes; in dreams and in imaginary landscapes. These are moments when light and void itself strike us as different and strange – producing a strong sense of presence.
> (Birnbaum in Noever & Turrell, 2002, 230)

The experience of Turrell’s work is reminiscent of Le Grice writing about the power of abstracted colour and its analogy to music:

> When color has become abstracted, by losing its specific object association but retaining an emotiveness in unspecific association, it is able to provide us with one of those strong phenomenological stimuli, like musical sound, capable of opening a new imaginative space. And like sound, when it is separated from the utilitarian purpose to become music, it becomes available as the basis for structured abstract experience... We return, if momentarily, to the pre-verbal, regressive and ecstatic – we suspend interpretation in favor of the experience itself.
> (Le Grice, 2009, 271)

Suspending interpretation, being in the moment experiencing the presence of light, allows an intense form of seeing that is evocative of the sublime, ecstatic. Spectators become participants in the experience.

### 2.5.2 Projections in a constructed environment

Bringing audio-visual work away from the fixed-screen allows it to be explored and experienced in constructed environments, in the three-dimensional world. Discourse around the beholder of a painting, or film, necessarily having a fixed viewpoint has a long history. Ernest Gombrich, the seminal art historian wrote:

> Our belief that we can ever make the world dissolve into such a flat patchwork of colours [a painting] rests in itself on an illusion… It is to the three-dimensional world that our organism is attuned, where it learns to test its anticipations against the flow of incoming stimuli, weeding out or confirming the predictable melodies of transformation that result from movement. The relationships in the plane that the illusionist painter has learned to attend to are of no biological relevance. They are studied in the highly artificial situation of one-eyed stationary vision.
> (Gombrich, 1960, 328–329)

Denis Diderot, the French philosopher, likened a painting to the stage; the static beholder is presented with a scene in perspective. One potential consequence of loosening control, of freeing the beholder to be mobile is to free the visual music composer of being overly concerned with the beholder who can move in and around the 'stage', because the beholder can take any point of view. Indeed, Diderot stated that the artist and the actor should be free from any constraints that playing to the crowd or impressing an audience might impose:

> Whether you compose or act, think no more of the beholder than if he did not exist. Imagine, at the edge of the stage, a high wall that separates you from the orchestra. Act as if the curtain never rose.
> (Diderot translated and quoted in Fried, 1988, 95)

In contrast, in this research, the freedom of the beholder is prized, and their experience is important.

A different type of display affords unexpected stimulus and, therefore, unexpected perceptual experiences. The perceptual psychologist James Gibson writes:

> [T]he same stimulus array coming to the eye will always afford the same perceptual experience insofar as it carries the same variables of structural information. If it also carries different or contradictory variables of information it will afford different or contradictory perceptual experiences.
> (Gibson in Adcock & Turrell, 1990, 217)

A truly immersive space frees the spectator's gaze, what they look at is not constrained as in fixed-screen media; i.e. the position and angle of their gaze and its duration are not pre-determined. Additionally, ideally the spectator moves around the space. Oliver Grau, the art historian and media theoretician, states of immersive spaces: 'viewpoint is no longer static or dynamically linear, as in the film, but theoretically includes an infinite number of possible perspectives' (Grau, 2003, 16). The spectator can look for as long as they want. However, this freedom is distinct from viewing the real world outside the constructed immersive space. As the film and media theorist Alison Griffiths writes:

> The sensation of entering a space that immediately identifies itself as somehow separate from the world and that eschews conventional modes of spectatorship in favour of more bodily participation in the experience, including allowing the spectator to move freely around the viewing space… One feels enveloped in immersive spaces and strangely affected by a strong sense of the otherness of the virtual world one has entered, neither fully lost in the experience nor completely in the here and now.
> (Griffiths, 2008, 2)

An immersive environment makes one feel drawn into the experience. This is not a binary experience – being either immersed or at a critical distance – but a state that is in flux.

> Obviously, there is not a simple relationship of 'either-or' between critical distance and immersion; the relations are multifaceted, closely intertwined, dialectical, in part contradictory, and certainly highly dependent on the disposition of the observer. Immersion can be an intellectually stimulating process… It is characterized by diminishing critical distance to what is shown and increasing emotional involvement in what is happening.
> (Grau, 2003, 13)

Immersive constructed spaces are not necessarily instantaneously understood in the sense that a work of art of great quality is instantly understood by the beholder, that it has a 'presence' – as in the long-held tenet of art critics and historians such as Michael Fried (Fried, 1988). However, in my experience, installations designed to be walked through and that require the beholder's eyes to adjust to the light, such as those by Turrell and McCall, have a different quality. In constructed spaces, the spectator-participant is more receptive to the work, and to being immersed in it, because they have given themselves time to adjust to the experience and to walk through the work. This gives them, literally, different points of view.

> [I]t takes time for the visual system to adapt to local light levels – but once it has become fully sensitized one might expect that, if anything, the viewer would be more receptive to the deeply penetrating 'immediacy' that Fried posits as being necessary for experiencing art of great quality.[36]

[36] Additionally as Andrew Hill stated at *Seeing Sound* (2016): in a post-modern world, an artistic idea is not 'transmitted' to spectators, spectators interpret what they see/hear based on their past experiences. The 'text' may

(Adcock & Turrell, 1990, 55)

Constructing an environment, for example working with light in what is essentially a black box – a television studio with black walls and no windows – allows the creation of illusions. It allows moments of beholding in which objects can be unnamed and unresolved.

> The difference between illusion and perception is intrinsic, and the truth of perception can only be read in perception itself. If I believe I see a large flat stone, which is in reality a patch of sunlight, far ahead on the ground in a sunken lane, I cannot say that I ever see the flat stone in the sense in which I will see the patch of sunlight while moving closer. The flat stone only appears, like everything that is far off, in a field whose structure is confused and where the connections are not yet clearly articulated.
> (Merleau-Ponty, 2014, 310)

A great advantage of working in a completely controlled environment is that it allows the creation of structures of light in haze and projections that change the perception of the space. For example, James Turrell's work typically creates spaces that give the illusion of being larger than the physical volume of the installation.

Working with dark environments also creates challenges. The beholders will need to acclimatise to the dark. Turrell's *Dark Spaces* (1983), for example, are almost completely dark; perceivers need to wait for about half an hour to adapt physiologically to the darkness. This is difficult in the context of museum-viewing as it runs counter to expectations, and, for safety in the dark, the numbers of people must be limited. The shift to night-time seeing, the Prukinje shift, changes peak luminescence sensitivity towards blue light and renders humans nearly colour-blind, as the more light-sensitive rods (rather than cones) in our eyes react to the low light. Adcock writes:

> [Turrell] manipulates perceptual fields that are almost invisible… perception at these low levels is never really a matter of 'seeing' so much as 'sensing' the light's presence… In the subtle conditions of the

---

impose limits and the spectators find some (cultural) commonality of experience but the composer cannot know that spectators will perceive what he/she intended (Hill, 2016).

*Dark Pieces*, light has ipseity. It is itself, just light, just the basic stuff of perception, and in that unique place, it is extremely intense, despite the fact that it hardly exists at all.
(Adcock in Adcock & Turrell, 1990, 111)

The relationship of audio and image in the space affords many opportunities to create depth. Kathryn Kalinak, a theorist of film music, gives an example of increasing the spatiality of a fixed-screen by projecting the film from the back of the hall on to a fixed-screen at the front, where the speakers projected the music back towards the projector: 'through a kind of transference or slippage between sound and image, the depth created by the sound is transferred to the flat surface of the image' (Kalinak in Cooke, 2008, 6).

This is further complicated when the projection is in 3D, as placing an image in space requires different considerations from sound in space; the two spatialisations are no more than analogous. The composer and director Jean Piché writes of 'experimenting with 3D projection as a way to spatialise visuals in a manner analogous to (but actually quite different from) placing sound in space' (Hyde & Piché, 2014). One reason for this is that sound and image have different immersive affects. Whereas the beholder's gaze falls on one point at one time, their ears cannot help but be immersed in the total audio; even if they choose to concentrate on just one part of it (Section 2.4.1). Joesph Hyde writes:

[S]ound and image work completely differently in spatial domain. Sound is fundamentally immersive (generally, if we hear something, we are immersed in the vibrations – if it's loud enough or low enough we can feel it on our skin or even deep in our bodies). Image, on the other hand, seems to always be something outside of ourselves, something that we observe. There is no (exact) sonic equivalent of 'the gaze', or indeed of closing our eyes.
(Hyde & Piché, 2014, eContact! online)

The breadth and depth of technological change and usage in the audio-visual domain affects both arts practices and everyday life, shaping how we react to audio-visual works. There is ubiquitous immersion in the small screen of smartphone and increasing aptitude for 'falling into' and being immersed in a small image. However, the immersion afforded by works whose size blocks out everything else cannot be denied (Section 2.2.2). ‘While not strictly isomorphic with immersion, “bigness” conjures up metaphysical constructs such as the sublime’ (Griffiths, 2008, 9).

### 2.5.3 Being a spectator-participant inside the work

Some large installations allow the spectator to enter into the work. Placing the spectator as a spectator-participant inside the work allows investigations of open-ended, unrepeatable, spectator-participant experiences using projections in real space. Allowing the spectator-participant to be mobile inside the work fundamentally changes the relationship of the beholder of the work, making them a spectator-participant in the work. Anthony McCall had his first encounter with an act of personal creation as a spectator, and experienced being a spectator-participant in the early 1970s at John Cage’s *HPSCHD*. This was performed at the Roundhouse in London, which had an old turntable, 60 feet in diameter, formerly used for steam locomotives. At the periphery, there were seven equally spaced harpsichords and each harpsichordist played a different tune. McCall stood in the centre and heard the cacophony, then walked towards different harpsichords in turn. He observed:

> [O]ne became a kind of mobile mixer, creating one’s own musical experience. The act of personal creation became a quite conscious part of the experience – and a source of considerable pleasure. It was qualitatively different from that of ‘following’ a piece of music. Cage’s placing of the spectator as central to the realization of the piece, his attitude toward musical sound and listening, and his use of space, all struck me as being extremely suggestive.
> (McCall, 2003, 60)

Complexity is added to the spectator-participant’s experience, as they are free to move around the space. This also ensures that each experience will be unique. As Jean Piché found:

> The audiovisual object adds a layer of complexity by integrating the space in which it is displayed and into which the audience can move. It reintegrates spatiality. You can walk around it; you can get very close to it or move far away from it. The object occupies a finite space that is

> filled with an acoustic wavefront. Consequently, when you move into this field, you vary your position of hearing as you vary your position of seeing. The viewer / auditor recontextualizes the relationship of sound to image by contributing his movement.
> (Hyde & Piché, 2014, eContact! online)

One means of creating 3D, volumetric-projections is to project light into haze. As soon as haze is present it begins to disperse; it is evanescent and continually changing, material and immaterial. Projecting into haze allows a form of interaction with the image that is impossible with fixed-media – it is possible to touch the projection. As Jennifer Barker writes: ‘Confronted with a viewing body that reaches toward them, the films refuse to “touch back”’ (Barker, 2009, 119). The haze will not ‘touch back’ but it will react.

Anthony Gormley’s *Blind Light* explores ‘real bodies interacting with a conceptually-structured space’ (Gormley in Caiger-Smith & Gormley, 2010, 111). Gormley designed *Blind Light* as:

> a very brightly lit glass box filled with a dense cloud where people will vanish as they enter the chamber but might emerge as shadows for viewers outside the box.
> (Vidler, et al., 2007, 53)

The box looked like a bright, cube-shaped cloud. It was about ten metres wide and three metres high, with an opening on one side. It contained a cooled atmosphere of 90% humidity, which was flooded by 7,000 lux of fluorescent light, giving visibility of less than one arm’s length. The exhibit was immersive; the spectators became part of the work when they entered the box and were observed by others outside the box. It was very popular and much discussed. Gormley designed *Blind Light* as a social experiment, a new perceptual experience and a new kind of encounter with the presence of others.

> With *Blind Light* you could say that light is the environment, but actually people are the environment. It’s about these very close encounters with the other… It’s a kind of social experiment. The idea of separating people from all the things that make them certain about where they are or maybe who they are.
> (Gormley in Caiger-Smith & Gormley, 2010, 111)

I went to *Blind Light* in 2007 with my daughter, who was four years old, and my husband. As we approached, we saw disembodied hands touching the glass walls with very faint bodies behind them. The bodies were formless, dissolved into the mist. My husband and daughter went into the illuminated box just before me; they were immediately enveloped in the mist and disappeared from view. I entered. I was surprised at how moist and cool the atmosphere was and how immediately and strangely isolating it was to be literally unable to see my hand at the end of my arm. I found my daughter and husband in the fog by the sound of their disembodied voices; they suddenly loomed up out of the fog. I had a strong memory of my father walking me to school when I was four through a dense fog: the wetness, the sound of our footsteps on the pavement, thoughts of being lost and us holding hands. I crouched at my daughter's eye-line as I wanted her to enjoy the experience – it had the potential of being scary – and we played with seeing and not seeing our hands by stretching out our arms. We three held hands and then let go briefly, to play with appearing and disappearing into the fog by stepping away. We went to a glass wall and touched it, aware that only our hand and forearm would be visible to the spectators outside. I played with making hand-symbols pressing my 'disembodied' hand against the glass, silently, as if in a dream, not knowing how my hand-symbols looked (I could not see my hand) or if they were noticed from the other side of the glass. We came out of the box laughing and slightly dazed. Once outside the box, I looked back at the disembodied hands against the glass walls with fresh eyes.

This project aims to contextualise visual music within wider artistic practices and so it is instructive to reflect on art-gallery experiences and also to look at the 'experience economy', as there are some correlations between creating an engaging visual music installation and a successful commercial experience for an art gallery. Companies have become more intent on, and more adept at, selling experiences, above and beyond selling products and services. Their success hinges on creating positive and memorable aesthetic experiences. Joseph Pine and James Gilmore stress the importance of creating a cohesive, positive narrative that engages all five senses (Pine & Gilmore, 1998). They define the quality of experience by dividing it into ‘four realms of an experience’. The realm is based on whether participation is more ‘passive’ (when the consumer has little effect on the experience) or ‘active’, and whether the consumer is more ‘absorbed’ or more ‘immersed’ in the action (Figure 59).

| | Passive participation | Active participation |
|---|---|---|
| Absorption | Entertainment events (e.g. films) | Educational events |
| Immersion | Aesthetic events (e.g. art-gallery visit) | Escapist events (e.g. acting) |

Figure 59. Four realms of consumer experience (based on Pine & Gilmore, 1998, 100)

Reflecting on these aspects of constructed experiences is useful; however, for installations that allow spectators to become participants, such as *Blind Light*, these four realms are more of a continuum on which spectator-participants slip from one ‘realm’ to another. For children, at least, research finds that the main forms of engagement with interactive exhibits involves participation in the experience, narration and the co-presence of others (Haywood & Cairns, 2006). Narration can be from the exhibit (explicit, implicit, inferred correctly or not) and also the participants’ first-person narrative of their own experiences. Co-presence makes the experience social and gives the opportunity to communicate the experience to others within and after the experience (aided by first-person narrative). My experience at *Blind Light* and with McCall’s work (Section 2.2.4) confirms the socialising effect of co-presence, and my experience with *Blind Light* also demonstrates that co-presence makes the experience both more affecting and more memorable.

### 2.5.4 Open-ended performances

Open-ended performances are performances in which there is no absolute beginning, middle or end and during which spectator-participants can come and go. The avant-garde composer and poet John Cage created temporal spaces, events that integrated sounds, music, language, images, objects and actions. These events had no basis in literary narrative structures or traditional musical structures.

> In the late forties I found out by experiment (I went into the anechoic chamber at Harvard University) that silence is not acoustic. It is a change of mind, a turning around. I devoted my music to it. My work became an exploration of non-intention... making my responsibility that of asking questions instead of making choices… I was to move from structure to process, from music as an object having parts, to music without beginning, middle, or end, music as weather.
> (Cage, 1989, JohnCage website)

During the 1950s and 1960s, Cage's influence was ubiquitous and is evident across temporal artforms, especially those that meld more than one traditional artform together, such as McCall's solid-light forms. A composition can have repetition, but the experience will always be unique for the spectator-participant. For example, in McCall's solid-light work *Doubling Back* (2003), he used repetition in the form of a wave of light, and placed the spectator-participant within it (Figure 60). The travelling wave has continuous, fluid motion and a figurative quality. It evokes a body moving slowly or moving under water. This quality of animacy (see Key Terms) evokes a human, not a mechanical, interaction between the spectator-participant and the light.

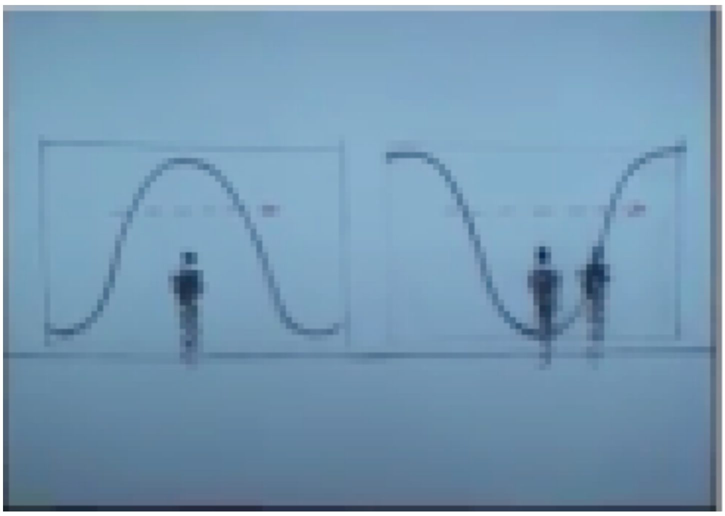


Figure 60. McCall's sketch for *Doubling Back* (2003), still image (McCall, 2014, Vimeo)

> The waveform simply repeats itself, but while it is doing so it moves at a certain speed as it is going through the frame and it changes height relative to the standing spectator. You can be in troughs or under arches, it can pass across your body.
> (McCall, 2014, Vimeo)

The very uniqueness of each performance helps the spectator-participant to be in the moment.

> We are living in a period in which many people have changed their mind about what the use of music is or could be for them. Something that… expresses itself simply by the fact of its vibrations. People paying attention to vibratory activity, not in reaction to a fixed ideal performance, but each time attentively to how it happens to be this time, not necessarily two times the same. A music that transports the listener to the moment where he is.
> (Cage, 1989, JohnCage website)

Just as I found in *Blind Light*, response, play and participation can be freely constructed in the moment. We see with our eyes and our imaginations, our knowledge of the world and our memories. Visual music compositions can be as much about creating a shared experience as they are about artistic self-expression; they can focus on the experiential. As the visual musician, Jordan Belson stated:

> I don't want there to be any ideas connected to my images, and if there are any there, if anybody sees any, those are entirely in the eyes of the beholder… Actually, the films are not meant to be explained, analysed, or understood. They are more experiential, more like listening to music Belson.
> (Belson in Brougher et al., 2005, 148)

Open-ended performances can create space for the spectator-participant by having incomplete sound and/or images, just as a sketch can free our imaginations and increase our enjoyment.

> [T]he incomplete painting can arouse the beholder's imagination and project what is not there… We tend to project life and expression onto the arrested image and supplement from our own experience what is not actually present… The willing beholder responds to the artist's suggestion because he enjoys the transformation that occurs in front of his eyes.
> (Gombrich, 1960, 200)

Both the sonic element and the visuals can allow spectator-participants the opportunity to complete them. As Katherine Norman writes of composing with recorded sounds:

> we can... emerge from our listening montage feeling that we had a say in creating the answers, even if the composer created the clues that directed our perception.
> (Norman, 1996, 37)

Arnheim was in favour of simpler audio paired with complex visual action or vice versa, otherwise one would detract from the other (Arnheim, 2007, 213–127), echoing Cook's analysis of audio-visuals (Section 2.4.1).

A key element in enabling an immersive spectator-participant response is to create very slow changes for extended periods. Gormley's *Blind Light*, Turrell's and McCall's work all change very slowly, to allow the spectator-participants the slow meditative, contemplative form of looking engendered by films such as *Empire* (Section 2.3.4). When cinematic works are projected into real three-dimensional space and spectator-participants are encouraged to walk in, around and though the projections, time is as vital as space; the projected light must move slowly enough to encourage the spectator-participants to move.

> I am drawn to slowness. It is not a problem for a movie [to be fast] but sculpture requires a different sort of looking which requires you to be mobile and some of what is actually discovered is done by you in motion. If the motion is too fast in a solid line piece we suddenly stop, frozen to the spot, but if the motion is slow enough it releases what I call 'sculptural looking' and people begin to walk around it – the fastest thing in the room should be the spectator.
> (McCall, 2014, Vimeo)

Conversely, if the changes are more rapid, the spectator-participants will be still and look at the changes. The quality of looking, especially when not physically reacting to the event, but just being in the moment, could be likened to Kaplan's soft fascination in nature (Section 2.3.4). The expectations of the audience are also key: if they come for a performance, they will be disappointed. McCall realised this early in his career and greatly slowed and lengthened his pieces so that the audience could enjoy drifting in and out of the display at will, choosing whether or not to participate in the experience (McCall, 2014, Vimeo)

### 2.5.5 The workings of the display – visible or hidden?

Artworks in the medium of light have different resonances if their workings and supports are invisible to the beholder. Wilfred's work (Figure 8) allows the viewer to concentrate on the smoky-textured, organically evolving coloured light without showing the source. The mechanics are hidden from view and the ever-changing movement of colours out of black epitomises the ethereal. Turrell's work (Section 2.5.1) appears to be pure light and evokes the vaulted heavens. He has developed his ability to work with the difficult medium of light, from his first '*deus ex machina'* attempts created using several devices. His later installations completely hide the hardware; all the workings and supports are invisible to the beholder (Adcock & Turrell, 1990, 226).

In contrast, Moholy-Nagy's *Light-Space Modulator* (Figure 6) shows its sculptural workings, which look like an assemblage of bought graters, sieves and mirrors. Seeing the source of the shadows adds to the work, as the size of the shadows, their varied nature and their nuance and beauty of light over the whole is all the more surprising with the source visible. The relationship between source and shadow is complex enough to give endless interest. This is reminiscent of looking at dappled shadows or caustic light reflections, where the source and the result are surprising even as they chime in rhythm together as they endlessly evolve. They evoke effects of nature, the source of Kaplan's soft fascination. The work of Nicholas Schöffer, the father of cybernetic art, has a similar effect. McCall also shows the source and the effect, allowing his spectator-participants to engage with the both the spectacle and the puzzle of a two-dimensional line becoming solid light from different physical angles. The artist David Batchelor advocates a visible-workings approach to keep the artwork in the realm of art and not in a quasi-religious domain:

> [A]lways in any of the work make sure that the support… is always visible to anyone viewing it. And one of the reasons for that is that there's always gonna be someone who sees a bright light in a darkened room and who will mistake it for a religious experience. In a way, the whole thing is if you can see the plug, then it stops you getting mystical.
> (Batchelor, 2007, 7)

In this research, the workings will be shown. Although I hugely admire James Turrell's works and find them deeply affecting, seeing others reacting to his work has made me aware of how hiding the workings can create, unintentionally, a quasi-religious experience for others. I wish to avoid this terrain.

### 2.5.6 Conclusion

*Ganzfeld* is an example of extreme immersion; it provides no visual array, no retinal image; the light is un-focusable. Self-experience is made chaotic. Being inside James Turrell's work approaches *Ganzfeld* and allows an intense form of seeing – haptic vision. Turrell's work allows no experiential distinction between perspectival and illusory vision; it is essentially formless. The individual shapes the experience. This intense experience of colour evokes the sublime. Expanding audio-visual work from the fixed-screen into constructed environments, into three-dimensional worlds, affords unexpected stimulus and unexpected perceptual experiences. The spectator's gaze is freed from looking at a fixed-screen: theoretically, there are myriad perspectives. Illusions can be constructed. Whilst an immersive environment draws in the spectator and makes them more receptive to the work, they are also in flux between being immersed and being at a critical distance.

Allowing the spectator-participant to be mobile inside the work fundamentally changes the relationship of the beholder of the work, making them a spectator-participant in the work. The relationship of audio to visuals changes as the spectator-participant moves through the space. The required dark environment poses challenges. Volumetric projection allows spectator-participants to touch the projection; it does not ‘touch back’ but is changed in response. Spectator-participants slip from absorption to immersion and from passive to active; their experience lies along a continuum of these states. By focusing on the experiential, visual music compositions can be as much about creating a shared experience as they are about artistic self-expression. Very slow changes for extended periods are key in enabling spectator-participant response. Wilfred’s and Turrell’s pieces hide their workings in contrast to work from Moholy-Nagy, Schöffer, McCall and Batchelor. The latter approach helps to keep artworks, especially artworks based on light, in the realm of art and not in a quasi-religious domain.

# 3 Research framework, methodology and work

This chapter demonstrates how I tested concepts, methodologies and processes from Chapter 2 in order to develop a new framework for composing visual music with human traces, from an animator's perspective. First, my research framework, main methodology and sub-methodologies are discussed (Section 3.1). The rest of the chapter is structured around the main methodologies being discussed, and the works that best exemplify my research using these methodologies are grouped together. This structure focuses on the development of methodologies, rather than the chronological development of works.

## 3.1 Research framework and methodologies

My research framework is based on 'Practice as Research' from Robin Nelson's *Practice as Research in Arts: Principles, Protocols, Pedagogies, and Resistances* (Nelson, 2013). Nelson makes the close integration of theory and practice central, as did a progenitor of Practice as Research, Paul Klee (Section 2.3.1). Nelson highlights how practice as a mode of research requires not only knowledge of conceptual frameworks ('know-that') and knowledge of what is 'working' and also worth pursuing ('know-what') but also, vitally for this project, experiential, embodied and tacit knowledge ('know-how') (Nelson, 2013, 37).

In Practice as Research, modes of knowing range from tacit to explicit and from embodied to shared.

> [K]nowledge exists on a spectrum. At one extreme, it is almost completely tacit, that is semi-conscious and unconscious knowledge held in people's heads and bodies. At the other end of the spectrum, knowledge is almost completely explicit or codified, structured and accessible to people other than individuals originating it. Most knowledge of course exists between the extremes.
> (Leonard & Sensiper, 1998, 113)

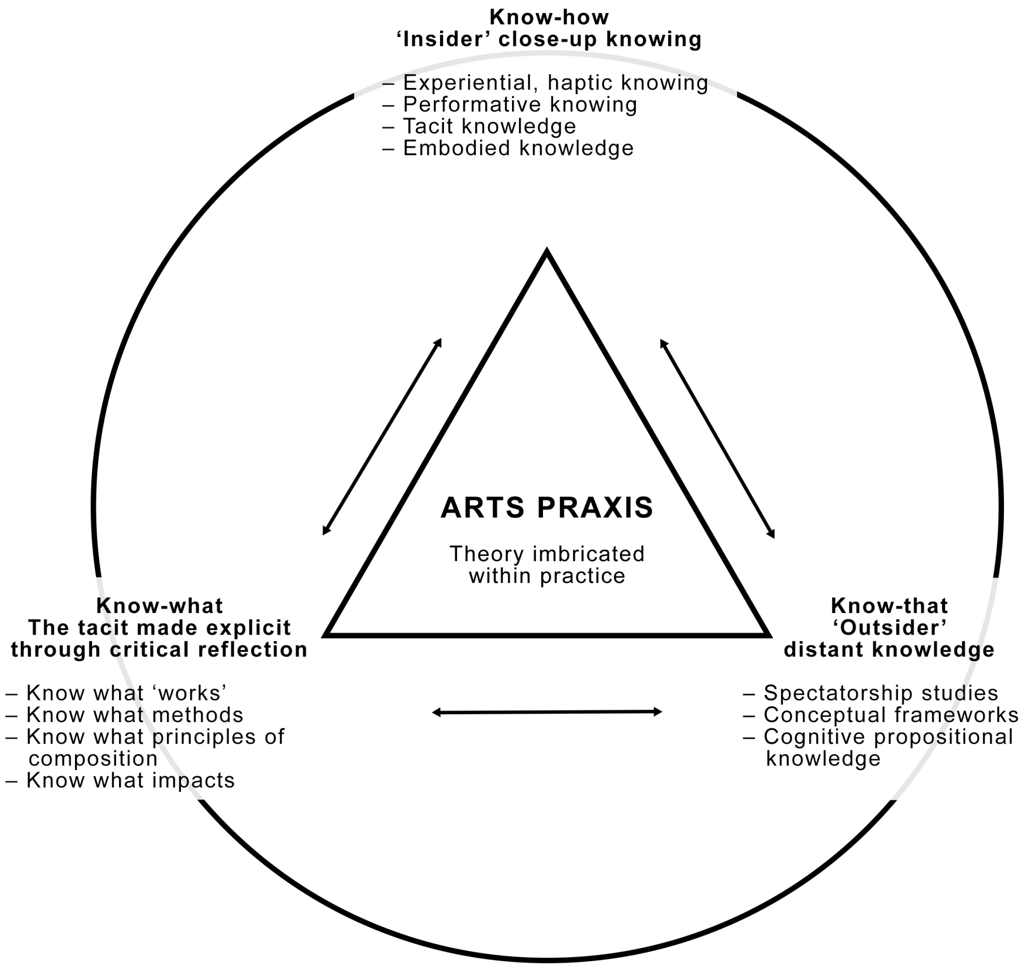



Figure 61. Arts praxis (based on Nelson, 2013, 37)

Nelson implicitly recognises this spectrum of knowledge with know-that being structured and accessible to others, know-what knowledge being 'tacit [knowledge] made explicit through reflection' (Nelson, 2013, 37) and know-how being inside the artist's head and body. Nelson visualises these three forms of knowledge as flowing to and from each other; with arts praxis – theory overlapped with practice – placed at the centre of all the knowledge (Figure 61). This project uses Nelson's framework as an iterative, dynamic model of research, recognising not only the flow of thought from the tacit to the explicit but also different modes of thinking.

> [T]he first moment of phenomenology originates in doing, but accompanying this doing is a weaving in and out of a line of thought, a line of questioning. The thought as it emerges is non-homogenizing,

> and sometimes goes quiet. In this sense it is different from normal analytical thought.
> (Kozel, 2007, 50–51)

Setting clear research objectives is vital to using this research framework: my overarching objectives were to expand the concept of visual music to include embodied visceral affect, to produce a framework for composing visual music and to create artistic works. A secondary objective was to test my proposition, as an animator, that visual structure, visual representation of sonic data and creating moving image *to* music are as valid for visual music composition as is the traditional approach of starting from music and musical structures (Section 2.1).

This research framework allowed innovative creative practice to be developed from the new theoretical perspectives on visual music articulated in Chapter 2. This practice is underpinned by my own long experience in industry as an animator, which enables me to look at visual music afresh and gives me a wealth of experience of turning know-how knowledge into know-what knowledge and positively acting on, often client-originated, know-that knowledge. The creative practice fed into the iterative development of a framework for composing visual music and the developing framework was tested through creative practice.

My perspective as an animator is through my practice. I work alone rather than collaborating with musicians or other artists. This aligns to Strand 1-A of visual music. Working alone allows a tacit mode of working in which, unlike working as a director, creative decisions do not have to be articulated to others, and many creative decisions are not even articulated to myself. As Kozel states, phenomenology starts in doing and a questioning mode of thinking arises from this that does not follow the lines of normal analytical thought. McLaren (in McWilliams, 1990) calls this working with the unconscious and it aligns to Klee’s concept of the artist as conduit. More broadly it is in the tradition of an artist exploring and researching through making.

McLaren stated that one is an artist of one's time – if he had been born later he would have animated using a computer (ibid.). I work across digital and analogue modes. In my role as animator, I also subsume the roles of director, camera, sound, editor, colourist and installation artist. McLaren's animations, created through scratching and painting on film, pastel drawings and 'pixilation' (in which live actors pose frame-by-frame), have influenced my work. My practice is underpinned by an awareness of many different opportunities for creating and controlling expressive movement, opportunities that are found in production, post-production and display. These include: traditional frame-by-frame drawings, (*Continuous Punctuation),* animating the camera (*Song Series Variation 1 & 9),* directing action (*Ambience 2)*, editing action through speed changes (*Song Series Variation 4)*, or repeating selected frames (*Reservoir)*, keyframing objects, morphing objects (*Singing Light 1*), tracking particles to human gesture (*Ambience 2*) and animating cycles of projected light (*Singing Light 1*).

Being a 'digital artisan', using contemporary and legacy materials and processes with an awareness of their original contexts and significance, gives incredible freedom to combine materials and processes, a freedom that challenges creating a cohesive work. The inspiration that McLaren was able to take from pushing against the boundaries of analogue processes has evaporated along with the boundaries. However, each mode offers different opportunities, and has different challenges – for example filming clouds digitally gives instant feedback but the lensing possibilities of the equipment and the cloud conditions at the time create limitations. In contrast, creating clouds from particles requires long rendering times and gives slow feedback but has almost infinite possibilities. I use inflexible frame-by-frame drawing and painting and also incredibly flexible keyframes. The former remains a visible process; the latter is not only invisible in the final render but can be made almost infinitely complex through adding expressions which algorithmically tie different movements together. I use this sparingly and instead rely on the nuance of human gesture.

The treatment of these elements of animation lies along a continuum, from preserving their origins as much as possible in the final piece to making the treatment and transformation key, in the manner of Joseph Hyde's '*video concrète*'. Similarly, digital layering has a continuum from being invisible, creating a new seamless, impenetrable surface from innumerable materials, to creating a collage that shows the edges of different elements. Wherever the work falls along this continuum, edges are always key. The diverse originating elements, their treatment and layering, taken in combination, allow incredible flexibility in nuancing the final piece along the continuum from the 'real' to the 'abstract', and this is key to me as an animator.

There is a difference between an animator's and a painter's perspective because animation can be seen only in movement. Therefore, the animation, at whatever stage of completion, must be played and the impression of that playing acted upon – to keep it, to change it, or to start again. Like McLaren working on *Blinkity Blank*, I generally work in short bursts – mine are from half a second to five seconds – and build these up. This is supported by my background; I worked in animation for commercials, which were usually thirty seconds long and built from shots with a duration of between half a second and five seconds. However, I also experiment with longer forms and very gradual changes (*Horizon* and *Singing Light 1*). For me, working to create immersive installations using animation means not only playing the animation but also playing it in situ, working out the next step as a maker by being in it, by fully experiencing it (see Appendix C).

I reflect on the body of my animated work and note approaches that I want to pursue further. One such approach is to treat colour as a separate element that has its own journey with its own timing. I pick out colour progressions and apply them, for example the colours of the sky as the sunset in *Horizon*. I also physically separate the colour from line and tone and animate it as a separate field that merges in the air with the line and tone, as in *Singing Light 1*.

Several methodologies were employed within this research framework. These methodologies evolved during the project through the framework of Practice as Research, through the three modes of knowledge, through creating, sharing and evaluating the work and undertaking further theoretical research before creating the next piece.

The main, overarching methodology was to pursue two diametrically opposite modes of composition. The first of these was to start with the pioneers of visual music – Richter's and Eggeling's – aspiration to create a universal language by synthesising visuals and audio in a meaningful way. The second mode, in contrast, was starting from the premise of expressivity and phenomenological experiences underpinned by references to artistic practices from within and beyond the traditional canon of visual music, especially Turner and the sublime. This is in response to Klee's methodology being centred on the artist seeing the world afresh through two diametric modes: constructive-geometrical and a metaphysical openness.

The methodology that supports investigating visual music as a universal language is creating a library of 'animated-image-audio units'. This is my own term; here unit refers to a single, indivisible entity of animated images always seen with the same audio. In terms of granularity (Section 2.3.1), each unit has a few frames' duration. The works that feature this methodology are *Shadow Sounds 1*, *Shadow Sounds 2*, *Shadow Sounds 3*, *Sky* and *Continuous Punctuation*. These works visually represent sonic data: Strand 2A. The area of exploration underpinning this methodology is mimicry of human gesture with simple shapes using animation. The methodology of animation-tempo and quality of movement forming *the* expressive tool of an animator is key. The works of Klee and McLaren are seminal influences. This area is at the nexus of several theories. Research from Heider & Simmel, Marshall & Cohen, McAleer & Pollick and Scholl & Tremoulet delineate animacy. Research from Michotte, Basawapatna, and Choi & Scholl broadens this with perception of causality. Gallese's work on mirror neurons highlights the pre-reflexive responses and ubiquitous nature of mimicry of human gesture.

Because the human gesture to be mimicked is vocal expression, both the qualities of vocal expression and audio-visual sync are key to this methodology. The inherent challenges of meaningfully mimicking vocal expression due to the differences between the perception of audio and visuals have been delineated in Chapter 2. This is underscored by broader effects of music as expressed by Zwaag et al. and Grewe et al. and Langer's theory that music expresses emotions more clearly, precisely because its meaning is imprecise. Conversely, Shimojo highlights cross-modal integration of our senses and Chion and Murch note the trans-sensorial effects of audio-visuals, which, while not synaesthetic, create a metaphorical synaesthesia (Section 2.2.1, Key Terms). Additionally, Leman, Iwanaga and Smalley found that human rhythms are the foundation of our perception of rhythm, in an analogous manner to Kant and Klee referring to the human scale in the visual. Therefore, at the level of embodied visceral affect there are possibilities for 'an equal and meaningful synthesis of the visible and audible' (Lund & Lund, 2009, 149), which is supported by Brougher et al. finding that optical effects affect the 'musical mind', enabling something analogous to synaesthesia.

At the reflective level, audio-visual elements to test and evaluate within this methodology are defined by Cook's concepts of conformance, complementation and contest and Chion's concepts of audio-visual relationships. Chion's sync-points and Huring's event-binding are of particular interest when synthesising the visible and the audible. Mapping can produce an absolute sync: as the different methodologies of McLaren and Pfenninger show. Avraamov creating microtonal music with the aim of producing a new universal language contrasts with the artistic approach of Fischinger. Current, computer-driven mappings reveal that, although technology has moved on exponentially, the fundamental problem remains the same: these mappings do not consider emotion when generating the music from visuals. Schafer states that redundancy is a requirement of language systems but inadvertently creating too much redundancy is a key challenge highlighted by mapping. At the other extreme is metaphorical sync (see Key Terms).

Given that integrating human traces and thereby eliciting an affective response is fundamental to this research, the desire for visualisations of the voice to have animacy as demonstrated by Pietrowicz & Karahalios is key. The other key linkage is the shape-sound-symbolism evidenced in Bremner et al. & Köhler's Bouba-Kiki effect, further developed by Ramachandran & Hubbard's phonemic inflections and Cuskley et al.'s relation of orthographic characters and how we speak.

The combining of animated forms and audio to create a universal language raises the problem of the difference in granularity of audio and visuals. Here Klee's concept (later adopted by Golan) of a continuum of visual granularity that ranges from blur, to dividual to individual objects, is useful, especially as it is not a fixed continuum but allows an element to change from one level of the continuum to another, with a change/zoom of view. Klein talks of reducing light, form and movement and sound to the same terms and indeed creating work that is not solely reductive is another key challenge. Schafer writes: 'All visual representations of sounds are arbitrary and fictitious' (Schafer, 1993, 127). In order to avoid the 'arbitrary and fictitious', animating vocal gesture needs nuance and the recognition of the animacy of the voice (Pietrowicz & Karahalios, 2014), not reduction. There is a gap in research around visualising musical gesture (Wishart & Emmerson, 1996). Exploring these opportunities and challenges was tackled iteratively through creating several libraries of animated-image-audio units and composing with them across the compositions listed above.

The methodology that supports composing visual music from the premise of expression is phenomenological, in the sense that I directly experience visual phenomena and use my experiences and reflect on them in my practice. This is inspired by the creative practice of Turner and the sublime and two main philosophical reference points: Merleau-Ponty and Deleuze. Some of my phenomenological experiences are in response to work created by artists, such as Turrell or Gormley, and other experiences are from nature. My first response to making visual music was to turn for inspiration to visual experiences that I find moving and that have a positive effect on my mood. From my own experience, I picked out two types of settings that I find especially affective. Both involve being immersed in natural imagery. The first is where the sky meets the sea and the horizon seems limitless. The sky and the sea meet seamlessly. My whole vision is filled. The effect is of being somewhere so wide open is that I feel wide open, my eyes open wider, the top of my head feels as if it has lifted off. I breathe in the air and feel that I expand out to the limitless horizon. Brian Eno's practice, when he made ambient soundscapes, was also inspired by reaching out to the horizon. He said: 'I want to make a kind of music that had the long 'now' and the 'big' here, and for me that meant this idea of expanding the music out to the horizons' (Ward and Cardazzo, 1989, 4.19, quoted in Long, 2017, 19).

The second setting is under leafy branches looking down at dappled shadow. The leaves form an unseen canopy above me, the invisible wind sways the branches and the shadows slowly dance, forming and re-forming. They drape over the uneven bridle path. The patterns are subtle, with soft, ever-evolving forms in muted colours. Ever-changing and ever-engaging. I imagine being able to blow, like the wind, and see the shadows dance to my breath, and how I would feel empowered, invisible and effective. My breath would become a visible gesture.

> The invisibility of the wind is indicative. What is the wind? It belongs, with motion, to the realm of verb. The wind is 'seen' in its effects, less than a verb, its visible being is what it has done in passing by.
> (Ihde, 2007, 51)

In both these instances, my vision is filled by the play of light. Filling the vision with all distal patterns (seascape) or all proximal patterns (dappled shadow) allows the relaxed experience of an element of disorientation, a feeling of being unbounded by spatial orientation. In this relaxed state, vision seems to open up, wider and deeper. The mobility of the light seen in the subtlety of the changing colours and the nuance in the interplay of shadows provides an enriching sensorial experience that is similar to soft fascination (Section 2.3.4). Slow cinema can also engender a sense of relaxation, unbounded-ness and an altered sense of time.

The works that feature this phenomenological methodology (Figure 62) are: *Ambience1, Ambience 2, Ambience 3,* moving image created *to* pre-existing music, Strand 3-A, initiated by a phenomenological experience of a human trace and Chion's concept of the omniscient *acousmêtre*. In *Horizon, Reservoir* and *Singing Light*, visual structure informs the composition of both sound and image, Strand 1-A. *Horizon* was initiated by a phenomenological experience of a seascape and *Reservoir* by a circular walk. *Singing Light* was initiated by phenomenological experiences of light and the Deleuze's concept of Turner 'breaking through' the canvas (in my work the canvas becomes the screen) and the concept of the *acousmêtre*. Through Practice as Research, this phenomenological methodology developed over time, from gathering inspiration from phenomenological experiences into also using light itself as a medium (Section 2.2.4) and adding immersion, turning the spectator into a participant, by moving from the fixed-screen to light-based-art installation (Section 2.5). Evolving beyond the fixed-screen was supported by McCall's methodology of defining practices as pictorial, cinematic and sculptural to tease out creative opportunities for both making and beholding, and Hyde & Piché's exploration of 3D projection (Section 2.5.2).

| | 1-A Visual structure informs the composition of both image and sound | 2-A Visually representing sonic data | 3-A Moving image created *to* pre-existing music |
|---|---|---|---|
| Methodology of creating a library of animated-image-audio units | | *Shadow Sounds 1*<br>*Shadow Sounds 2*<br>*Shadow Sounds 3*<br>*Sky*<br>*Continuous Punctuation* | |
| Phenomenological Methodology | *Horizon*<br>*Reservoir*<br>*Singing Light* | | *Ambience 1*<br>*Ambience 2*<br>*Ambience 3* |

Figure 62. My works in relation to methodologies and strands of composing visual music

A cornerstone of this research is creating embodied visceral affective non-representational visuals that reach beyond formal geometric abstraction without being mimetic. This is supported by the methodology of following Young's approach that reality and abstraction are only conceptual absolutes and that there is a continuum between the two, in order to create work that elicits a constant flux between visuals being perceived as mimetic or abstract. This is aided by synthesising different artistic practices, beyond the traditional canon of visual music, as discussed in Chapter 2. In particular, Klee's non-perspectival, broken picture-plane, Merleau-Ponty's concept of Cézanne's paintings, Moholy-Nagy's exulted, emotional response to the pictorial richness of cubist collages, the new view of objects that photograms allowed, the new vision and found abstraction made manifest by abstract photography all support creating non-objective, non-perspectival, multifaceted works, that even in static, or almost static images, evoke the passing of time. This methodology incorporates gathering footage-as-data in order that the viewer can retrieve or construct a new experience (Section 2.2.5). For example, *Horizon* is distanced from a mimetic rendition of a seascape through the use of different spatialities and textures and enables a new experience of a seascape.

Inspired by Klee, this research keeps the technical in service of the aesthetic, rather than pursuing technology for its own sake. Working with technology poses several challenges. As Rees writes, technology provides a continuum, from computer screen to cinema screen and from hand-made images to digital images (Rees, 2011, 3). The technical base is always developing. Therefore, to quote Le Grice: 'to treat the technological base as integral to the construction of meaning' (Le Grice, 2009, 236) can be problematic. This problematising of the technological base supports creating non-algorithmic mappings as used in *Shadow Sounds*, *Sky* and *Continuous Punctuation*. When algorithmic mappings are used, unless the artist has written the code, the artist will have much less control than is desirable.

> The 'language' may be much less separable from the medium, much less under the fundamental control of the artist in this area than in more artisanal technologies.
> (Le Grice, 2009, 268)

Although there is great freedom in using the continuum of technology, it is at the cost of intrinsic media coherence, and losing the impetus that the limitations of processes can give to creative artists, as exemplified by McLaren's methodology (Section 2.3.2). There is a tension between deconstructing methodologies and processes from eclectic practices to spark new possibilities for creating visual music and merely recreating old concepts with current technology. In this research Ron Kuivila's methodologies were used to combat these challenges. He proposes getting 'under' technology, by working directly with physical principles; by staying 'over' technology, by working with abstract principles; or by diving 'into' obsolete or banal technologies (Kuivila & Behrman, 1998, 13). *Singing Light* works directly with physical principles, the framework for composing visual music works with abstract principles and *Reservoir* uses footage from obsolete technologies. Allied to this methodology was the development of the concept of being a 'digital-artisan', i.e. to use contemporary and legacy materials and processes with an awareness of their original contexts and significance. This is key, as an artist can choose to combine any number of diverse media and processes, which not only sacrifices their intrinsic media coherence but also digitally flattens the output, losing the original qualities of the processes, especially in fixed-screen work. Awareness of the challenge of being a 'digital-artisan' gave added impetus to composing visual music that goes beyond fixed-screen display and incorporates human traces, to counterbalance any digital flattening.[37]

This methodology to counter the negative effects of technology was augmented by looking afresh at the categorisation of artistic mediums and by teasing out new opportunities. Given that visual music is a creative practice that is 'ultimately its own artform' (Lund & Lund, 2009, 149), how best to contextualise my Practice as Research in the art world? McCall's categorisations are helpful here. He states:

> Many artists define themselves by the medium they use… it makes more sense to categorize the work in the art world in relation to three broad bundles of discourses: the sculptural, the pictorial and the cinematic… The sculptural… issues of forms in space. The pictorial… the making of images… the cinematic… all art that foregrounds time, or movement, or both.
> (McCall in Walley, 2004, 67)

This research is focused on finding new creative opportunities in the nexus between the cinematic, the sculptural and the pictorial (see Key Terms).

Klee's methodology incorporated starting from fundamental, formal principles, scientifically analysing key variables in art, defining opposites to work with and measuring key pictorial factors. He used scientific rigor and foregrounded process and the development of his framework over final form. My response to his methodology was two-fold. First, I carried out series of tests of variables in visual music, using formal elements and opposites. In *Song Series,* the opposites were: percussive sync to metaphorical sync, high and low tonal contrast, and formless to grid, and these were set against different styles of vocalisation. Opposite styles of composition were tested: one long shot forming a continuous journey and becoming a metaphor, in *Horizon* and

[37] As Levin (1994) notes, human traces with all their inherent individualistic randomness obviate the need for computer-based randomness.

*Reservoir*, was contrasted with animating in five-second bursts and letting the animation unfold, inspired by McLaren's approach to *Blinkity Blank*. In addition, different formal compositional variables were isolated in studies inspired by Klee, McLaren, and Survage.

Second, I regard all of my output as in-process, as on-going studies and tests that are furthering my Practice as Research but that are not in themselves important as final forms. They are initiated by exploring the currently most pressing elements arising from my increasing know-how, know-what and know-that knowledge. So long as my exploration is furthering my practice and the output is cohesive is some way (Section 2.4.4), it is 'working' for me and worth sharing.

In order to encourage the flow from the tacit know-how and know-what knowledge to the explicit know-that knowledge, throughout this research the methodology of sharing knowledge and insights, development of theory and artistic works with wider communities, was practised. This took the form of publishing papers, giving papers and presenting works in solo exhibition, at conferences and publishing works online via Vimeo (Section 1.4) and teaching. Artists researching, theorising, writing, exhibiting and teaching has a long lineage that includes Klee. By embracing outputting research throughout the project, knowledge had to be structured and made accessible to others, becoming know-that knowledge. This methodology of sharing knowledge in turn created more resonances from the know-that to the know-what and know-how and there was the great benefit of communication with, and feedback from, both visual musicians and the wider community.

# 3.2 Testing visual, audio and audio-visual variables

## 3.2.1 *Song Series*

*Song Series* (Watkins, 2015c) was a pilot study to refine which parameters of visual music to explore in relation to the key area of audio-visual sync. Nine *Variations* were produced to map tonal contrast in the image in visual compositional structures ranging from formless to grid, against three parameters of sung music: mode, percussive quality and musical tempo. This was inspired by Klee's scientific methodology (Section 2.3.1). Conclusions were drawn from the study, outlining which combinations of these parameters would be most effective for future research.

Tonal range, i.e. the degree of visual contrast, a cornerstone of Klee's framework, was limited to four degrees of tonality: 100%, 75%, 50% and 25%. This allowed a range from very distinct visual contrast (100%), often associated with percussive rhythm and loud sounds, to subtle visual contrast (25%), often associated with non-percussive rhythm and quiet sounds. In order to concentrate on tone, colour was deliberately limited to red–yellow plus a turquoise to complement the red.

A visual compositional scale was defined as: formless – or field of colour, following on from research into James Turrell and Thomas Wilfred; texture – too many to be counted, like Klee's 'dividual' elements; gestural marks; and grid. Grid refers to mathematical spacing according to Cartesian coordinates, in a mode similar to Hans Richter's *Rhythmus 21,* or polar coordinates as used by John Whitney. I produced a table to give examples of tonal contrast against form for artworks by seminal artists who have influenced this research: James Turrell, Mark Rothko, Agnes Martin, William Turner, Albert Irvin, Piet Mondrian, Wassily Kandinsky, the photographer Paul Kenny, Norman McLaren and John Whitney. Mapping the artworks relative to each other visually in colour and in grey-scale highlights the visual areas under consideration (Figures 63 and 64).[38] To highlight the range of the *Song Series*, the nine variations were placed in the same tables, in grey-scale and in colour (Figures 65 and 66).

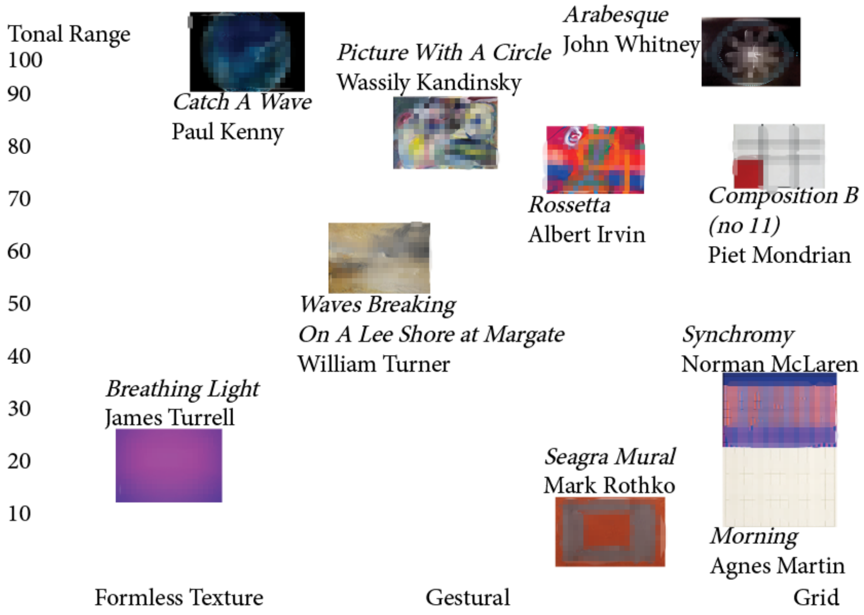



Figure 63. Tonal range mapped against compositional structure of seminal artworks, shown in colour

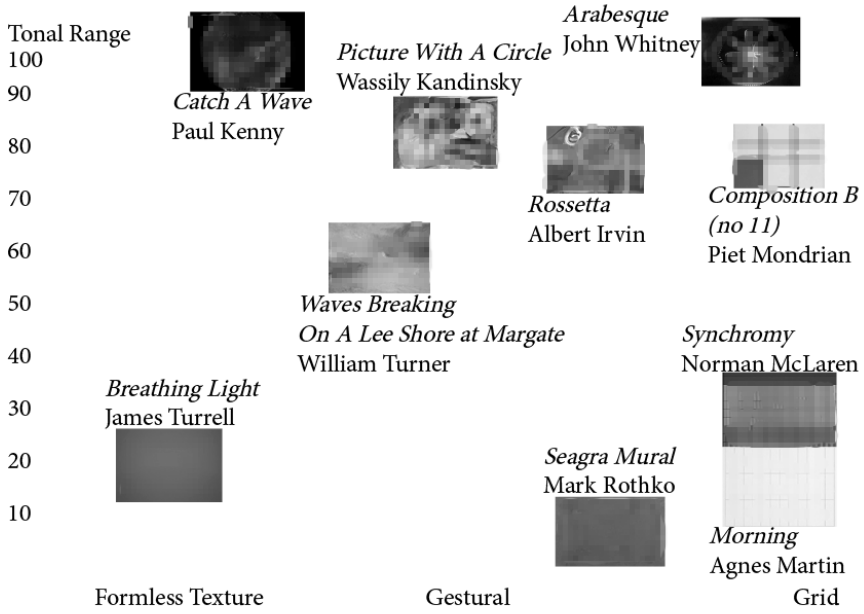



Figure 64. Tonal range mapped against compositional structure of seminal artworks (black and white)

---

[38] As Paul Klee noted, the linearity of text is not the best method for communicating about all aspects of visuals.

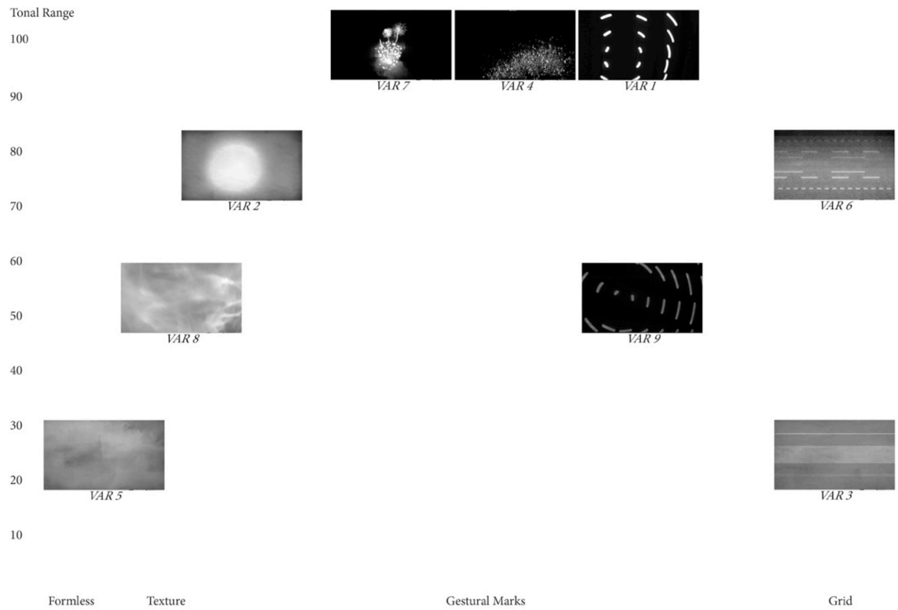



Figure 65. Tonal range mapped against compositional structure of *Song Series Variations 1–9* (Watkins, 2015c) (black and white)

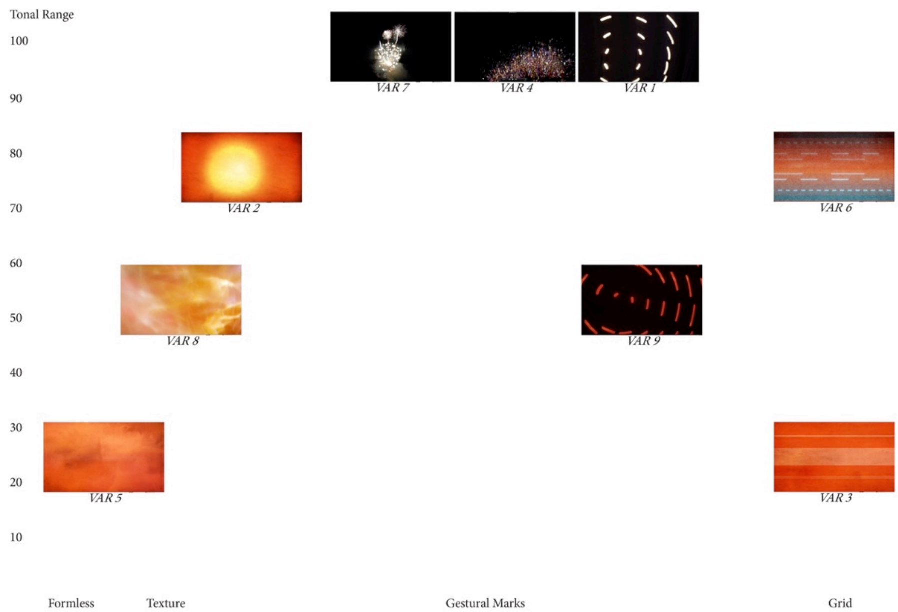



Figure 66. Tonal range mapped against compositional structure of *Song Series Variations* 1–9 (Watkins, 2015c), shown in colour

I decided to examine audio-visual syntax – synchronicity to metaphorical sync – using traditional songs, as traditional music has long been used in visual music. For example, Mary Ellen Bute stated:

> The two abstronic films I have made are based on the music of ‘Hoe Down’ by Aaron Copeland and ‘Ranch House Party’ by Don Gillis. Because this music is simple rhythmically, clear and sharp, I thought it suitable for my first experiment in this new art medium.
> (Bute, 1954)

Additionally, traditional songs are formed from, and constitute part of, a shared pool of experience. Music can be a harmonising influence (Schafer, 1993, 2). ‘Communities sing to tell stories, to mark events, to replay the news and to bring poetry to the most mundane aspects of daily life’ (Hodgkinson, 2009, 67). Schafer notes the paradox that, while our times are dynamic, we prefer the music of the past: ‘music no longer functions as the antennae of the spirit but as a sensory anchor and stabiliser against future-shock’ (Schafer, 1993, 6). Newly sharing traditional songs also follows the impetus of film-makers such as Oskar Fischinger, Hy Hirsh and Harry Smith, who, as Kerry Brougher asserts, merged ‘[P]ainting’s spiritual dimensions with popular culture; for them art was not so much about the self but rather a commonly shared, egoless experience’ (Brougher et al., 2005, 120).

For this pilot study, the sonic element was the voice – a key human trace (Section 2.3.3). All the versions of the traditional songs were sung *a capella* and wordlessly to emphasise the emotion of the song and avoid the associations that cling to words. The singer is unseen, an *acousmêtre*. Musical parameters were chosen that elicit affective, physiological and psychological responses; these include modes, percussive quality and musical tempo. To encapsulate the main emotive triggers, these will be delineated as: (1) mode – pentatonic major or minor; (2) percussive quality – smooth, aspirated or articulated; and (3) musical tempo – fast, medium or slow (Figure 67). The meter of the song is not stressed, but subsumed under the melody. This affords a more neutral backdrop for the investigation of mapping synchronisation to the musically phrased dynamics and/or the changing amplitude.

| MODE: MAJOR PENTATONIC | | | |
|---|---|---|---|
| | **Percussive quality** | | |
| **Musical tempo** | Smooth | Aspirated | Articulated |
| Slow | 1 | 2 | 3 |
| Medium | 4 | 5 | 6 |
| Fast | 7 | 8 | 9 |

Figure 67. Music parameters for *Song Series Variations 1–9*

Three strands of enquiry into audio-visual sync were pursued: first, editing live-action gestures *to* music; second, mapping amorphous light effects *to* music parameters; and third, mapping geometric shapes *to* music parameters inspired by McLaren's *Synchromy*. Editing gestures *to* music was explored through editing camera motion caught in the footage of an abstracted view of lights in *Variation 1* and *Variation 9*. For *Variation 4*, the gesture of throwing was traced by the thrown glitter, which was captured in slow motion. For *Variation 7*, the dynamic motion of firework footage was used. In each instance, the footage was edited and re-timed to map movement *to* the musical phrasing.

In *Variation 4*, the sound–vision relationship is extended. Falling glitter was filmed at high speed to clarify the motion of individual particles within the dynamics of the whole motion of thrown particles (Figure 68). My feeling and intuition for combining audio and visual elements comes from working for many years as an animator and (mainly) timing animation and live action *to* audio. Audio-visual synchronisation corresponds to sync points and to the gesture, 'spectromorphological life', embodied in sounds. I have used this research in my practice. Further, this motion was edited to the musical dynamic phrases. Thus, the throws of glitter are timed to the dynamic phrases of the music but the synchronicity of individual particles of glitter is random. In *Variation 4* the overarching visual phrasing and abundance of detailed motion gives a greater impression of synchronicity.

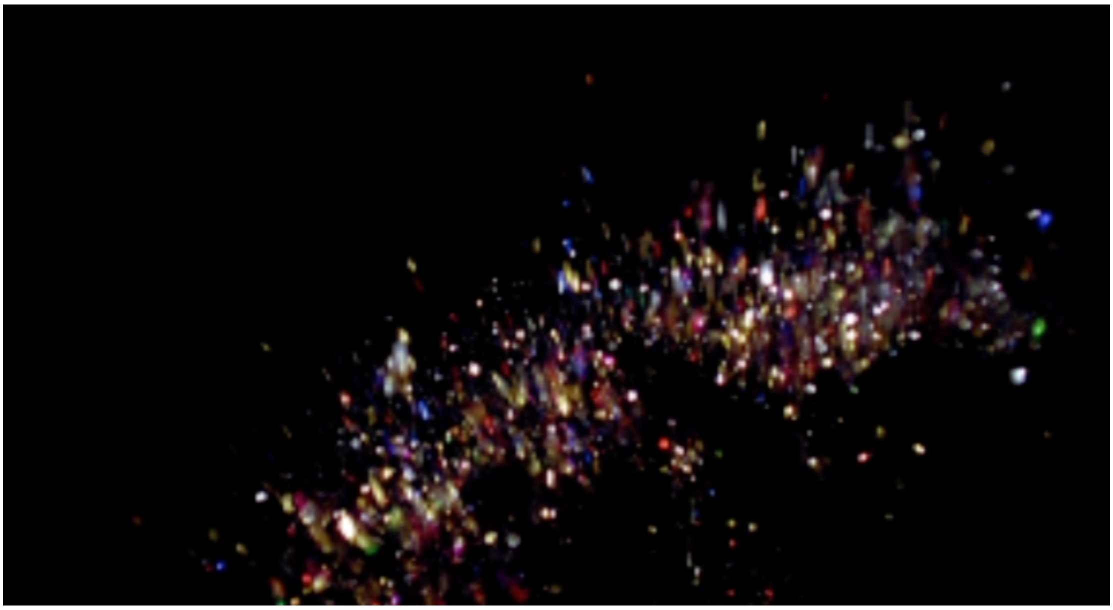


Figure 68**.** Still from *Song Series Variation 4* (Watkins, 2015c)

Figure 69. Still from *Song Series Variation 7* (Watkins, 2015c)

For *Variation 7*, live action of fireworks (Figure 69) was edited to the onset of sung phrases, resulting in percussive synchronisation points. The sung phrases are vectorised and have a strong forward impetus. The fireworks begin as if caused by the beginning of the wordless, sung phrases and are edited and speed-ramped to echo the arc of the phrases. The detailed development of the fireworks was not planned to the music. Perceptually the viewer adds sync to the visual detail, demonstrating our liking for, and ability to create, synchronous events, and metaphorical sync (see Key Terms).

Using a mix of obvious local mapping combined with a higher level of more generalised mapping concurs with Battey and Fischman and Garro. This combination of the human voice as impetus to visible gestures, initiated with percussive synchronisation points is key to *Song Series* creating a meaningful synthesis between the visual and the auditory.

*Variations 2*, *5* and *8* explore mapping amorphous light effects *to* music parameters in the aspirated songs. Visual qualities such as opacity, scaling and brightness are mapped to the changing amplitude of particular frequencies. The methodology was to apply an audio filter in six passes that extracted the amplitude data for the frequencies of the pitches of the song. The relationship between the visual and the music is a loose, metaphorical sync, partly because the shapes are amorphous and partly because the performance of songs is the least percussive.

Figure 70. Still from *Song Series Variation 5* (Watkins, 2015c)

*Variation 5* references Turrell's work; it also has no object and no particular place to look (Figure 70). The layers were constructed with loose reference to the paint-strokes and turbulent motion in Turner's *Rough Sea*. Six animated layers represent the six most dominant audio frequencies after the song was filtered. The amplitude of each pitch governs the opacity of one of the layers. The animation has been greatly simplified and smoothed out, so that, instead of changing on every frame, the shortest change lasts for half a second. Turbulence was added to the visual as a metaphor for breath. Nevertheless, these images and audio were overly synchronised, i.e. the changes in amplitude of the frequencies and the visual changes matched closely, making the overall result too predictable. Further visual layers were added with no correlation to amplitude to make the audio-visual sync more metaphorical. This made the cloud-movement more like Ihde's invisible wind changing the colours.

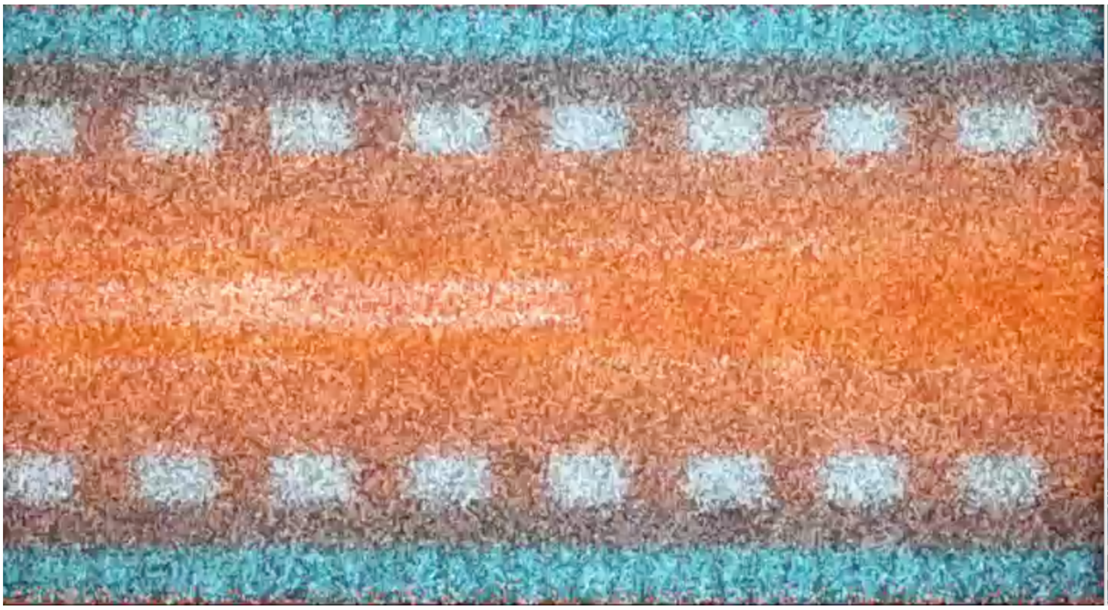


Figure 71. Still from *Song Series Variation 6* (Watkins, 2015c)

*Variations 3* and *6* explore abstract geometric animation to the most percussive, articulated songs. In *Variation 6*, the background is a warm red-orange and the rectangles, which represent sung notes, are rendered in complementary blue. They are mirrored about the x-axis to make a visual metaphor for an open mouth (Figure 71). The mathematical spacing and sizing of the rectangles are influenced by Norman McLaren's 1971 film *Synchromy*. The lower the frequency, the closer it is to the vertical centre of the image. The lowest frequency is half the width of the screen, the next lowest frequency being a quarter of the width of the screen, and so on. The changing amplitude of each of the six filtered pitches of the song determines the height of the visualised notes every twenty-fifth of a second.

The myriad synch-events flatten the audio-visual phrasing of the sequence. The pulsing of rectangles to each change in volume of each pitch quickly became redundant. Trying to ameliorate this deadening sync through the use of moving particles did not work; the larger shapes dominated over the particle effect. The use of complementary colours to describe the shapes (using hue rather than tone), similar to the manner in which the Impressionists used to create fleeting impressions of a scene, did soften the effect of synchronisation in comparison with high tonal contrast, but the overriding impression of the piece was redundancy of sync.

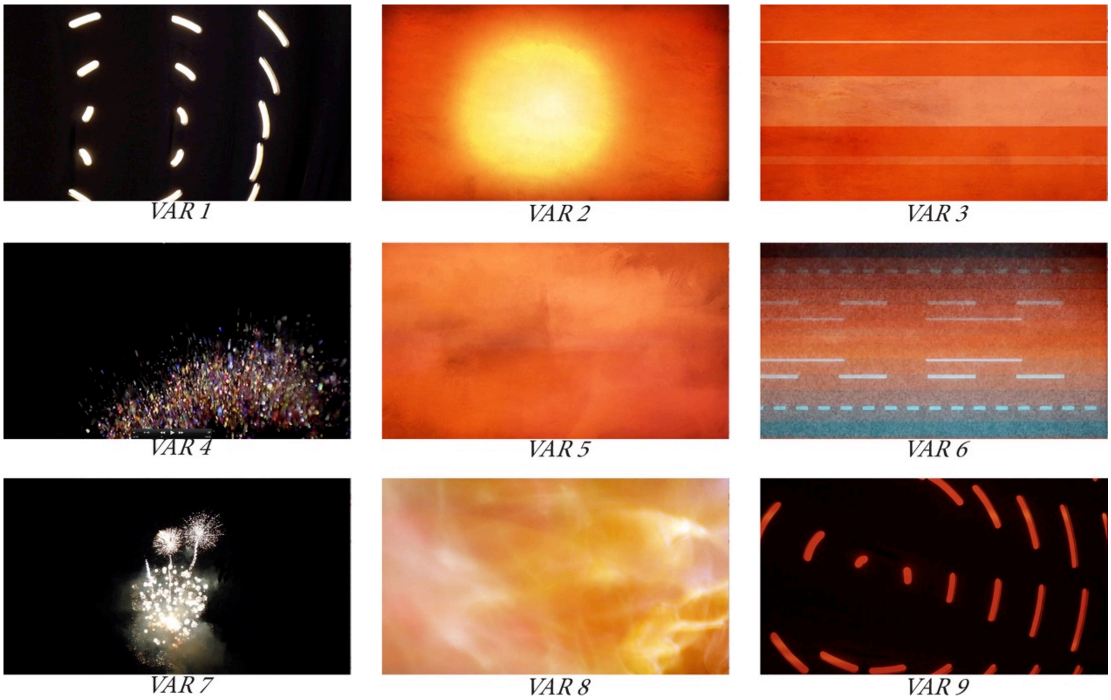



Figure 72. Stills from *Song Series, Variations 1–9* (Watkins, 2015c)

**Key findings**

Overall there were too many variables to test exhaustively with nine *Variations* (Figure 72), but the nine *Variations* did highlight productive avenues of audio-visual syntax – from percussive synchronisation points to metaphorical sync, to pursue. The most effective combination was using the human voice as impetus to gestures, initiated with percussive synchronisation points and ending with looser sync. Using the full tonal range from black to white, 100% contrast, was effective in emphasising the rhythms of the moving image, which helped to bind the visuals with the music (*Variations 1*, *4* and 7) (Figure 73). This echoes the finding that tonal contrast can enhance participant appreciation of interactive visualisation of vocal expression (Pietrowicz & Karahalios, 2014). Timing the live action in the edit to the sung phrases gave flexibility to the filming of the live action and created an efficient workflow.

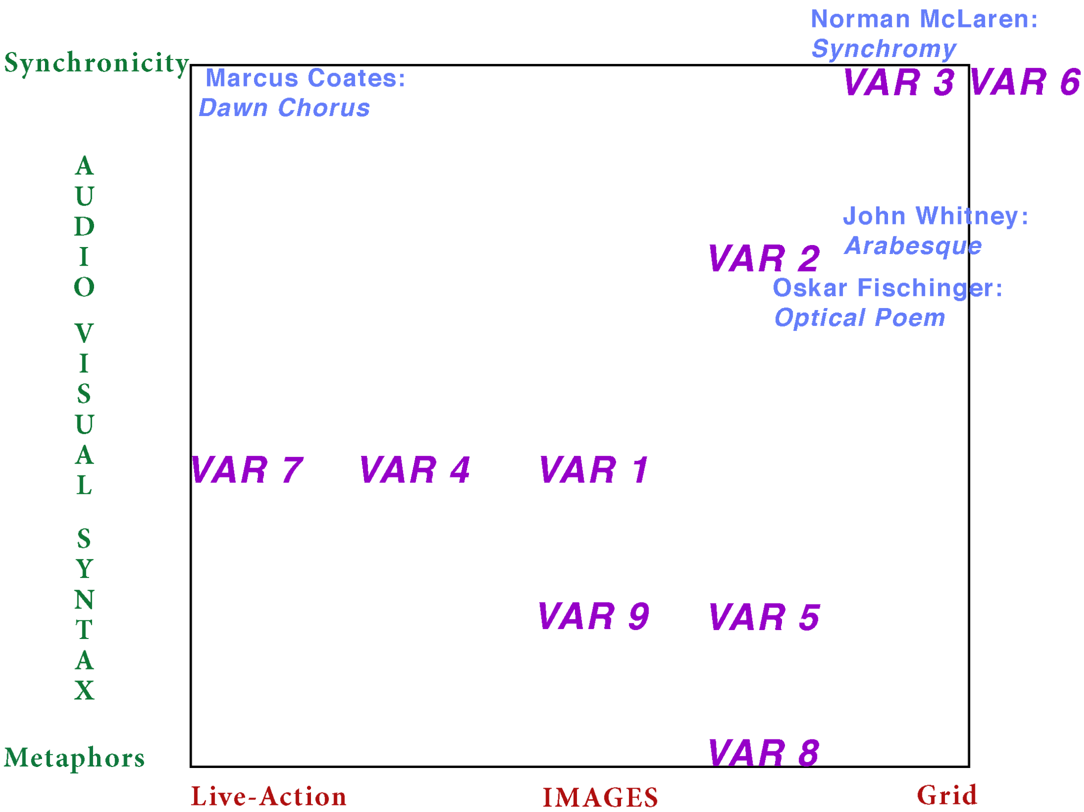



Figure 73. *Song Series, Variations 1–9* set above matrix diagram

Animating *to* music, using musical structures, is the norm, as in Strand 3-A, moving image created *to* pre-existing music. When the audio and visual elements are created separately, generally the visual follows the audio; going against this norm is challenging. Song Series *Variations 1*, *4* and *7* create a meaningful synthesis between the visual and music through visually echoing the musical phrasing.

Seeking generalised principles for mapping sound to image or image to sound is useful for unleashing creative concepts of how to meaningfully relate the two. However, the implementation of mapping highlights the technical over artistic expression – whereas a key methodology is to keep the technical in service of the aesthetic. The redundancy of sync caused by 1:1 mapping in *Song Series Variation 6* makes a weak compositional structure and has a deadening effect on engagement; using metaphorical sync in *Song Series Variation 5* is novel because it goes against the norm of the ubiquitous audio-visuals that we behold but its very lack of predictably, which we like (after Huron), makes it less engaging. Summing up: *Variations 1*, *4* and 7 showed the most promise – the challenge became how to work with gesture within a framework of visual composition (Strand 1-A).

### 3.2.2 Animated studies inspired by Klee, McLaren and Survage

Inspired by Klee's scientific methodology, I explored variables from Klee and McLaren's compositions with line. There are several illusions that animated lines create but that are apparent only in movement.

I conducted tonal studies based on Klee. *Tonal Study 001* keeps the unique bridge between line and tone and reveals nuances of tonality as the shapes dissolve up and down. However, it is somewhat static. In contrast, *Tonal Study 002* is dynamic, and multiple compositions are created as the transparent tonal rectangles slide in and out.

I conducted colour studies based on Klee. There are a great number of changes, too many to count, as the transparent rectangles with additive colours slide over each other. They come in and fit together like a puzzle, which is satisfying. It is impossible to visually disentangle the separate shapes from the completed whole, until a shape moves. The colours do not mix, no matter how fast and how busy the animation becomes.

Inspired by McLaren's *Blinkity Blank,* I explored using images out of black with the aim of finding a starting point for a library of animated-image-audio units.

**Key findings**
Like Norman McLaren, I found a great difference between vertical and horizontal lines: the horizontal lines appear to be affected by gravity and float up and down, whereas the vertical lines seem to have their own agency (McLaren & Munro, 1976). By making the thick line move more quickly than the slow line, the thick line appeared closer, i.e. perspective was created in the image-plane. The sense of perspectival depth is more obvious with horizontal lines.

Both *Tonal Study 001* and *Tonal Study 002* have been created digitally, with a clean precision. This emphasises the aspects of formal composition and nuances of areas of exact tones overlaid in multiple combinations, and loses the painterly watercolour textures of the original. The mathematical, idealised nature of the digital tones is highlighted by the contrast. There are ways to soften this effect, to blend in painterly textures (see *Horizon*).

At the fastest point in the second, busier animation of colours, the colours have a sense of moving flow; the transparent rectangles seem to flock into place. Very many layers are needed to achieve this effect.

Animating still images from Léopold Survage’s *Colored Rhythm* made it clear that painterly images are not a good starting point. The images are formed from simple shapes, but the rich colours and painterly textures predicate against animacy, i.e. predicate against the personification of the movement of simple shapes. The engaging human traces apparent in Survage’s images are gestures of mark-making, which raise the same problems as Golan Levin’s system (Section 2.4.4) and treating David Hockney’s archives of i-Pad drawings as animation (Section 2.3.4). A different methodology for creating a library of animated-image-audio units was needed.

Please see Appendix B for more detail and close analysis of these animated studies.

### 3.2.3 Animated deconstruction of Blinkity Blank

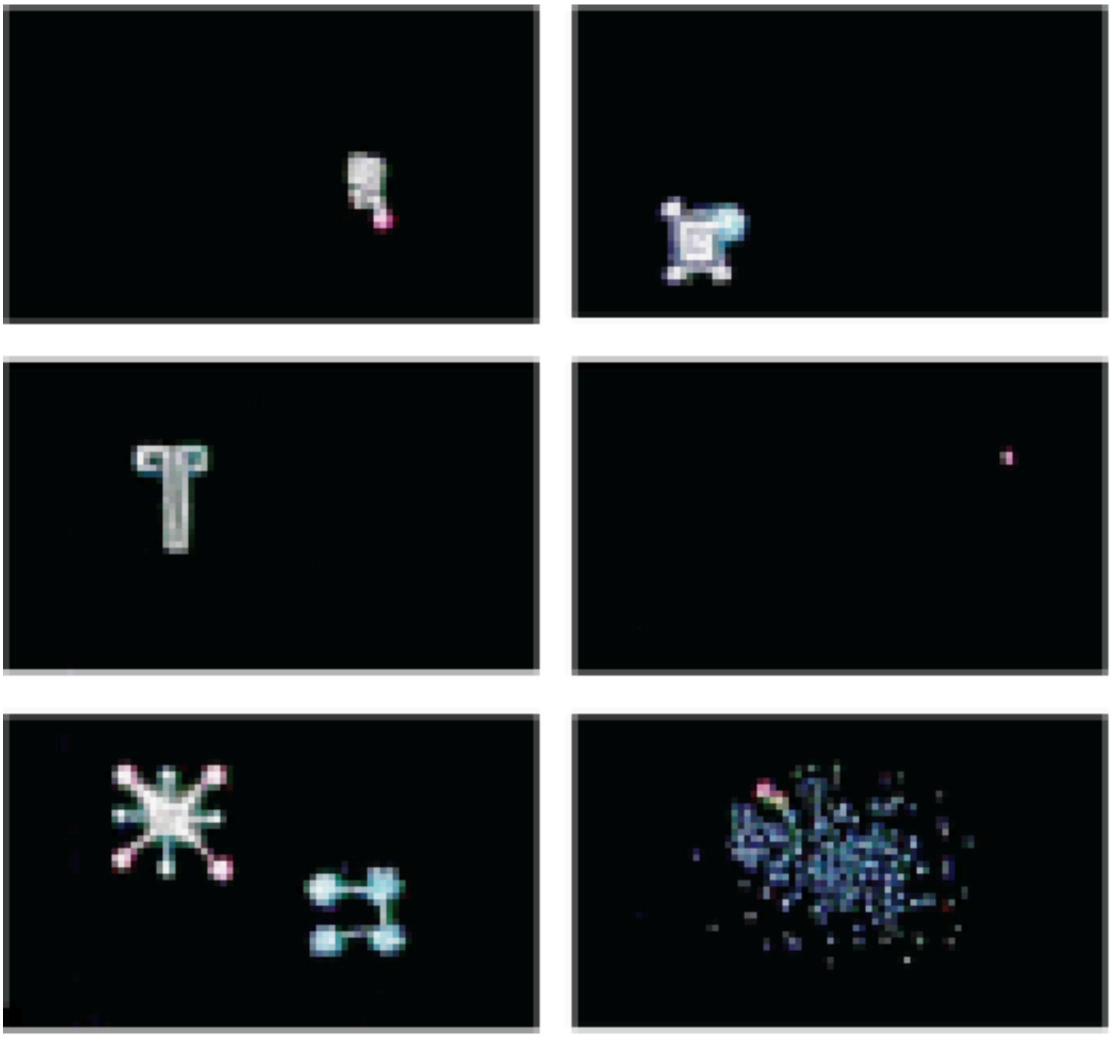


Figure 74. Sample frames from the 34-second section of *Blinkity Blank* (McLaren, 1955)

I decided to deconstruct Norman McLaren's *Blinkity Blank* in relation to audio-visual sync, because this piece continues to surprise and delight, unlike *Synchromy*, which is a tour de force of mapping but does not have the surprise element of animation after the first few seconds. I chose a section of *Blinkity Blank* where McLaren animated the sound in the optical track, as the percussive sounds emphasise the rhythm and, unlike using a section with musical melody and instruments, using this section avoids adding extra variables, such as the motion of the animation tracking pitch (Figure 74). Given that *Blinkity Blank* has a remarkable variety of imagery, texture, mark-making and colour, the premise was to simplify the imagery as much as possible and then build it up in stages to see when a rich sense of audio-sync is regained.

The greatest degree of simplification is a binary on or off. As *Blinkity Blank* is animation out of a black background, a white rectangle was used (rather than flashing the whole screen, which would be uncomfortable to watch). First, a white rectangle was animated in the centre of screen, so that it was white only when animation was present, a binary on or off. Second, the flashing rectangle moved to the centre of the animation. Third, the rectangle was scaled to the size of the animated figure but remained centre-screen, flashing on and off with the animation. Fourth, the rectangle was scaled to the size of the animated figure and also changed position. All the animation was as accurate as possible, keyframed on a frame-by-frame basis over the 850 frames over the original animation, which was from the best-quality DVD available.

Figure 75. Flashing square and flashing moving square

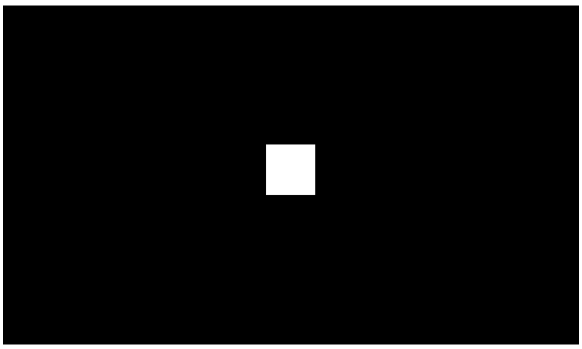


Figure 76. Flashing scaling square stayed in the centre of the screen

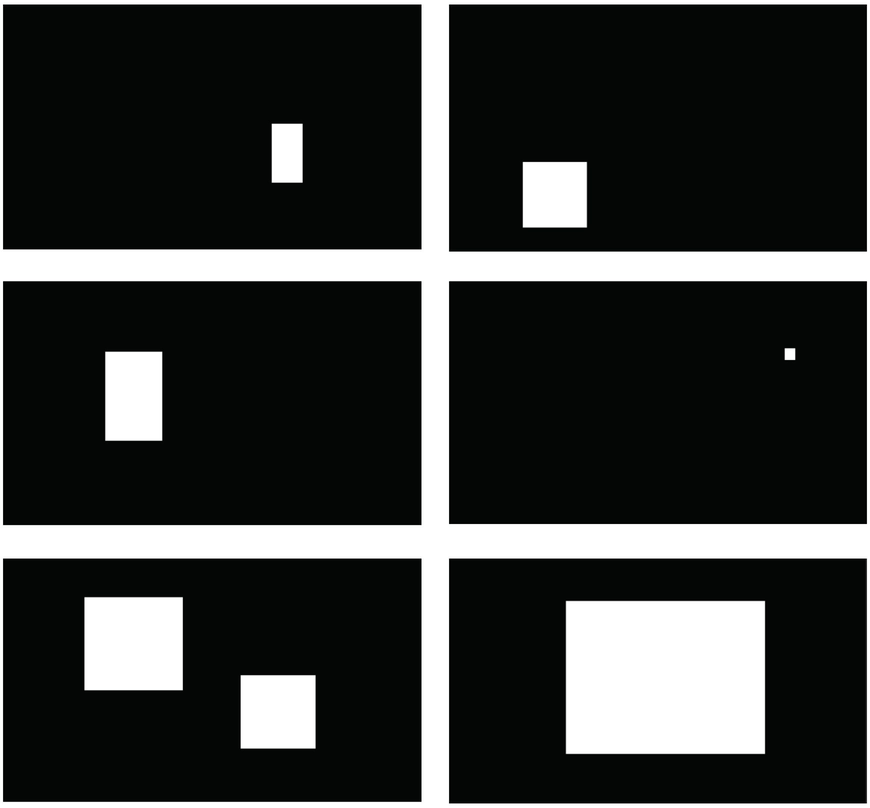


Figure 77. Flashing moving scaling square

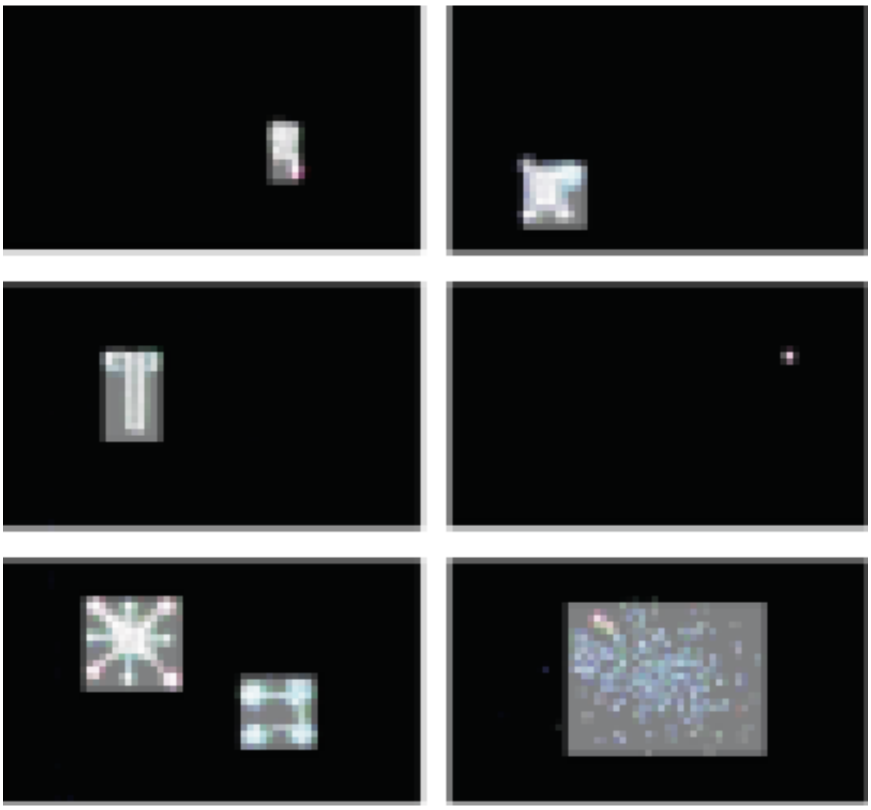


Figure 78. For comparison: flashing moving scaling square mixed with the original animation

**Key findings**

The central-screen flashing on and off had some rhythm but with loose sync to the audio; adding movement to the flashing increased the sense of audio-sync and having two rectangles on screen to evoke the two characters of the scene was key (Figure 75). However, the audio-sync and sense of character came with the scaling, the ‘squash and stretch’ of the animation. Suddenly, when the rectangle was scaled to the size of the animated figure and flashed on and off with the animation, even though it remained centre-screen, the rectangle had animacy and there was perception of causality (Figure 76). Adding change of position to the rectangle gave the ‘character’ more impact and the beholder more to look at as the beholder’s eye jumps from one place on the screen to another (Figures 77 and 78), but did not significantly increase the audio-sync beyond what was achieved with the fixed position, scaling version.

The animated audio is full of character; therefore, though just animating a plain white rectangle loses the fantastical mark-making, hugely imaginative detail and vibrant colours of the original, remarkably, much of the mood of the animation is retained.

# 3.3 Creating a library of animated-image-audio units

## 3.3.1 *Shadow Sounds*

*Shadow Sounds 1* (Watkins, 2015b) explores the methodology of creating a library of animated-image-audio units (Section 3.1) and fulfils Strand 2-A, visually representing sonic data. The aim of *Shadow Sounds 1* was to create a pilot for a new, affective experience, to move away from measuring and mapping the voice as audio data, or physiological data, or scientific neural data, and place embodied experiences at the heart of the work. Non-verbal vocalisations, such as speech and music, can be personified by the listener (Section 2.3.3). Therefore, animating visuals to vocalisations as a whole, rather than mapping to separate aspects such as amplitude, emphasises the emotion in the voice (see Pietrowicz & Karahalios (2014) on visualisations of vocals). *Shadow Sounds 1* was a test of creating and composing with animated-image-audio units. The process of creating an animated-image-audio-unit started with visualising an animation, then an appropriate sound was created, then the animation was fine-tuned to the sound.

Creating *Shadow Sounds 1* started with defining and visualising a set of playful animations. The polymorphous 3D light shapes of Thomas Wilfred's lumia influenced the flowing sound-shapes. The dappled background of *Shadow Sounds 1* is influenced by the shadows created in Schwerdtfeger's and Hirschfeld-Mack's Bauhaus experiments with light. Vibrant colours were animated with strident motion in contrast with the soft, shadowy, continuously moving, grey, dappled background (Figure 79). Some of the animations softly drifted whilst others erupted with hard attack like a cartoon punch.

After visualising the animations, I recorded non-verbal vocalisations such as 'ooh', 'ah', 'eeh' and 'pah' and refined the animations to match the audio more closely, using at least one initiating percussive synchronisation point. This process relied on my skills as an animator. The challenge of this method is the huge differential in time between slowly creating and rendering an animation and almost instantly creating the audio. Visualising the animations before vocalising was key to obtaining a good starting point for matching the animation and audio.

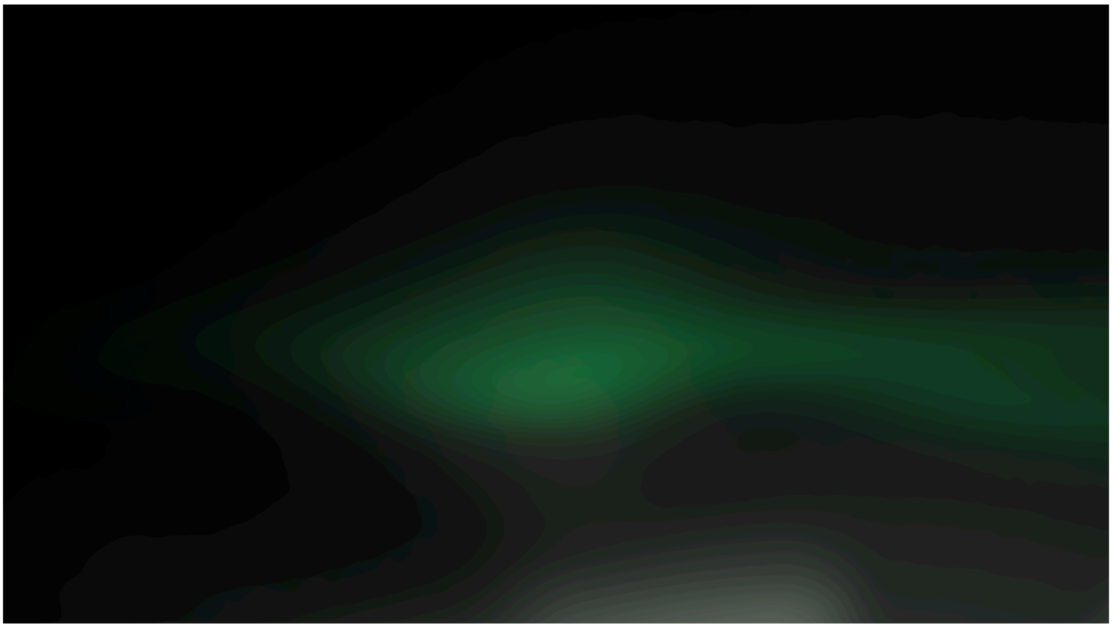


Figure 79. *Shadow Sounds 1* (Watkins, 2015b)

I also drew on what I learned from making *Song Series Variation 7,* i.e. that whereas initiating the action with a percussive synchronisation point, obvious local mapping, is key to creating a meaningful synthesis between the visual and the auditory, the development of the animation can have metaphorical sync (see Key Terms) as the viewer will add sync to the visual detail. On reflection, some animated-image-audio units are well matched, for example the animation of a softly falling shape to a sigh. However, many of the animated shapes could have been more nuanced in relation to the onset, continuance and termination of each non-verbal utterance, reflecting the audio more clearly and creating a more meaningful synthesis between the visual and the audio.

Whereas Oskar Fischinger, and other visual music pioneers, seemed to have composed pioneering visual music using time-based correlations of animation *to* music from micro events, to gestures, to the whole work, *Shadow Sounds* is based on layering and adding motion to animated-image-audio units. To compose the piece, no overall pattern was followed, I built the piece fluidly from short phrases of animated-image-audio units, placing one phrase after the other and letting the composition unfold – inspired by how McLaren scratched into celluloid. Rather than music providing the mood and meaning to animation, the audio and visual elements are fused.

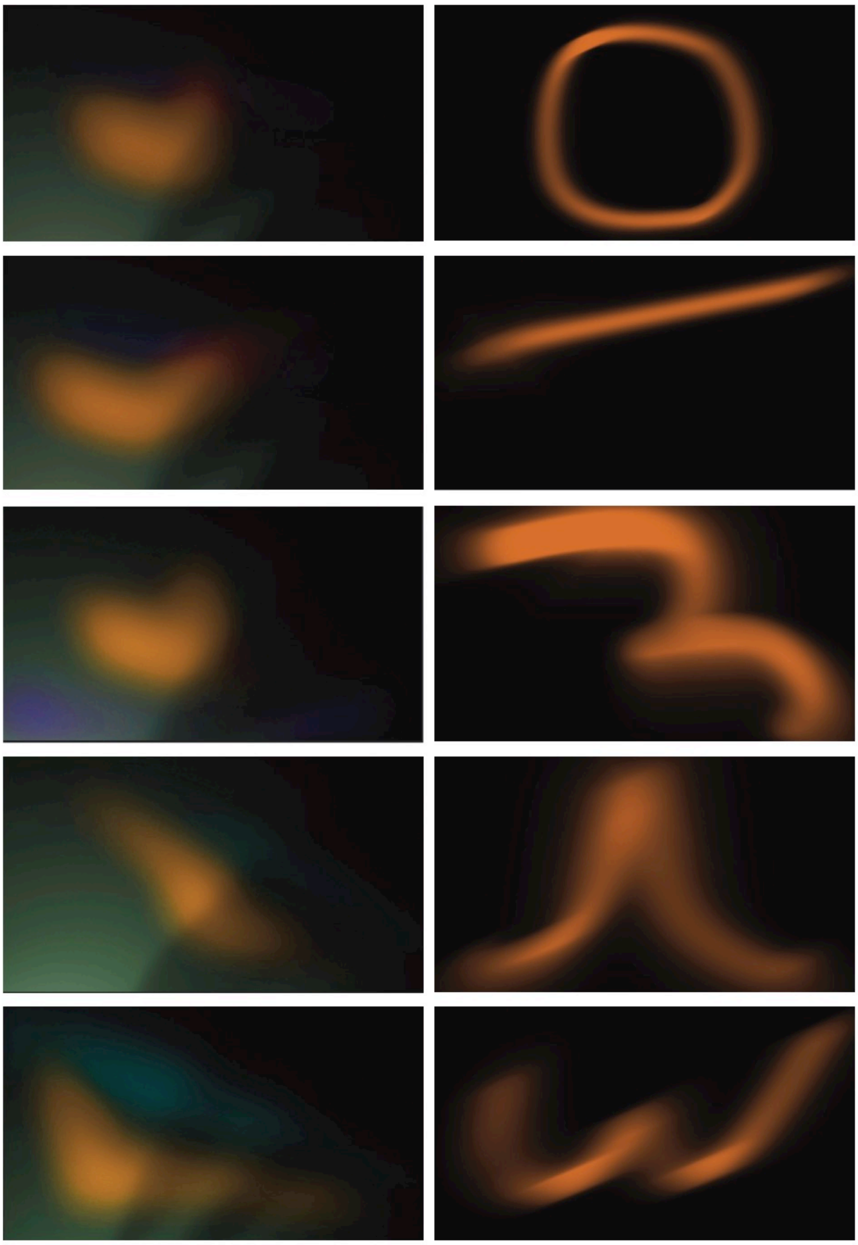


Figure 80. Comparing shapes from *Shadow Sounds 1* (left) and *Shadow Sounds 2* (right) for ‘ooh’, ‘ahh’, ‘bah’, ‘aah’ and ‘wah’

I created *Shadow Sounds 2* (Watkins, 2018e) after creating *Sky* (Watkins, 2017b) and following research into the 'Bouba-Kiki effect', particularly Cuskley et al's proposal that literate participants also map the letter shapes of non-words to the abstract shapes (Cuskley et al., 2017). The underlying audio, and number and placement of animated-image-audio units are the same across *Shadow Sounds 1* and *Shadow Sounds 2*, but the animations in *Shadow Sounds 2* are influenced much more by mouth-shapes and graphemes (Figure 80). The animations of the non-words are brief; for example, at 25 frames per second, 'ooh' lasts 14 frames, 'ahh' 8 frames, 'bah' 8 frames, 'aah' 12 frames and 'wah' 10 frames. The animations are much more closely matched to vocalisations and a more meaningful synthesis was created.

*Shadow Sounds 3* (Watkins, 2018f) is a newer composition that uses the animated-image-audio units from *Shadow Sounds 2* to create a perception of causality and animacy.

**Key findings**

Animated-image-audio units create strong audio-visual bonds, reinforced by repetition as the piece progresses. The animated-image-audio units are utterly distinct from each other and have a short duration, from one-third to one-half of a second. This makes them easy to identify and remember, and gives a great deal of flexibility when composing a piece. Composing with animated-image-audio units means that the composition is built of indivisible image and audio; the two are fused. The audio and the image are layered in simultaneously as the composition progresses. In practice, as a composer, the image and the audio became an animated character. An animated-image-audio unit has animacy and two or more give the perception of causality if there is spatial and temporal congruence. Composing became the act of putting the animated characters on the timeline. The image of the character was positioned and scaled, and layered, i.e. blended rather than occluding other characters. Working with one character, such as the 'pah' animation popping up all over the screen and getting more and more frenetic invited making a contrast with another character, a gentle 'sigh'. It may be that the animated-image-audio units of *Shadow Sounds* are so full of lively character that it seems natural to construct perception of causality and animacy. A more downbeat library of animated-image-audio units might tend towards a more neutral rhythmic approach to composition.

### 3.3.2 *Sky*

*Sky* (Watkins, 2017b) developed the methodology of creating a library of animated-image-audio units and fulfils Strand 2-A, visually representing sonic data. *Sky* developed the methodology used in creating *Shadow Sounds* by using aspects explored in the creation of *Ambience* (particle flows and the singer as an unseen *acousmêtre*) and *Horizon* (gathering data to create an abstracted animation).

The background of *Sky* is created from footage of clouds treated as data: re-timed, layered, colourised and revealed through particle-animations. There is an emphasis on the horizontal, the treated sky moves horizontally and the animations have lateral movement, primarily. The sky, colourised so its tones are inverted, appears to be a contiguous layer until the animations cut across and tear into the background imagery revealing a brighter blue, as if breath or Ihde's invisible wind has been made visible and torn a collage in three-dimensional space (Figure 81). The surprising interplay of 2D-3D, which is a tool I use as an animator, is apparent, with the visual tension of strong tonal contrasts flattening the three-dimensionality of the image (*Porch Shadows* and *Grid Dance*).

The library of animated-image-audio units I created for *Sky* was driven by vowels and consonants. Twelve vowels that moved from the front to the back of the mouth were used (including 'ih', 'uh', 'aw' and 'oo'). The consonants, B D G V L Z and M were chosen to give a distinct range of sounds. The 12 vowels each had 15 variations: the vowel is sung by itself and seven consonants were placed both before and after the vowel. Clearly, vowels and consonants cannot be cut together but must be sung individually, i.e. ‘Z’ and ‘ih’ do not sound the same as ‘Zih’.

Informed by my research, the onset of the sound and the visuals were absolutely synchronised but the development was given a looser correlation inspired by the impetus and spectromorphological life of the sounds and influenced by mouth-shapes made to create the sounds and the graphemes associated with the sounds. The animations were implemented using motion paths in three-dimensional space, velocity, density, textures, particle shapes, fine lines and motion blur. Each animation was fused with its unique sound to create a library of animated-image-audio units. The singer, Martin Nelson, asked if the shapes were programmed from the sound data, as they seemed to fit so well. It was pleasing that using my sensibilities as an animator resulted in animations that felt so right to him.

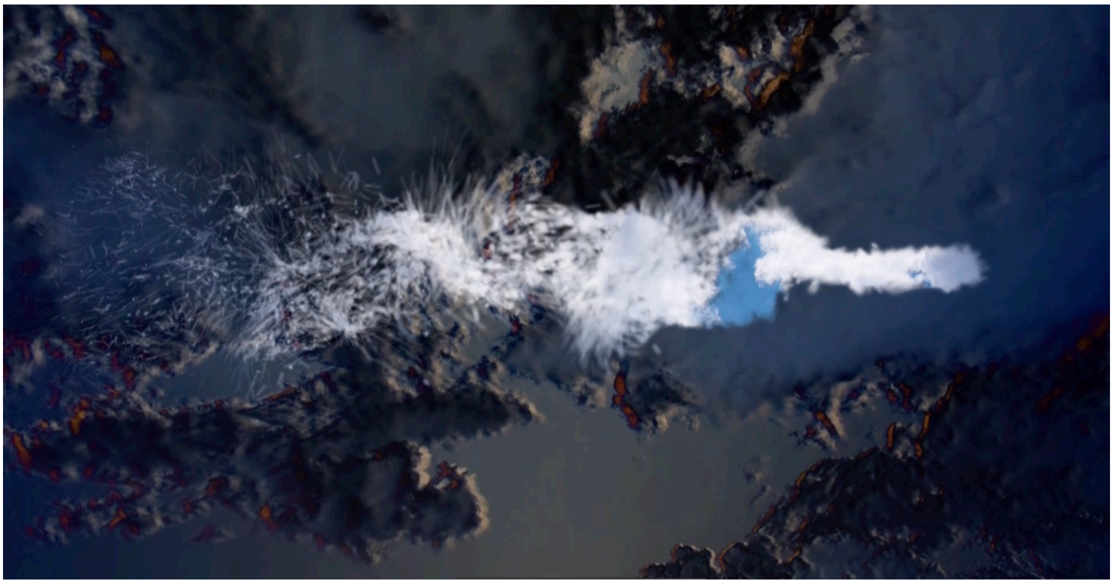


Figure 81. Still from *Sky* (Watkins, 2017b)

The pitch has a low frequency centred around ‘A 3’, 220Hz. Low-frequency sounds carry further and can evoke the ocean or a womb; it is hard to locate the source and they seem to wrap around the listener and offer a more immersive experience. The frequencies are contained within about two pitches, with about 20Hz variation in the sounds, allowing a rich, reverberant, resonant human dissonance. There is no melody in a traditional sense, no chord progression. This is deliberate. The close pitches form a non-chord tone and then resolve. Using close pitches allows the creation of musical suspension, a drawn out tension from extending the duration of a note while the other notes close to it are sung, changing the harmony, creating dissonances that are resolved and then built up again. Working within this close range of pitch creates a drone, a point of meditation.[39] Rhythm is vital to create meaningful audio-visual synchronisation; the rhythmic nature of the animated-image-audio units has been emphasised by using sounds with little pitch variation. Using sung phonemes allows maximal emotional information in minimum time, and great flexibility in how these are strung together and layered as sound.

Influenced by Klee (Section 2.3.1), I created *Sky 2* (Watkins, 2018h) with the individual particle animations flying across an animating dividual grid. The grid supports the individual and the glow and scattering particles integrate the two (Figure 82).

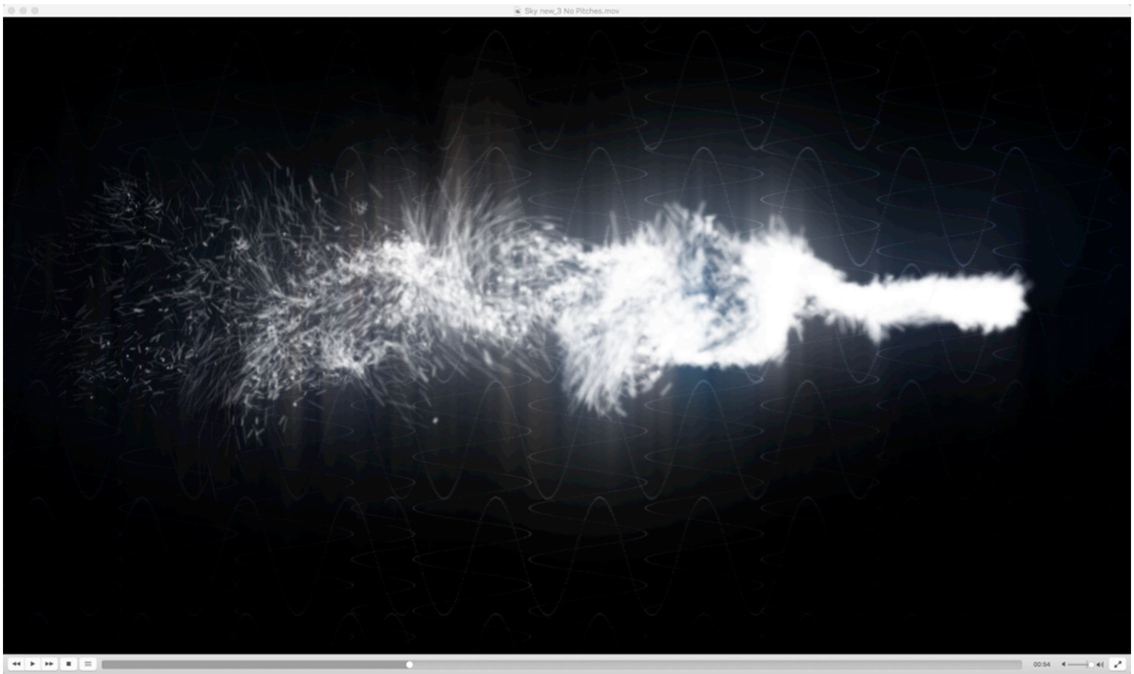


Figure 82. Still from *Sky 2* (Watkins, 2018h)

[39] Schafer (1993) notes that, with the decline of religion, sacred noise is in search of a new custodian.

**Key findings**

The horizontal motion across the flattened image works at this duration (under 3 minutes). Flattening, collaging and patterning work well on fixed-media pieces, where the screen can act as a movie-canvas (Section 2.4.4). Synchronising the onset of the sound and visuals whilst allowing a looser correlation in the rest of the animation creates a tight audio-visual bond without redundancy. Combining the influence of mouth shapes and graphemes into the animation made them feel much more fused to the sounds than the animations in *Shadow Sounds 1*. Using a very limited pitch range allows the exploration of musical suspension. Creating work with no recognisable images, no words and no tune, that is nevertheless full of human resonance emphasises the human traces and the expression precisely because the meaning is so imprecise (Section 2.4.3).

## 3.3.3 *Continuous Punctuation*

*Continuous Punctuation* (Watkins, 2018c) develops the methodology of creating a library of animated-image-audio units and fulfils Strand 2-A, visually representing sonic data. *Continuous Punctuation,* one minute of rapid animation, was also made as a contrast to my pieces including *Horizon* and *Singing Light 1* that are influenced by slow cinema. This highlights the methodology of pursuing two diametrically opposite modes of composition. The aim of *Continuous Punctuation* was to create a piece that continually surprises the viewer, starting on a black void and creating colourful and impactful animations that embody human traces through the gestures of mark-making and non-verbal vocalisation. As in *Shadow Sounds* and *Sky*, the methodology was to create a library of animated-image-audio units and the sonic element was purposefully limited. The surprise was to be in the mark-making and animation rather than a change of pitch. I drew inspiration from McLaren’s creation of surprise by ‘sprinkling’ animated frames over black in *Blinkity Blan*k and his pared-back imagery, that was, in turn, inspired by Klee.

As a digital artisan, I wanted to keep the painterly aspects of working in a painterly medium, so for *Continuous Punctuation* I created frame-by-frame animations in soft black pastel on heavy watercolour paper in order to capture the nuances of human traces of mark-making – every smear and every crumb of pastel (Figure 83).

Figure 83. Frame-by-frame animation in soft pastel marks

These pastel marks show the original trace in great detail, unlike much computer-based work that destroys the original trace. I created frame-by-frame animations exploring different types of line and circles, in black soft pastels on white watercolour paper. The desire to use painterly techniques was influenced by the early pioneers of animated visual music – abstract painters turned film-makers – especially Walter Ruttmann filming frame-by-frame animation of his paint-strokes on glass (Figure 84).

Figure 84. *Opus 3* (Ruttmann, 1924)

A major challenge was to create an animated shape, a shape with growth and change, rather than an archive of marks (Section 2.3.4). Animating the still images by Léopold Survage demonstrated that still images are not a good starting point for creating visual music. I avoided this by creating elements to animate rather than still images. This was mainly successful, i.e. the sequence of images, such as a line becoming a spinning form, have their own progression that is not the same as an archive of images showing how a spinning form was drawn.

I had an awareness of the digital processes I would use as I created the pastel marks, and the colour and movement were created digitally with a digital-artisanal sympathy for the frame-by-frame footage. The animations were slowed down to 25% of their original speed to make the build of mark-making apparent. I shot footage of moving textures such as silk cloth and, using digital techniques, re-coloured and keyed these through the pastel marks; giving a subsidiary movement of colour through the frame-by-frame imagery. I sang non-verbal, percussive vocal audio, for example ‘t’, ‘ob’ and ‘tzee’, knowing the animations that these sonic elements would support. For example, visually rhythmic lines, drawn one after the other, have a hard sound such as ‘ig’ whereas lines that are smeared have the sound ‘blah’ repeated as the blurred lines appear. I edited the audio *to* the colourful frame-by-frame animations; creating 11 animated-image-audio units (Figure 85).


Figure 85. Timeline with repeated audio emphasising the individual pastel strokes in each of the eleven ‘animated-image-audio units’

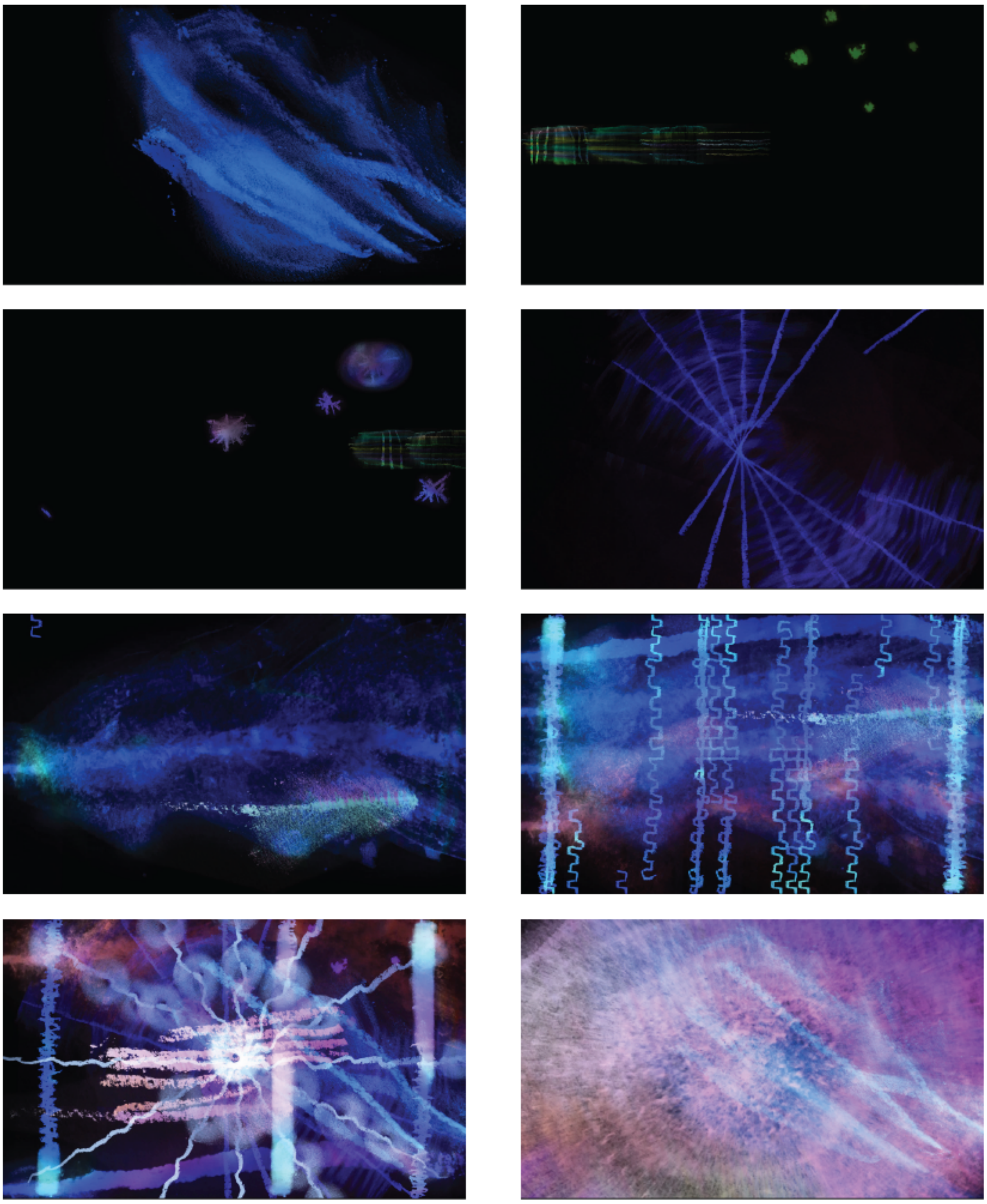


Figure 86. Stills from *Continuous Punctuation* (Watkins, 2018c)

As I layered the animations together to create the final piece, I muted some layers of audio so that the sounds did not become overly repetitive or redundant. For example, in heavily layered sections, about of half of the drawn marks have sonic elements but this gives the effect of being more complete than when each mark has a sonic element. Given that there are many rapid, obvious sync points to follow, when these are doubled the effect is cacophony and it becomes impossible to follow the sync. Therefore, adding more sync points gives the impression of less sync.

Like *Shadow Sounds* and *Sky*, *Continuous Punctuation* is not structured around a narrative or a musical structure. It was created in the manner in which McLaren worked on *Blinkity Blank*: in short bursts, letting the very impressionistic narrative unfold burst by burst; in order to create surprise. I created some moments of animacy (Section 2.3.2), for example the green circle appears to react to the light blue line, and the small green circle and larger pink circle, each following a different spiral, inspired by Klee's *Two Ways* (1932), appear to chase each other around the screen (Figure 86).

**Key findings**

Starting with a painterly medium, i.e. soft pastels on watercolour paper, a medium that is both performed and composed through mark-making gestures, allows a mix of planned, intentional explicit composition and intuitive play, a blending of composition and performance. Trevor Wishart writes of music practice: 'some balance must be struck between what is created explicitly and what is created intuitively' (Wishart, 1994, 6). This is just as true in animation practice. Working in this way allows flexible, rapid creation of many 'takes' of frame-by-frame motion resulting in playful variations on a theme, in this instance line and circle.

The human traces are highly visible in the quality of the marks, the changing densities and textures within the strokes and the variation and irregularities within the repeated marks. The full-frame scale of many of the marks combined with the frame-by-frame build of mark-making emphasises this human variation within repetition. The theme of line and circle appears limitless and each result is unique without resorting to randomisation. In visual music featuring human traces, human variation is much richer and more engaging and surprising than any added randomisation. As Golan Levin wrote of his software, software that was mouse-movement-based and much more limited in terms of mark-making:

> Human gesture, in particular, is already such a rich source of input, with its own stochastic and irregular properties, that additional randomness is hardly needed.
> (Levin, 1994, 107)

The animations of the pastel marks retain their unique character after being filled with colour, slowed and digitally layered, showing a digital-artisan's concern for materials and processes.

The animated-image-audio units on the black background are free of being in a coherent perspectival space and can be appreciated for their richness as images. The norm, to use Klee's term (Section 2.3.1), created by the background in *Continuous Punctuation* is black, allowing maximum contrast with the bright colours. Unlike the very gradual changes of tonality used for *Horizon*, *Continuous Punctuation* uses rapid changes of contrast, punctuating the black void with colourful shapes out of the black, which, combined with the audio elements, emphasises the rhythmic repetitions within the mark-making. The use of strong tonal contrast works well with the percussive audio to create animated 'surprises', as inspired by *Blinkity Blan*k.

The overall macro-structure is visually led; the micro-structures are a fusion of audio and visuals. At the micro level (pastel strokes), there is predictability as the same sounds are repeated with the same strokes, which, as Huron notes, is correlated with pleasantness. However, at the macro level there is a lack of predictability, which, as Chion notes, keeps the spectator in a state of anticipation (Section 2.4.2). The short duration, one minute, allows enjoyment of the frenetic pace, which would become wearisome if sustained over several minutes. I aimed to produce, as Moholy-Nagy writes of his response to cubist collage: ‘a rhythmical and emotional exultation’ (Moholy-Nagy, 1947, 128). To date, *Continuous Punctuation* has been received as playful and engaging, which I consider a success for an abstract animation with no melody.

### 3.3.4 Conclusions

These works demonstrate opportunities and challenges of creating a library of animated-image-audio units with which to compose. Reducing light, form, movement and sound to the same terms, as Klein stated (Ramachandran & Hubbard, 2001) creates unity. In this library the reduction is fusion of particular sounds to particular animations. These animated-image-audio units can be made into innumerable patterns that have cohesion, a cohesion created by the artistic sensibility that made the library. Other composers can use the libraries, which extends their possibilities further. There is great flexibility for digitally layering and colouring the visuals as they are combined together into a composition and the volume of the audio can be animated. However, it is not possible to use textural and timbral changes to morph one animated-image-audio-unit into another. Therefore, like the unblended synth effect of *Synchromy*, it will always have limitations as a compositional tool, no matter how big the library of animated-image-audio units.

# 3.4 Developing a phenomenological methodology

## 3.4.1 *Horizon*

*Horizon* uses a phenomenological methodology to explore visually structuring composition, based on one long shot with the sound of constant waves. The painterly sunset becomes a metaphor for time passing. This fulfils Strand1-A, visual structure informing the composition of both image and sound. My initial exploration, *Horizon* (Watkins, 2014a), was focused on creating visual music through abstracting a natural setting that I found resonant – a seascape with a distant, 'limitless' horizon. Inspired by Turner, I chose Margate Beach, where Turner painted. The concepts of new vision, found abstraction and an eye engaged in, as Brakhage posited, 'an adventure of perception' (Section 2.3.1) have had a profound influence on my work. This influence includes: the importance of selection, finding new angles and a fresh way of seeing the familiar, excluding the context of images and thereby abstracting them to create visual patterns and textures and using found abstraction to encapsulate feelings.

I apply these concepts not only to composing and treating still images and moving footage but in selecting what to explore, i.e. I choose subjects that will benefit from these methods. My methodology to abstract a natural scene started with close observation of my experience of time passing as the sky gradually darkened, the light and colours gradually changing, as the sun set (Figures 87 and 88). As in slow cinema, the changing colours were almost imperceptible moment-by-moment but after twenty minutes, the colours had definitely changed.

Figure 87. Late afternoon at Margate beach from *Margate Sky* (Watkins, 2014b)

Figure 88. Sunset at Margate beach from *Margate Sky* (Watkins, 2014b)

Figure 89. The ‘magic hour’ at Margate from *Margate Sky* (Watkins, 2014b)

Living on earth means living under the sky. The horizon is a joining line, between the sky and the sea. But it is also ephemeral. On Margate beach, the horizon seemed vast, indeed infinite; it felt as if my perception opened up.[40] The horizon moved with the rhythm of my breathing, it seemed to blur and re-focus in my eye. At times, the evanescent light dissolved the horizon and the change from sea to sky was imperceptible, but at sunset the whole length of the horizon was marked with a vivid, coloured, slash (Figure 89).

I framed the scene from many angles to highlight rhythm and texture, inspired by Alfred Stieglitz’s ‘abstract’ *Songs of the Sky* and *Equivalents*. I found the most effective composition to be a framing with a low slash of the horizon line cutting between the sea and the clouds. The top breadth of sky and lower flattened plane of the sea achieved the effect of emphasising the horizon line and the great distance of the horizon from the viewer.

While at Margate, I captured a wealth of material: field recordings of audio, hours of video footage and numerous stills from many perspectives. This wealth of material afforded creating abstracted images through layering, re-

[40] The importance given to visual perception in Maurice Merleau-Ponty’s Phenomenology of Perception supports my methodology

timing and texturing, which enables the perceiver to reconfigure it into a new experience (Section 2.2.5). This is similar to a soundscape composition: visuals are recorded from the real world, i.e. sampled, then changed in order, in Truax's words 'to invite the listeners' [or viewers'] imagination' (Truax, 2017).

Looking through the lens in situ, breathing in the sea air and hearing the waves, the two-dimensional image seemed already abstracted. However, when I later viewed the footage on a screen the image was not abstract enough. The scale of the human-made elements, and their clean sharp lines, detracted from creating an unbounded sense of space, a vast horizon. Finding a balance between the mimetic and the abstract or abstracted informs both my work and my methodology. I digitally removed the human-made elements but I was not satisfied with the resulting feeling of space.

As a digital artisan, I developed a mixed-media process (both digital and painterly) and, using repetition, created abstracted, rhythmic patterns of light and shadow. I fragmented the picture-plane, inspired by early cubist collages and the desire to access a more affect-based response to the work. Overlapping and interwoven textures of different sizes and scales give a sense of collaged, textural depth. The use of formal drawn perspective was purposefully avoided – to create a horizon with metaphorical space and free the viewer from the connotations of a literal sunset. The audio-visual relationship also enhances metaphorical space and perspective by juxtaposing close (acousmatic) audio with distant image. The nebulous, almost infinite distance of sky and horizon line and close-up audio of (unseen) waves confounds the viewer's expectation of space. This non-realistic use of scale and perspective is crucial to the methodology of balancing abstraction and mimesis, resulting in a liminal space between abstract and mimetic landscape depicted on a 2D screen.

*Horizon* was constructed in layers and animated over time in a manner that has some similarity with creating a painting – working by building up layers. It is the result of many iterative tests: the rate of colour change from grey to blue to black in the sky, how to treat the horizon line to keep it as a focal area, how to blend static and moving textures to create a painterly form of animation that changes very slowly (Figure 90). Time passing is evidenced by the sky darkening from grey, to blue, to black, with changing tonality as temporal change. This indicates a way of deploying Klee's measurement of tonality in relation to temporal change. This time-collage is an attempt to allow the viewer to meditate on the image in the way that a static image can be viewed, whilst simultaneously gradually changing to keep the viewer's gaze in the increased state of activity that Moholy-Nagy identified (Section 2.3.4). It is a blend of the pictorial and the cinematic, in both the result and the methodologies and processes used.

Figure 90. Still from *Horizon* (Watkins, 2014a)

**Key findings**

Creating *Horizon* confirmed the value of including seminal artists, such as Turner and Klee. Turner inspired the subject matter, the location and the use of painterly brushstrokes. The emphasis on the formal visual elements of line and tonality in *Horizon* is underpinned by my research into Klee. Creating

*Horizon* confirmed the tension between representative images, especially from nature, and 'abstract cinema' or abstracted-natural-imagery, which emphasises formal visual aspects, as a methodology for my work. *Horizon* encompasses establishing metaphorical space, using both visual and audio cues, investigating the almost-static movement-image and variations of collage in time-based media, slow cinema and acousmatic audio. *Horizon* attempts to elicit the fluid perception given to movement-image in an almost-still image. The gathering of footage-as-data allows a new experience to be retrieved or constructed by the viewer.

### 3.4.2 *Reservoir*

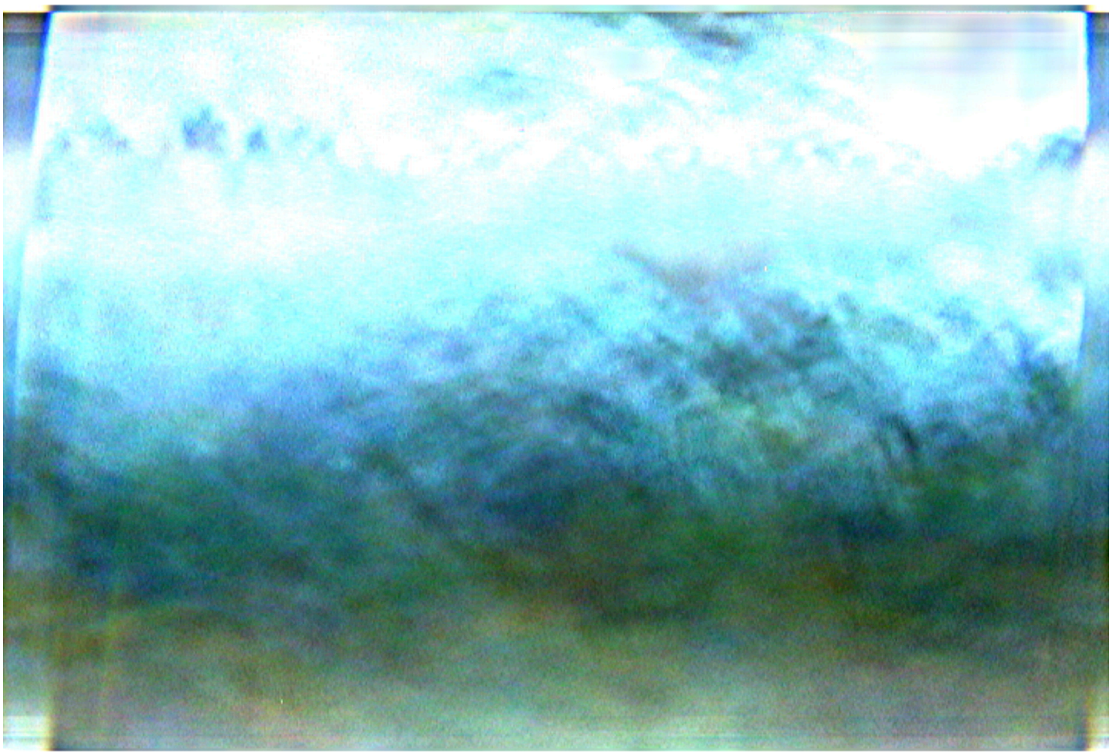


Figure 91. Still from *Reservoir* (Watkins, 2015a)

*Reservoir* (Watkins, 2015a) builds on the phenomenological methodology used in *Horizon* by exploring walking in a circular journey, again composed as one long shot but on this iteration the audio was structured by the visuals and the materiality of digital video was key. It fulfils Strand 1-A, visual structure informing the composition of both image and sound.

*Reservoir* is created from footage that I filmed in 2000 walking around the reservoir in Central Park in New York, capturing video and audio on a Sony TRV900. The camera shot at a resolution of 720 x 480 pixels. I placed it in progressive mode. The distant abstracted-landscape is doubly framed: glimpsed through the wire mesh and purposefully enclosed again by the presence of the edge of the frame. This captures the geographical motion of walking around the reservoir into a graphic space. Walking is lensed by the camera, haptic and proximal change becomes the rapid movement of close-up fence and the slower changes of the distant landscape. The resulting imagery is animated by being massively sped up and then step-framed, i.e. each frame is printed seven times, to create a step-frame effect that breaks the flow of live action and makes the viewer aware of the individual frames. The video is then layered and colourised until the image almost disintegrates and becomes completely impressionistic (Figure 91). The circular journey purposefully limited the acquired material. I treated this to a wide-ranging series of processes; the transformations of the material become more important than the original material and informs the structure of the composition. This is similar to Hyde's '*video concrète*' practice and is also informed by my digital-artisan methodology.

The sound-data for *Reservoir* was captured at the same time as the point-of-view footage; whilst circling the reservoir on foot. All the sounds are acousmatic; the viewer sees the effect of the sounds on the camera movement but not the makers of the sounds. The visual image and sound are disassociated; the visual image is limited to the frame and the sound becomes a separate sound image with its own framing. The audio events play in real-time; they are not tied to the images in the realist manner of synchronous sound but are structured by the visuals, forming audio-visual vertical chords with the step-framed images, which synthesise the audio with impressionistic visual. The methodology of balancing abstraction and mimesis separated features from the whole, to create a form of abstract animation that has mimetic sonic elements embedded within it. As the film and video artist

Malcolm Le Grice states of abstract animation, ’the process of separation of the component features and qualities from the “whole” of an object’ means that abstract animation ‘is not synonymous with non-representation’ (Le Grice, 2009, 290).

**Key findings**

The completion of the composition is emphasised through echoing the first scene at the end. In *Reservoir*, the seemingly random diegetic audio increases the sense of place and time; using these sounds in the order they were captured keeps intact the original acoustical geography of the circular walk. Nevertheless, the overall impression is of texture and timbre changes, in the mode of ‘*video concrète*’.

Using one long shot for the composition, albeit treated and step-framed, is aided by the journey being circular. Looking into the area circled, away from the sources of the audio, allows the sounds to be acousmatic. The resulting separation of the visual and the audio framing is intrinsic to the piece and a good area for further exploration. However, it would be better to avoid dialogue. In *Reservoir*, the fragments of dialogue, as Arnheim (2007, 196–212) describes, do sound somewhat intrusive and seem more portentous than the other sonic elements.

In *Reservoir*, I used vision and audio as data in order to fashion new aesthetic experiences from the world around me, using the methodology of a digital-artisan. Digital video can be treated to make visible the base material of the moving image. Given that digital-video lacks the tangible physicality of film, which forms an aesthetic for artists such as Guy Sherwin, the ability to push the digital material to show both its structure and its fragility is important in establishing a digital aesthetic that relates to a historical format and resolution of digital image.

### 3.4.3 *Ambience 2*

*Ambience 2* investigates phenomenological methodology in composing visual music, building on the methodologies used for *Horizon* and *Reservoir* but starting from a different point of human traces taken from a performance of wordlessly sung traditional songs. This fulfils Strand 3-A, moving image created *to* pre-existing music.

The melody of a traditional song unfolds. The song has no words and is not literal in any sense. The singer remains unseen, off-screen. There is no face, no mouth to gaze upon. The singer is an unseen *acousmêtre* (Section 2.4.1). The emotion of the melody and performance is embodied in soft circles and light plays that move in sync with the music. Delicate colours softly change and particles sway and flow as if performing (Figure 92).

Figure 92. Still from *Ambience 2* (Watkins, 2016b), particles tracked to head

The choice of traditional music was inspired by Mary Ellen Bute's work. I choose the human voice as the instrument to underpin the abstract movement of light and colour because of its unique power (Section 2.3.2). I asked the singer, Clare McCaldin, to sing musical iterations of a traditional song wordlessly, focusing on using smooth singing and then articulated, aspirated singing. She sang different versions with the same melody but at different speeds, with different articulation and timbre and with different prosody. This allowed editing phrases of the song together to make a new song structure to underpin my visual music composition.

*Ambience 2* follows Whitney's advice that images should respond on a higher level to the music, and demonstrate Cook's 'complementarity' (Section 2.4.1). Today's technology makes it much easier to make the images respond on a higher level to the music, using input, i.e. data, from the singer's performance. Abstracting the face beyond recognition here meant mapping facial movement of the singer to changes in colour and showing only these changes, not her face. This was with the aim of affording the spectator a less associative and more meditative experience. I tracked Clare's head-gestures, her singing motion and animated particle effects to this motion, leaving only traces of her head and mouth movements in the flow of particles that create their own pattern. It was vital to animate the particles rather than to map them to, say, the amplitude of her vocal. Animating allowed fine-honing the result, to show her movement in the abstract, without the individualising associations of her face or physical form. By abstracting the face beyond recognition, by removing Deleuze's 'nudity' of the close-up, the gesture of her head movement – the motion itself – is affective.

My aim in abstracting the face was to create Lye's 'figures of motion' (Lye et al., 1984) and images that intrigue and engage the viewer, as pareidolia does, and, also like pareidolia, evokes forms only in passing. The only direct visual mimesis in *Ambience 2* is of the sound of the singer's voice, created using a digital version of the oscilloscope (Figure 93). This is inspired by the pioneering creation of sound imagery by filming oscilloscope patterns in Hy Hirsch's *Divertissement Rococo* (1951) and Mary Ellen Bute's *Abstronic* (1957). My practice developed through animating non-verbal vocalisations, animating an abstracted performance of an emotive melody and historicising the methodologies for creating abstract visual music that has no narrative but is suffused with human presence and emotion and might afford a meditative experience, similar to soft fascination.

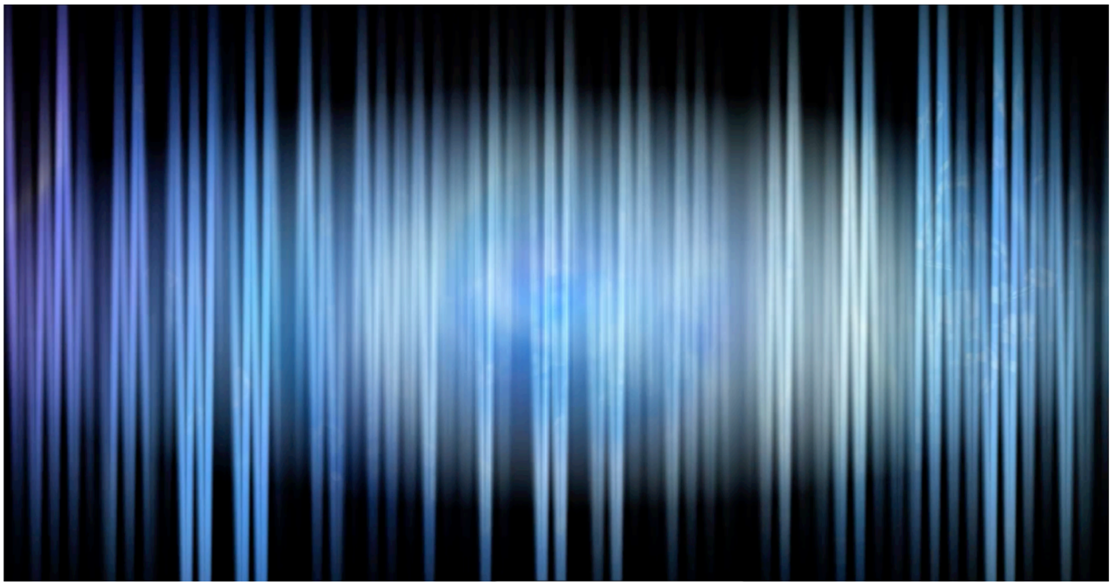


Figure 93. Still from *Ambience 2*, oscilloscope patterns

**Key findings**

In this visual music composition, the voice holds sway, it drives the delicate visuals. The visuals are animated; they are not mapped to the audio. This is the crucial difference that makes *Ambience 2* affective, as the voice activates Cox's mimetic hypothesis and the audience, when it was presented at DRHA 2016, swayed along with the singing. The oscilloscope patterns are the least successful section as they put more emphasis on the voice and the mechanical following; the mapping of the audio does not have the delicacy of the other sections. *Ambience 2* is underpinned by wordlessly sung music and other human traces; some human traces are visual, some auditory and some are cross-modal. The hope is that these human traces arouse affect and so are engaging even though they do not conform to the dominant artform as seen on the internet, television and in cinema, i.e. to counterbalance the lack of traditional narrative, words or referential associations to the figurative. It is possible to create abstract visual music that unifies sound and image and avoids obvious associations by abstracting both natural image and visual performance.

## 3.4.4 Adding immersion – display, participation and art of light

**Installation of *Ambience 1, Ambience 2* and *Ambience 3***
I created *Ambience 1* (Watkins, 2016a) and *Ambience 3 (Watkins, 2016c)* after *Ambience 2*, using the phenomenological methodology starting with vocal expression and the same mode, Strand 3-A (moving image created *to* pre-existing music)*.* Through Practice as Research, this phenomenological methodology expanded beyond gathering inspiration from phenomenological experiences, into adding immersion. This was supported by McCall's methodology of defining practices as pictorial, cinematic and sculptural, and Hyde and Piché's exploration of the effects of 3D projection on audio-visual perception. Spectator-participant opportunities, the sense of immersion (Section 2.5). Display opportunities and challenges were evaluated by displaying the works in different ways, including moving beyond the fixed-screen.

The three works could be played contiguously or separately. *Ambience 1* and *Ambience 3* were designed to contrast with *Ambience 2*; their visuals had rich reds and a greater tonal range. As a digital artisan, I used several formats of footage to create pieces that highlight the nature and materiality of the different digital formats, demonstrating that they are not transparent and can transform the image, as seen in *Reservoir*. The installation of *Ambience 1, Ambience 2, Ambience 3*, in the gallery at *SOUND/IMAGE* 2016 gave spectators the opportunity to walk through a *Waterfall Installation* in which the works were presented on six monitors (Figure 94). The screens had offset sync, creating a waterfall effect. Spectators could stop and don headphones to hear the audio running in sync with the vision. The *Waterfall Installation* led directly into the *Multi-layered Installation* of the works (Figure 95).

Figure 94. *Waterfall Installation* (Watkins, 2016), standing with my back to the *Multi-layered Installation* (Watkins, 2016) at *SOUND/IMAGE* 2016

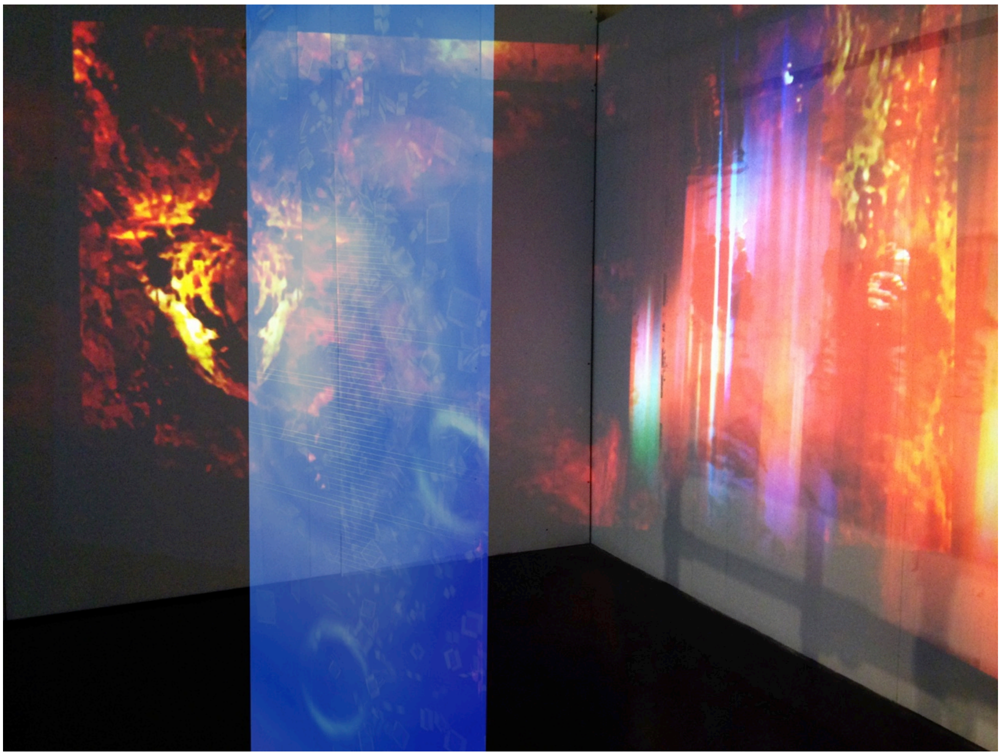


Figure 95. *Multi-layered Installation* of *Ambience 1, Ambience 2* and *Ambience 3* (Watkins, 2016) at *SOUND/IMAGE* 2016

The *Multi-layered Installation* projected the work, with offset sync, from the first and second projectors onto two walls and from a third onto hanging screens. The audio from the projection on the furthest wall filled this space. There was no need for headphones in the *Multi-layered Installation*.

**Key findings**

Spectators stayed longest in the *Waterfall Installation*. Some had a private experience with the piece using the headphones. Others walked slowly down the installation, hearing the audio from the *Multi-layered Installation*, in which case the audio became atmospheric, rather than attached to one piece. At the end of the *Waterfall Installation*, some turned around and others walked through the *Multi-layered Installation*, around the hanging screens. There was space for one visitor to walk around freely. The freedom from headphones encouraged looking around more. A lone spectator could become a participant, constructing their own experience and immersing themselves in the *Multi-layered Installation*. It became clear that a more closed-off area than the *Multi-layered Installation* space and/or a bigger space would create more freedom for walking around and through this installation. A closed space with totally controllable lighting would be ideal.

In Figure 95, the image on the hanging screen has been brightened; the Perspex screens gave bright images from only a limited range of angles. The limited angle of view for bright reflections on the hanging screens led me to investigate other materials to project onto. A fabric such Holo-Gauze would be better, although this fabric is fragile – it needs to be handled with gloves – and not appropriate for this exhibition area. The Perspex hanging screens also seemed to discourage walking through the installation – narrower screens of a softer material would be better.

The choice of audio sync or not worked in the *Waterfall Installation*; without the headphones, the audio created an atmosphere, once wearing headphones one was attached to a monitor and it was immediately apparent that the work in that monitor was in sync. One could glance over to the other monitors whilst hearing that audio and see that they had random sync. However, having one wall out of three in sync in the *Multi-layered Installation* did not work because the visual balance (e.g. brightness) of the installation did not cue looking at the projection that was in sync and 'adding' the others by walking around and changing views. This led me to investigate having a brighter animation with the audio sync mixed with other light-animations in real three-dimensional space for *Singing Light 1*.

*Ambience 2* was also screened in the lecture theatre. On the fixed-screen, the audio-visual balance changed; the audio became more dominant and the delicate visuals were somewhat subsumed. As at DRHA 2016, the melody and performance of the singer held sway. This led me to investigate using singing based around one pitch and intermittent audio in *Sky* and *Singing Light 1* (Watkins, 2018g), as I strove to create 'an equal and meaningful synthesis of the visible and the audible' (Lund & Lund, 2009, 149).

# 3.5 *Singing Light*

## 3.5.1 *Singing Light 1*

The phenomenological methodology was developed further in *Singing Light 1*; light itself became the medium (Section 2.2.4). This deepened the immersion by inviting spectator-participants to walk through the work, to be inside it and to react to it (Section 2.5.3). The evolving light gave structure to the work and the audio followed this structure. *Singing Light 1* fulfils Strand 1-A, visual structure informing the composition of both image and sound.

Figure 96. *Singing Light 1* (Watkins, 2018g), from inside the volumetric light tunnel

Light has long been animated in performances of visual music, in projected light shows and works, and used to create, in James Turrell's term, 'sensing spaces'. In *Singing Light 1*, the spectator-participants walk through an architecture-of-light-with-sound from an unseen singer (Figure 96). Each experience is individual and unique. The piece creates a deep space: the projected animation is broken across long, illuminated hanging strips that recede into the space. The ‘breakthrough’ of the screen was inspired by Turner ‘breaking through’ his canvas to create more expressive, affective work (Section 2.2.2). The singing is played from speakers at each side of the room to emphasise the space, the projection into 3D. The light forms animations in the air, given volume by the ever-changing haze created by a haze machine – this effect was inspired by Anthony McCall’s solid light. Coloured lights constantly evolve and change, softening the austerity of the monochrome light tunnels and adding more depth through colour. Using evolving colours in light was inspired by Thomas Wilfred’s work.

*Singing Light 1* exists only when it is installed – it cannot be played on a fixed-screen. I chose to install it in a TV studio, which is essentially a large black-walled space, with completely controllable lighting. The interaction of the animation and the display directly influenced my creative process as I developed the work. Creating the piece necessitated creating animations and experimenting with how I displayed them in the performance space. I walked around the space to absorb the full effect. I reflected on how to get closer to my vision, created new animations to test, developed the display with the new animations and reflected on the result. This was an iterative process over several weeks. Appendix C presents a closer examination of the development process.

Additionally I used my findings from previous works, especially the fixed-screen *Waterfall Installation* and *Multi-layered Installation* displays of *Ambience*. I used a bigger space with one entrance-exit and completely controllable light. I used haze as a more flexible and interactive surface than Perspex. I used tracing paper to act as six hanging flags to increase the sense of depth, rather than two, bigger hanging sheets. The narrower tracing paper flags encouraged walking through the installation, unlike the Perspex hanging screens, and they could be touched, unlike Holo-Gauze. The audio was played through speakers, obviating the need for headphones. The audio track was based around one pitch and the singing was intermittent, so the voice would not hold sway over the visuals (unlike the fixed-screen version of *Ambience 2*). The audio was clearly synced to the brightest light, i.e. the white animated light – the coloured light changed independently and very slowly and gradually so it did not affect the audio-visual sync set by the brightest light (unlike the *Multi-layered Installation* displays of *Ambience*).

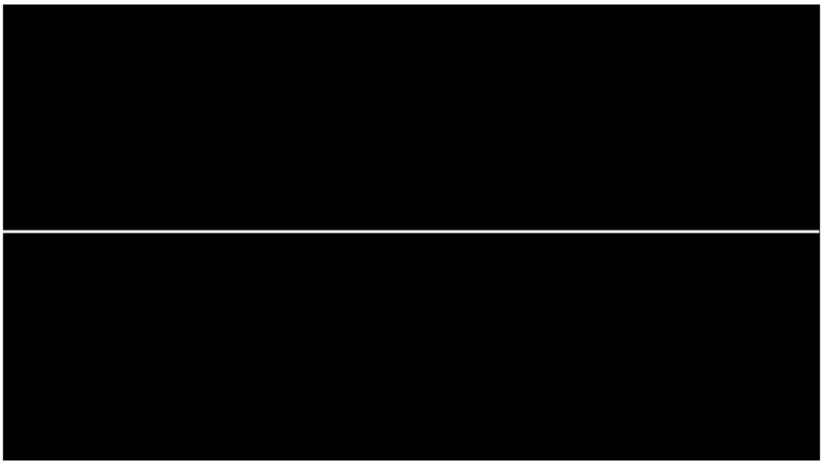


Figure 97. Projected line

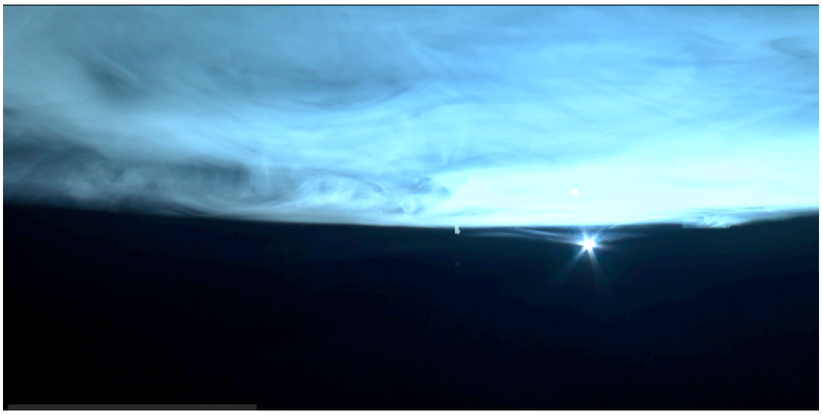


Figure 98. Looking back at the projector

As an animator, my starting point was to imagine the singer's voice in the space and to create a horizon line, the fundamental line that separates sky from earth, as a moving bright line, animated in space (Figure 97). The line is given impetus to move and animation-tempo (see Key Terms) by the vocal expression of the voice. The line is literally and metaphorically central to the work. This builds on my initial phenomenological explorations into proximal and distal environments, the areas I explored in *Horizon* (Section 3.4.1), and my research into Klee and McLaren and shifts in texture. The line is given substance by the haze, which has its own texture and density (Figure 98). Reflecting on the animation of geometric forms by Richter, who used the cinematic frame as a movie-canvas and contrast-analogy, resulted in the realisation that outside the frame of a screen, beyond the screen, i.e. in the haze, the restriction is not bounded by the frame but by what is visible in the haze.

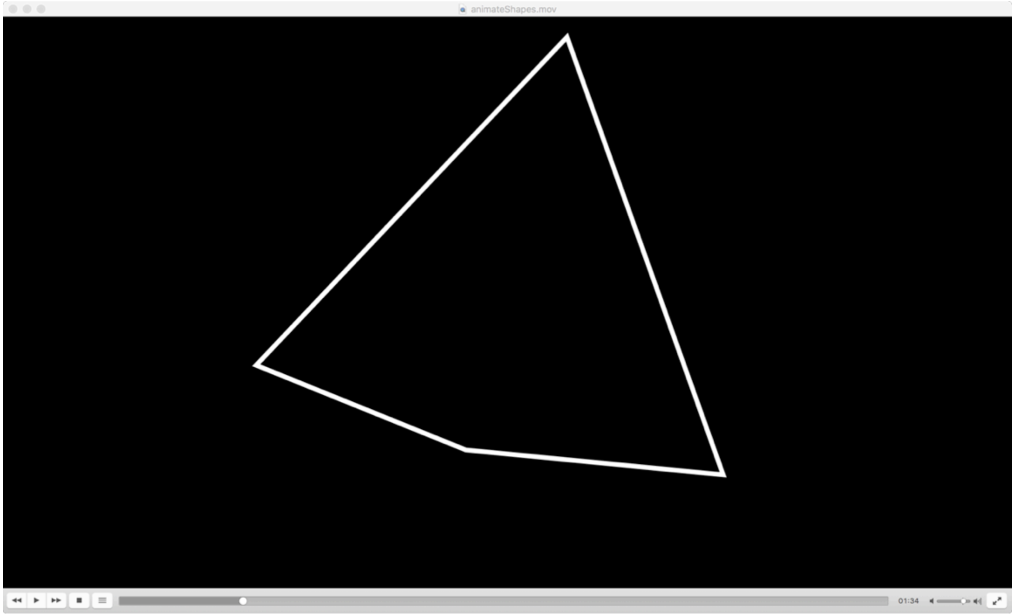


Figure 99. From *AnimatedShapes* (Watkins, 2018a), a triangle fluidly morphing into a square – this would be impossible to achieve with metal barn-doors

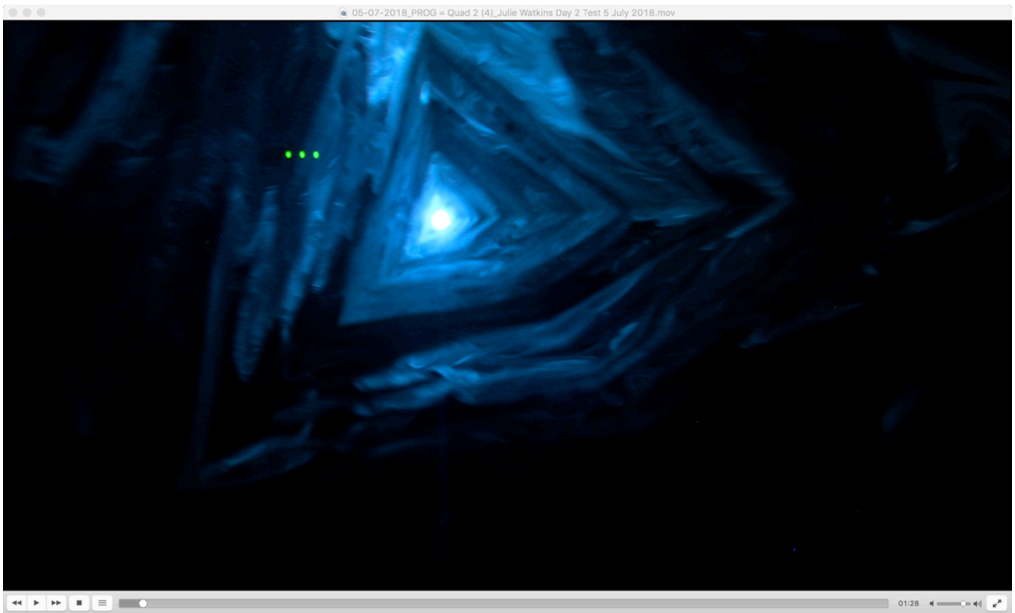


Figure 100. Looking towards the projector through the haze

I reflected on expected and unexpected forms of light. Wilfred's lumia are unexpectedly beautiful in their organic movement, flowing shapes and evolving colours. McCall's solid light is unexpected because light is not usually constrained to forming a shape such as a cone. These reflections and the results of the first session gave rise to development of a new piece that has a flow of changing coloured light in motion. This exploration of volumetric light would be impossible to create if the light were physically shaped by metal or barn-doors, for example, because the forms fluidly evolve from one geometric shape to another, i.e. they morph as only animation can (Figures 99 and 100).

Additionally, referencing Klee, I explored dividual-individual shapes. Circles were divided and augmented with rotating circle segments, thus integrating hard-edged linear dividual elements with the smooth cone (Figures 101 and 102).


Figure 101. *RingSegments* projected in the haze, looking back at the projector

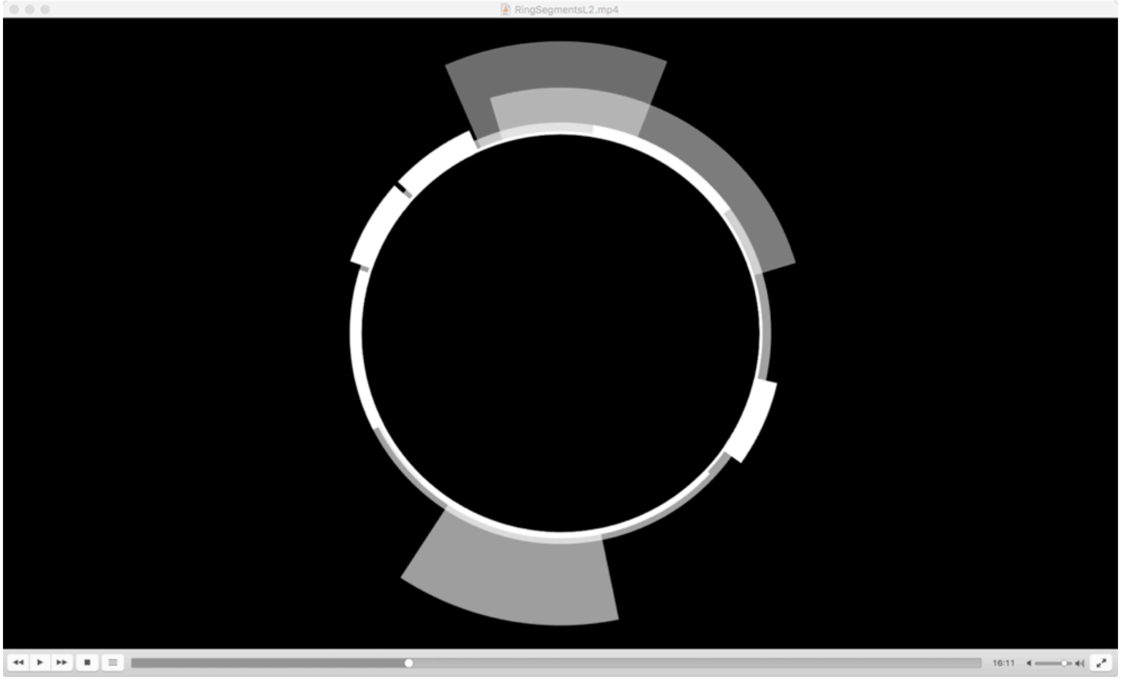


Figure 102. *RingSegments* animation

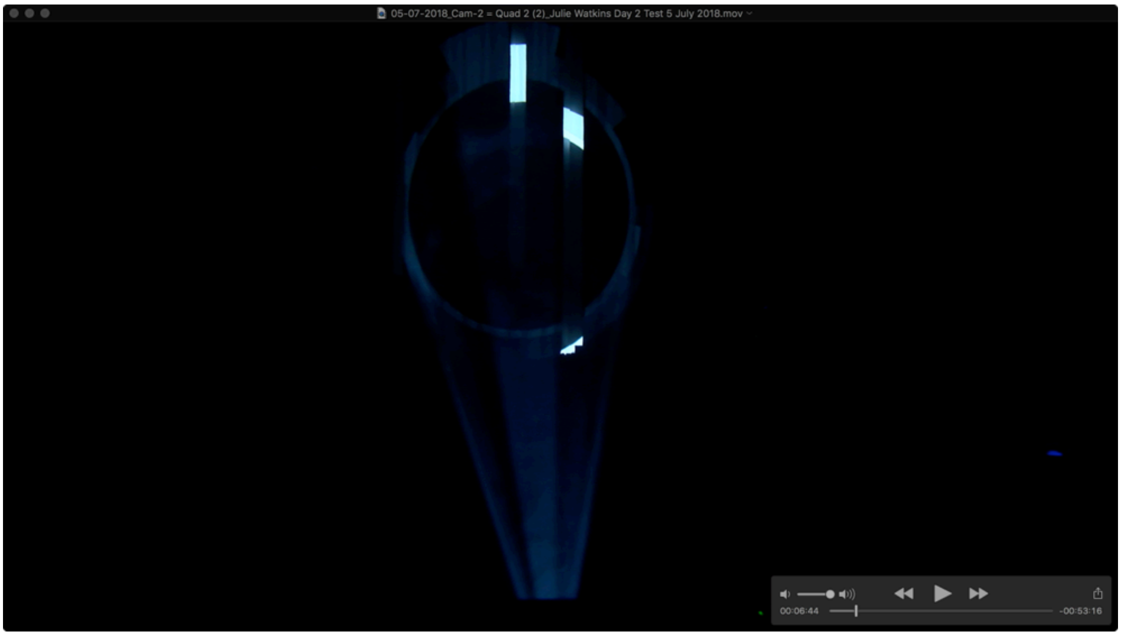


Figure 103. *RingSegments* projected in the haze and highlighted by flags

The projection was further broken across the planes of narrow flags, spaced to create more depth (Figure 103).


Figure 104. Close-up of interacting with the projection

The power of animating light (Section 2.2.4) was key to creating abstract animation that had the potential to be affective over a sustained period. The light in the ever-changing haze looks soft and inviting, touchable (Figure 104). I created very slow animation to allow spectator-participants to move around and through the installation and give them time to react to it; for example, I used a six-minute-change from a horizontal line to the outline of a rectangle filling the screen. The change is almost imperceptible until minutes have passed; it is slow cinema. This slowness is emphasised through contrast with rapid sections: the rectangle quickly scales into a vertical line over eight seconds, and then rotates to become a new horizontal line over the next eight seconds. The most rapid changes occur over half a second. The piece is unpredictable, as changes occur at irregular intervals and with irregular pacing. The aim was to evoke something more akin to being in nature and experiencing soft fascination (see Key Terms) than to seeing a performance. To this end I created a loopable, hour-long animation, *AnimatedShapes* (Watkins, 2018a). In order to create a meditative sound, the singing is purposefully limited to a single voice singing single pitch. The voice wells up. It has presence, it is an *acousmêtre* (Section 2.4.1).

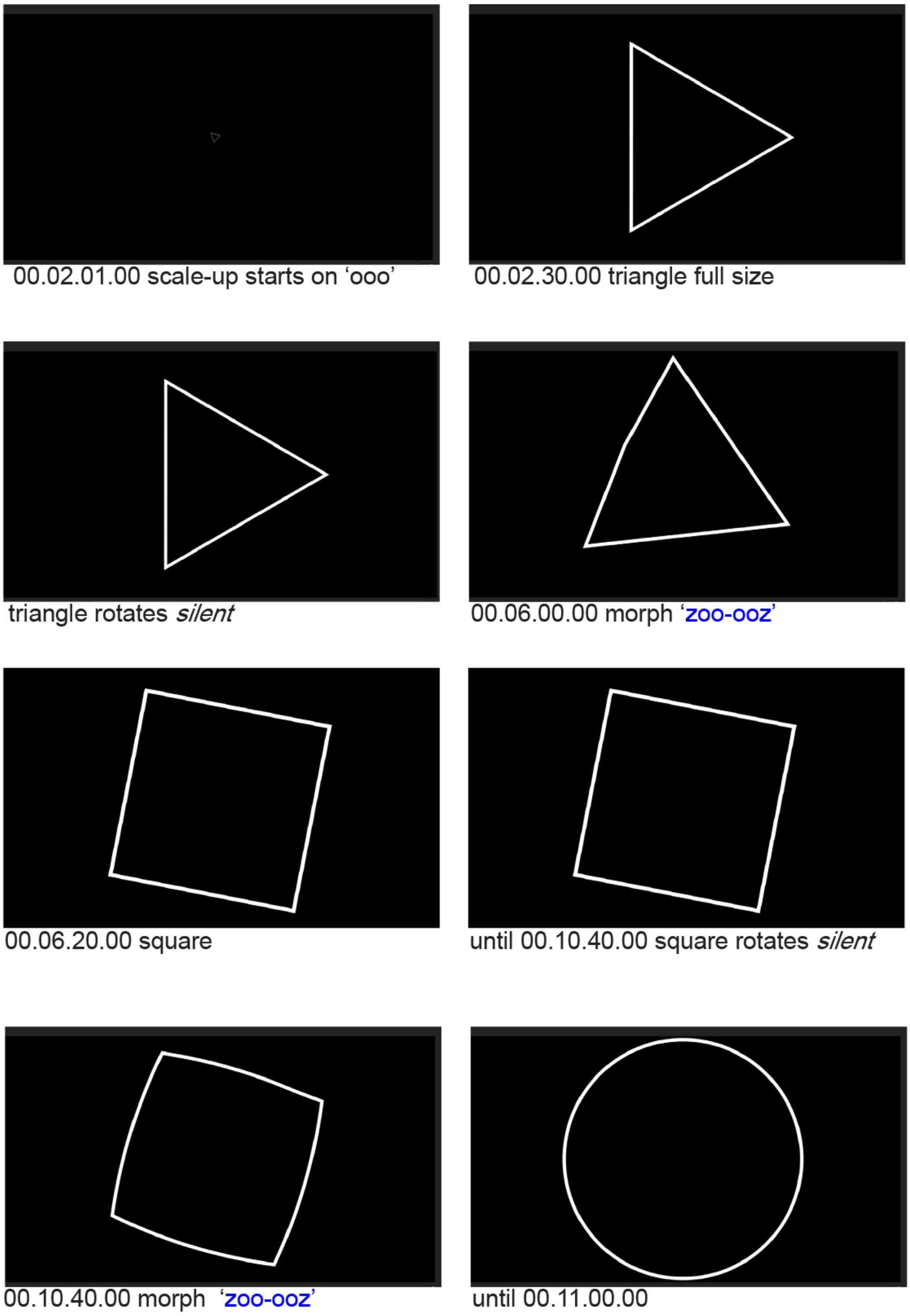



Figure 105. Keyframes from *AnimatedShapes* (Watkins, 2018a)

The line animations were designed with the knowledge that they would be emphasised with audio, sung phonemes (Figure 105). I created animated-image-audio units by consistently associating certain sounds with particular animations, developing from *Shadow Sounds*. Vocal expression was key. The vocal both emphasises and creates the impetus for change, for example scale change and the drawing on or off of lines start on ‘ooo’. Some animations are back-timed to emphasise the ending point, for example a line stops rotating on the ‘g’ of ‘ooog’. ‘Dividual’ elements (Section 2.3.1) are shaken in or out of lines on ‘voo-oov’ which gets louder on shake out and quieter on shake back. Morphs are associated with ‘zoo-ooz’. These motions have acceleration or deceleration (Section 2.3.2). Constant motion, for example slow rotation, contrasts with this and is emphasised by the movement being silent. Additionally the juxtaposition of sounds was considered, for example there is no ‘ooo’ on the scale change at 00.49.58.18-00.50.00.00 because it is followed by a morph with ‘zoo-ooz’ at 00.50.00.00 (Appendix C). Only voicing the morph makes the whole sequence more effective. The sonic element feels of equal weight to the visuals although the visuals are continuous and there are minutes of silence. To use Gombrich’s term, the audio is ‘incomplete’ (Section 2.5.4) and so gives the beholder’s imagination space to respond.

### 3.5.2 Installation of *Singing Light 1*

I installed *Singing Light 1* for *SOUND/IMAGE* 2018 in the same television studio at the University that I had used for developing the work. With 9-metre high walls, it was higher than *Momentum*, and its height was accentuated by the flags draping down from the light-bars (Figure 106). I used a 13,000 lumens projector on the floor to project *Animated Shapes* upwards against a black curtain at the back and a 3,000 lumens projector to project *Volumetric Colours* at an angle to this, to mix in evolving colours in the upper portion of the space. Placing the projections at an angle, i.e. not projecting horizontally, ensured that the volumetric projections in the haze did not evoke fixed-screen projections in a cinema. Mixing colours from a second projector across the first further distanced the projections from a film.

I hung six tracing-paper flags to create planes of depth and thoroughly integrate the animation into real three-dimensional space (see Appendix C). I did not weight the ends of flags but allowed them to curl and gently sway with the breeze caused by the fan moving the haze and in response to spectator-participants brushing against them. For me the swaying evoked the first spark of inspiration that I had for *Singing Light 1*, being in the dappled shadows under trees with gently swaying branches. The soft, marbled turbulence of the haze, the irregular curls of the flags and irregular shapes of the spectator-participants contrasted with the geometries of the animation and the linearity of the projections and cast shadows (Figures 106 to 110).

Figure 106. Interacting with *Singing Light 1* (Watkins, 2018g), at *SOUND/IMAGE* 2018

Displaying the animation less brightly on the black back curtain than on the flags (see the triangle in Figure 106) and even letting the folds of the back curtain distort the animation to make more of a texture than a clean image (Figure 107) was important in creating a balance in the installation. If the back-curtain image was stronger, participants tended to become spectators and fall into the fixed-screen habit of looking at the back wall. The tracing-paper flags were translucent and showed the white line – as chevrons of highlights – and colour projections from the front and back (see Figures 106 and 112). This gave an equal level of intensity of imagery to spectator-participants whether they were facing the back wall or looking in the direction of the projector. This careful design, balancing the projection sources and receiving surfaces in the environment, created an installation that was multi-planar with complex levels of depth that changed as the animation progressed (Figures 108 to110). Inspired by Turner, the arrangement 'broke through' any sense of a screen to create embodied, visceral, affective work (Section 2.2.2).

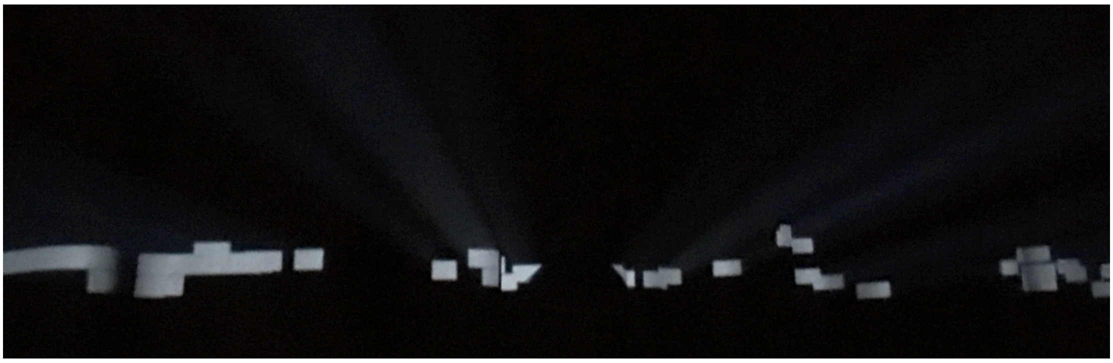


Figure 107. Animation broken by round shadow from spectator-participant's head in centre and rippling over the folds in the black curtain

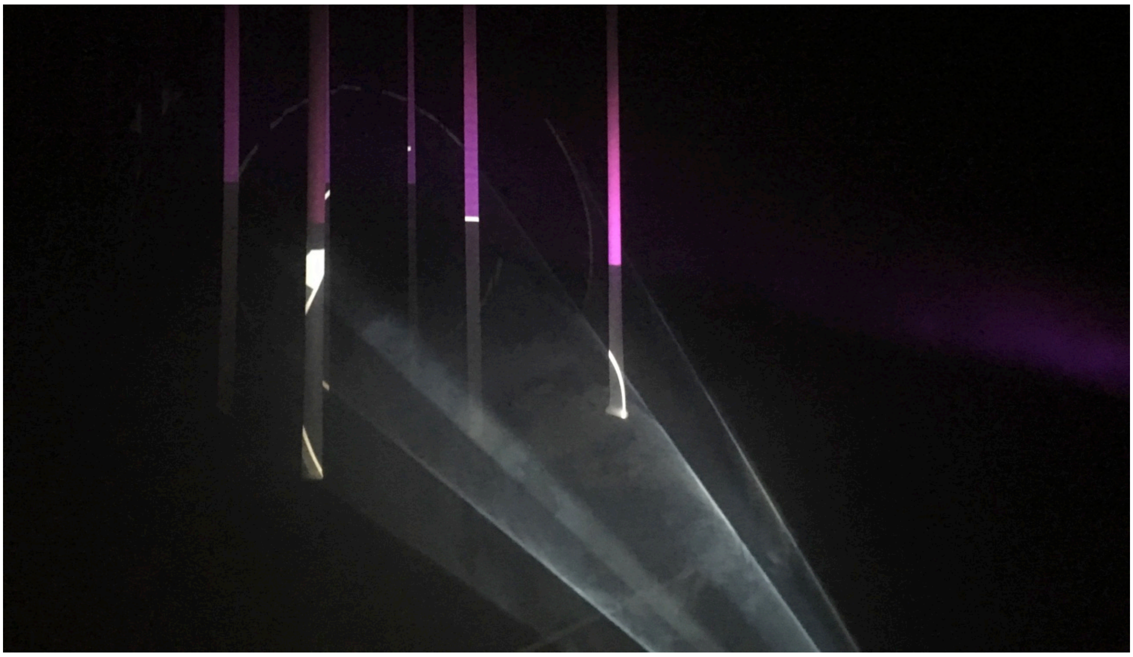


Figure 108. Concentric rings of light, flags and colour projection, *Singing Light 1* (Watkins, 2018g), at *SOUND/IMAGE* 2018

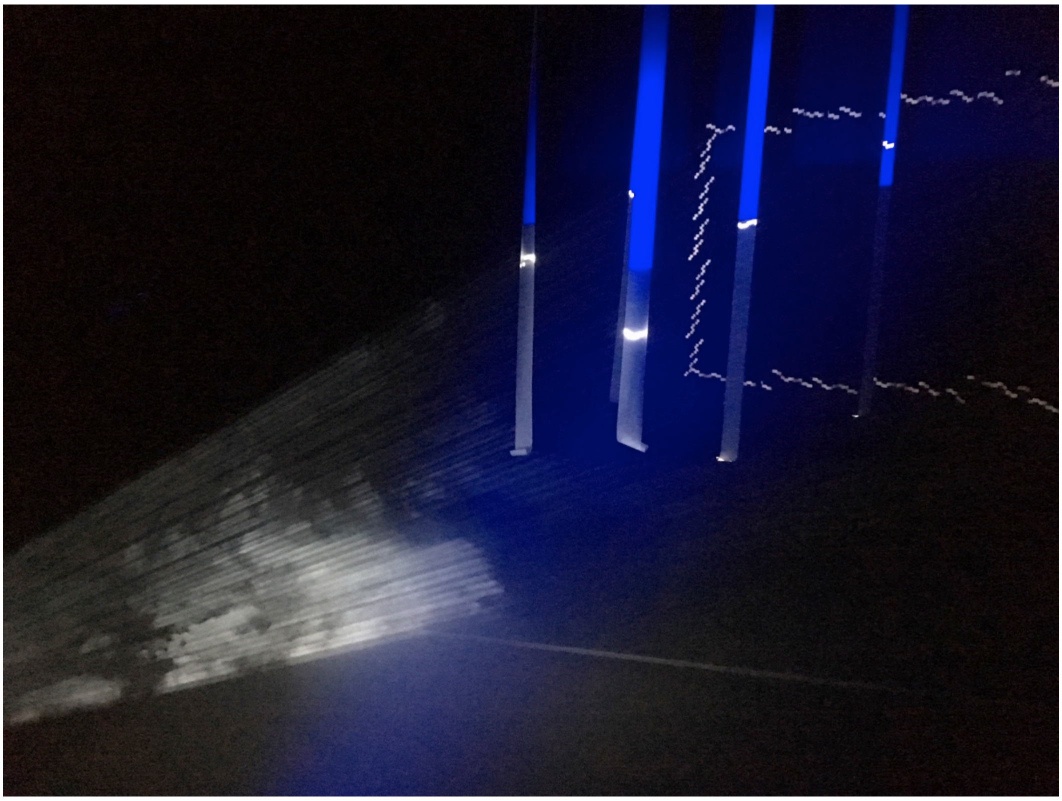


Figure 109. ‘Dividual’ elements animating to form a rectangle and creating a different quality of projected ray and depth in the environment

Figure 110. ‘Dividual’ rectangle rays of light, spectator-participant filming the rays and interacting with them, flags adding to the depth

The source audio of *Animated Shapes* was hidden; it was fed through two speakers placed at either side of the room behind the black curtain that circled around the wall. This added to the surprise of intermittent, meditative acousmatic sound that welled up out of the darkness from both sides, enveloping the space. The singer was an unseen *acousmêtre* (Section 2.4.1). There were other sounds present in the environment: the fan created a continuous low hum; the haze machine gently puffed out haze every few minutes; and spectator-participants talked quietly with each other, stopping when they heard *Animated Shapes.*

I wanted to create an intimate experience in which spectator-participants could explore and be playful. Therefore, I collected data unobtrusively and passively. Prior to the event and on the door to the room I posted notices that the event was being filmed and photographed. I recorded a wide-angle view of the whole installation by positioning a Sony A7 camera in a corner of the room. I boosted ISO to cope with the low light level. From the footage (Appendix D): in the first 30 minutes, about forty spectator-participants entered the space; and in the second 30 minutes, about thirty more entered. The maximum number in the space at any one time was about twenty. People tended to be more still, explore less and interact less when the group was larger.

Many spectator-participants stayed for between five to ten minutes. They stayed longer if they took photos and played in the light and longest if they found a spot at the side of the room in the dark from where they observed. A few stayed for about thirty minutes. The shortest visit was about one minute. The briefest visit was when a spectator-participant glanced in and the animation was creating a small blade of light. In James Turrell’s terms they did not self-select to wait and see what would happen next. As noted above, spectator-participants talked quietly with each other, becoming quiet when they heard *Animated Shapes.* The intermittent *acousmêtre* caused varying degrees of surprise; the spectator-participants tended to stop moving and look at the animation on the back wall; one was visibly startled. Those staying for the shortest times would probably not have been aware of the audio.

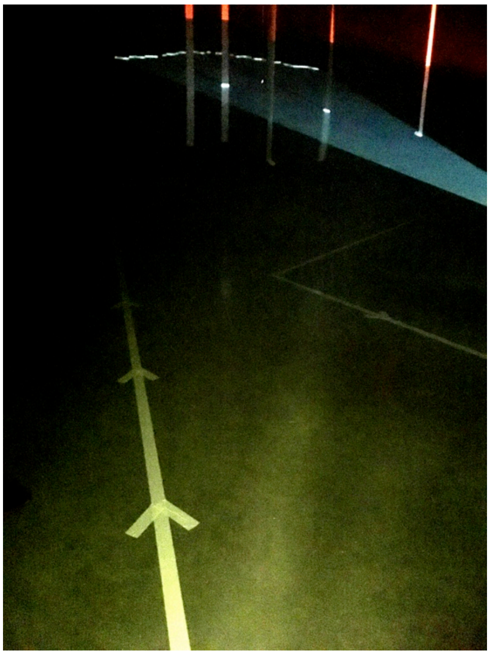


Figure 111. View from the open door

I put tape on the floor to give the spectator-participants a safe path to follow in the darkness (Figure 111).


Figure 112. Spectator-participants entering

Spectator-participants tended to hesitate as they entered, getting their bearings in the dark space and letting their eyes adjust to the low light. A few groups of three or four followed each other around the line on the floor and stopped against the back wall. They stood in a huddle, watched the animated shapes and looked around the environment (Figures 112 and 113).

Figure 113. Heading to join others at the back wall to look into the tunnel of light

Figure 114. Posing in the light

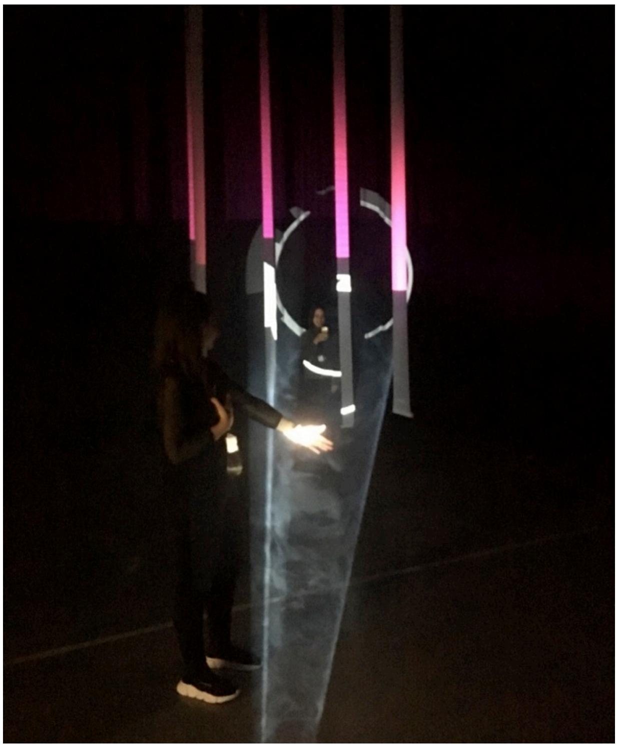


Figure 115. Taking photos of friends


Figure 116. Checking photos

Then they started to interact: they filmed the light beams, took photographs of each other, and 'selfies', in the light and checked their photographs. As they became more confident, some of the spectator-participants played in the light, drawing shadow shapes with their fingers, sitting in the light, posing in the light, examining the flags and looking around the space (Figures 114 to 120).


Figure 117. Drawing finger shadows in the light


Figure 118. Photographing partner sitting on the floor, face bathed in the light

Figure 119. Others joining in taking photographs

Figure 120. Examining the flags and looking all around the space

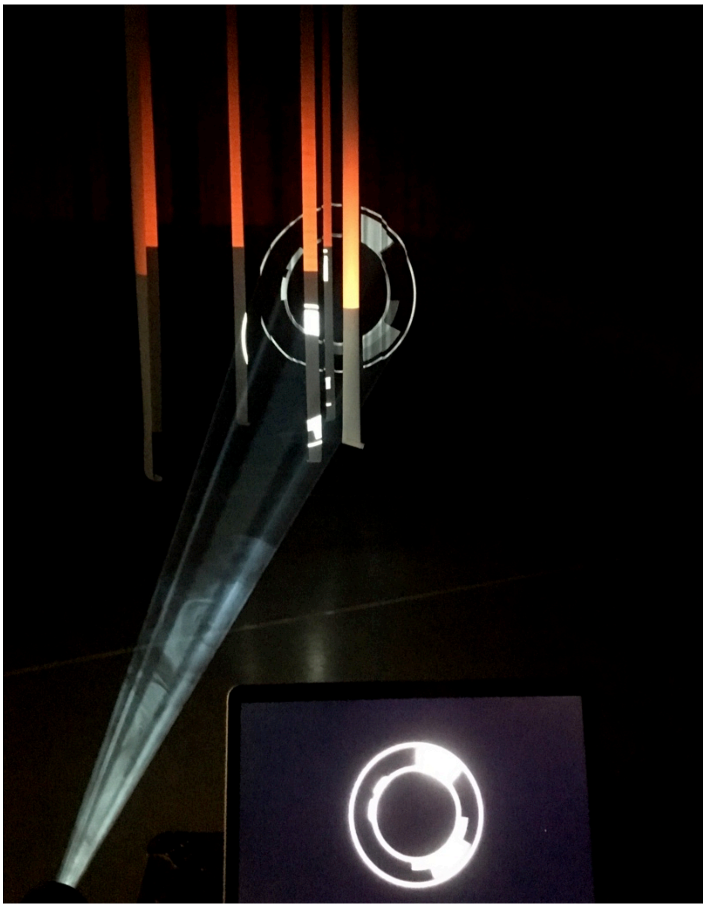


Figure 121. Visible 'workings': the animation that creates the volumetric light

The workings of the display were not hidden (Section 2.5.5). The animations, projectors and flags were all available to be examined (Figure 121). When they reached the end of the path, spectator-participants they could see the animation as it was being projected (Figure113). The spectator-participants were taking part in the *SOUND/IMAGE* conference and many were curious to see the details of the workings.

The reaction was overwhelmingly positive. Anonymous comments include: 'Beautiful', 'Meditative', 'Lovely', 'Mesmerising', 'Light always fascinates', 'Love this', 'Wow, it is great to interact with it', 'The space is like infinity', 'It is very sweet to see people interact with the light', 'Amazing illusion of 3D' and (in response to a 'selfie' in the light) 'This is so going straight on Instagram'.

When there were some twenty spectator-participants in the room, one comment was: 'This is a very personal experience – there are too many people to play freely – the younger ones do.' I noticed that a greater number of spectator-participants resulted in less interaction. The optimum number seemed to be between two and ten. There was a social awareness of the others in the room, with a good deal of careful movement so that people could get different views and visually record themselves and each other. Spectator-participants would circle around and come into the light again, rather than blocking others. It was only when the room was very nearly empty that one spectator-participant cupped her hand around the strong projection beam, irising-down the stream of light at its source, blinking it off for an instant, before releasing the flood of light and illumination.

**Key findings**

*Singing Light 1* was successful as a visual music installation on several levels. The environment was large enough to allude to the sense of 'bigness' that evokes nature and the sublime. As previously noted, creating an installation at a scale large enough to immerse a person (McCall, United Visual Artists, Turrell) – in contrast to, in Klee's term, a sensual scale, i.e. a human scale – is central to exploring different approaches to composing visual music. The scale combined with the darkness immediately identified the space as an immersive space, 'as somehow separate from the world' (Griffiths, 2008, 2).

As previously noted, a truly immersive space does not impose the constraints of fixed-screen media, i.e. it allows spectators to look around freely. The duration, position and angle of their gaze are not pre-determined by gazing at a screen. As well as affording spectators this freedom, *Singing Light* was designed to take advantage of being viewed from multiple directions. As stated above, the careful positioning and balancing of the intensity of the coloured and white projections of light, the flags, the choices of surface to receive the projections, the use of flags to allude to planes of depth, all created a multi-planar environment with complex levels of depth that was engaging when viewed from any one of multiple viewpoints.

Ideally, an immersive space allows the spectator-participant to move around the space, meaning that their ‘viewpoint is no longer static or dynamically linear, as in the film’ (Grau, 2003, 16). Spectator-participants moved around *Singing Light 1*. This engendered a more bodily experience: moving into, through, around and out of the projections. This movement made the spectators into participants as their actions changed the experience for the others as well for themselves. As noted above, there was a social awareness: spectator-participants could be seen to give each other room to see different angles, and space to visually record themselves and others. This ethos became part of *Singing Light 1*. It was inhabited as an experiential piece, as Belson articulated (Section 2.5.4).

Observation of the spectator-participants demonstrated that their experience of immersion in *Singing Light 1* had similarities to my own experiences of immersion in such installations such as *Blind Light* and *Momentum*, and as discussed more generally. Although one is surrounded and affected by a space that is ‘other’, the experience of critical distance or immersion is not binary but complex and multifaceted. Perception and affect intermingle as Deleuze describes (Section 2.2.3). The spectator-participants demonstrated how one’s state flows between being affected and absorbed in the physical present and being mentally stimulated. Physically playing with and observing the light highlights the affect and absorption. Curiosity about the ‘workings’ of the piece and expressing the desire to create something using light projections themselves highlights the mental stimulation. The affordance of being more deeply immersed, or at more of a distance and musing, aligns *Singing Light* to Kaplan’s soft fascination.

Most of the spectator-participants exhibited surprise when they saw how the projected animation became a shape with incredible three-dimensional volume in the haze when one steps into the beam. This was demonstrated by their expressions and how they huddled together to watch the volumetric projection (Figure 113). I too experienced this surprise when developing

*Singing Light*: stepping into the beam for the first time and seeing a tunnel of light has a visceral quality; it is affective. It is akin to the surprise that animators produce when one object suddenly becomes another, for example in *Blinkity Blank*. There is an element of illusion; the effect of the light is completely different looked at from outside and inside the beam (Appendix C). Once having seen this three-dimensional volume, one's perception of the beam changes. Merleau-Ponty writes of a 'stone', which, on closer inspection resolves to be a patch of sunlight (Section 2.5.2). In *Singing Light*, knowing that the projection can be a tunnel of light informs subsequent perception of the projection, from whichever angle it is viewed. The surprise of the beam becoming a tunnel of light, once experienced, has a playful quality. In contrast the surprise of the voice welling up out of the darkness never became predictable. There are different qualities to surprises and illusions in light in contrast to vocal surprises.

*Singing Light*, like *Blind Light*, explores 'real bodies interacting with a conceptually-structured space' (Gormley in Caiger-Smith & Gormley, 2010, 111).There was a haptic dimension, unlike film on a screen; some spectator-participants touched the projection. The projection did not actually touch them back, but their touch cast shadows into the projection (Figure 117) and the haze reacted to their movement. This was engaging and affecting for the spectator-participants who touched the projection, and also fascinating for observers; it is so unusual to be able to do more than observe visual images (Figure 118).

Change, for example when one shape morphs into another, caught the attention of spectator-participants. However, when the change was imperceptibly slow, for example the rectangle changing height over six minutes, attention mainly stayed with the three-dimensional volume. The variation in rate of change influenced the flux from mainly almost-static spectators of visible change – some quickly photographed it – to more participants – moving, and playing with the light – in the imperceptibly changing sections. This is reminiscent of Moholy-Nagy reflecting on the desire to seize insights from moving image:

> Kinetic composition so to speak enables the observer's desire to seize instantly upon new moments of vital insight, whereas the static image generates these reactions slowly.
> (Moholy-Nagy, 1987, 23)

In the moments of obvious change, spectator-participants wanted to instantly grasp what was happening; in the moments of almost imperceptible change spectator-participants explored more. The moments of faster change were supported by and emphasised by acousmatic sound to create a deeper immersion in the work. All of these findings fed into my framework for composing visual music.

# 4 Framework, meeting the aims and outcomes, and future work

## 4.1 A framework for composing

The entirety of this research supports a key outcome, a contemporary framework for visual music composition (Figure 127) that is informed by artistic traditions in animation, photography and painting. The framework is founded on visual and expanded visual music and expressed in the key terms defined earlier in this thesis (and Appendix A). We will start with an overview that positions animation-tempo at the heart of the framework (Figure 122).

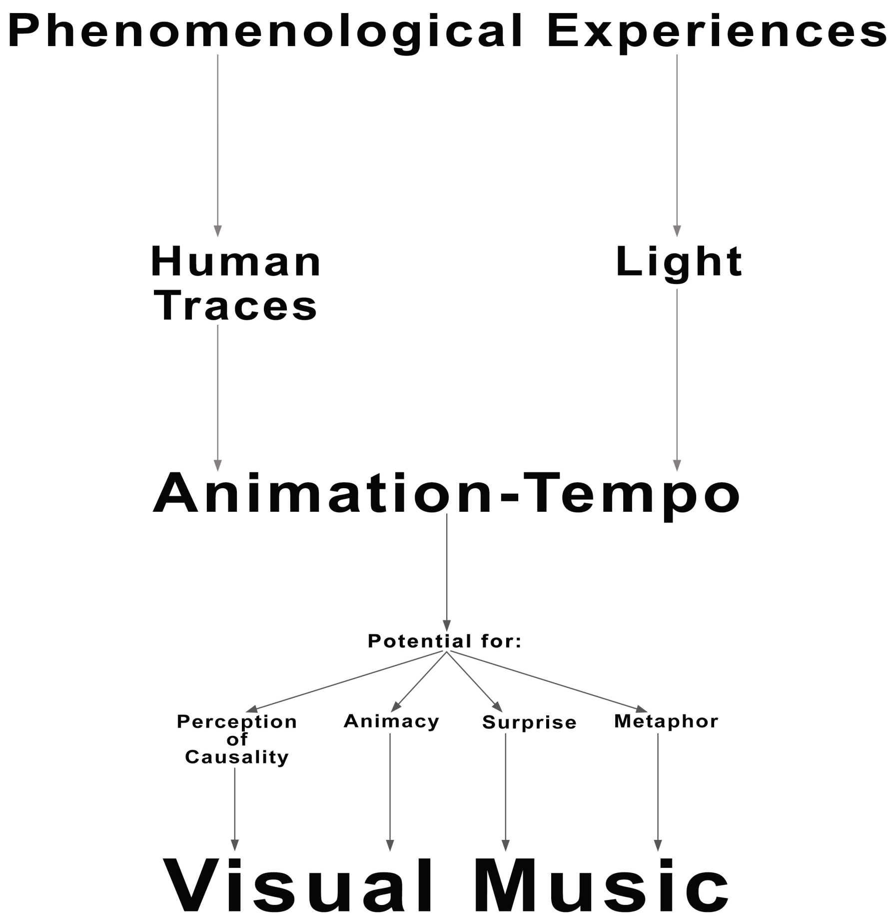



Figure 122. Overview of a framework for composing visual and expanded visual music

The framework for composing visual and expanded visual music starts with the input of phenomenological experiences of human traces and light. Inspired by Klee (Section 2.3.1), the framework posits that the composer is a conduit between phenomenological experiences of light and human traces and visual music composition. The composer has phenomenological experiences as a result of embodiment; these are direct experiences of the things perceived. In this framework the things perceived are affective: human traces of gesture and vocal expression and changing light (for example, see dappled shadows and sunsets in Section 3.1). The aim of incorporating a sonic element, a human trace, a non-verbal vocal expression, is to increase the affect of the composition.

Animation-tempo is at the heart of the framework, freeing composing visual and expanded visual music from dependency on: musical structure, musical tempo, a visual interpretation of music, conceptual linkages between the audio and the visual, sound-to-image or image-to-sound mapping, algorithms, and the sonification of images. The composer's embodied experience of human traces, the record of a visible gesture or vocal expression, inform the animation-tempo. Animation-tempo is made visible as movement, i.e. change of: colour, opacity, texture and motion (Section 2.3.2). The rate of change and its quality: constant, accelerated, decelerated, zero or irregular, is intrinsic to the expressivity of the work. The expressiveness of animation-tempo can be viscerally affective and result in the perception of causality, animacy, surprise or metaphor.

Expanding upon this overview of the framework we will now explore aspects relating to composition (Figure 123). The framework celebrates the power of phenomenological experiences of light by making these a starting point for composition. Approaching light as an affective artform is inspired by Turner, Schad, Moholy-Nagy, Schwerdtfeger, Hartwig, Hirschfeld-Mack, Wilfred, Turrell, McCall and United Visual Artists. (Section 2.2).

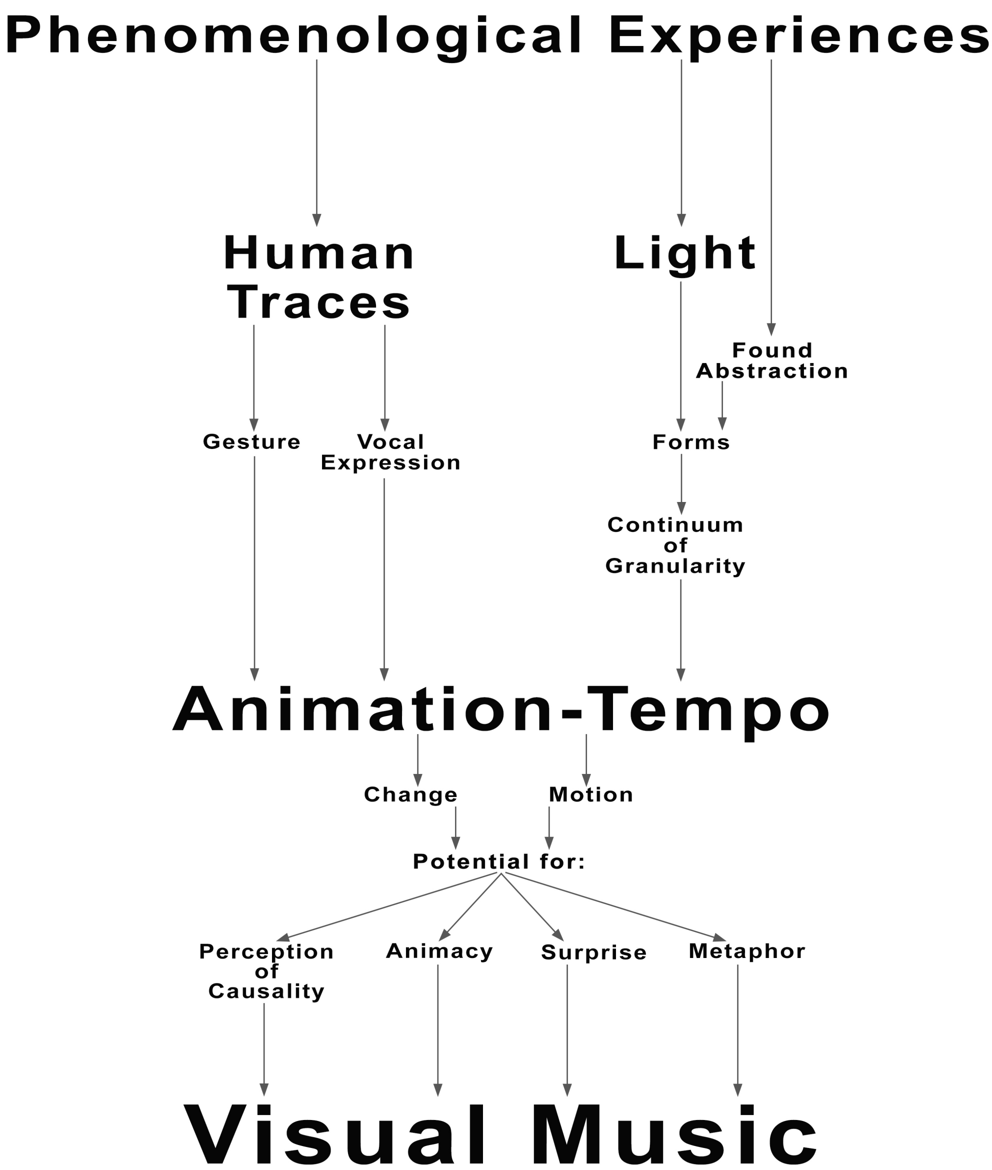



Figure 123. The composition section of a framework for composing visual and expanded visual music

The composer is the conduit through which phenomenological experiences of light and found abstraction (Strand, Stieglitz, Section 2.2.5, *Singing Light 1*) feed into forms. The forms are spread along a continuum of granularity, that, inspired by Klee and Levin, goes from smear, particles, groups, individual within a group to individual object. We can identify smear (shifting colours in *Ambience 2*, *Singing Light 1*), dividual texture (*Song Series*), a foregrounded individual within a texture (the horizon line in *Horizon*), dividuals with group behaviour (fireworks, particles and cloud effects in *Song Series*, *Ambience 2*, *Sky*) and individual objects (*Shadow Sounds*, *Continuous Punctuation, Singing Light 1*). Following Klee, placement of forms on the continuum of granularity is a value judgement by the artist. The continuum of granularity allows a virtual zoom in or out that has no correlation in audio. The granular aspect of elements can change as the animation progresses; to take Klee's example, the individual fish can become a dividual fish amongst a school of fish and vice versa.

These forms are going to move in animation-tempo. Applying movement to these forms gives the potential for creating perception of causality, animacy, surprise and metaphor. The beholder completes the open-ended composition by synthesising visual and expanded visual music through their experience of embodied visceral affect, arising from their perception of causality, animacy, metaphor or surprise. Surprise engages the attention and is linked to the sublime (Section 2.3.1) and we have a strong desire to perceive causality and animacy and to identify metaphor (Section 2.3.2). Therefore, these affective perceptions can be triggered in many ways along the continuum of granularity through the expressivity of movement applied to the forms. Individual objects trigger surprise (the vocals and light tunnel in *Singing Light 1*), or animacy (*Shadow Sounds*), and also perception of causality if there is spatial and temporal congruence of two or more objects (*Continuous Punctuation*). Group behaviour with animacy, such as flocking, can be perceived (particles in *Sky* and *Ambience*). At the level of smear, a journey of colour can be perceived as a metaphor for a day passing (*Horizon*).

We will now explore aspects relating to display. Visual music can be pictorial, cinematic and sculptural (Figure 124). Visual music can be projected into haze and create volumetric tunnels and effects (Figure 125), displayed across flags in real 3D depth (Figure 126) or on a 2D flat screen. Pictorial combined with cinematic leads to a 2D fixed-screen output (*Horizon*), cinematic combined with sculptural leads to an installation (*Singing Light 1*). Fixed-screen display has a more passive spectator, whereas the beholder of an installation may be either a more active participant walking through the work in real 3D space or a more passive spectator looking on (Sections 2.5 and 3.5.2). Scale and immersion is key, whether the display is fixed-screen or installation (Section 2.5).

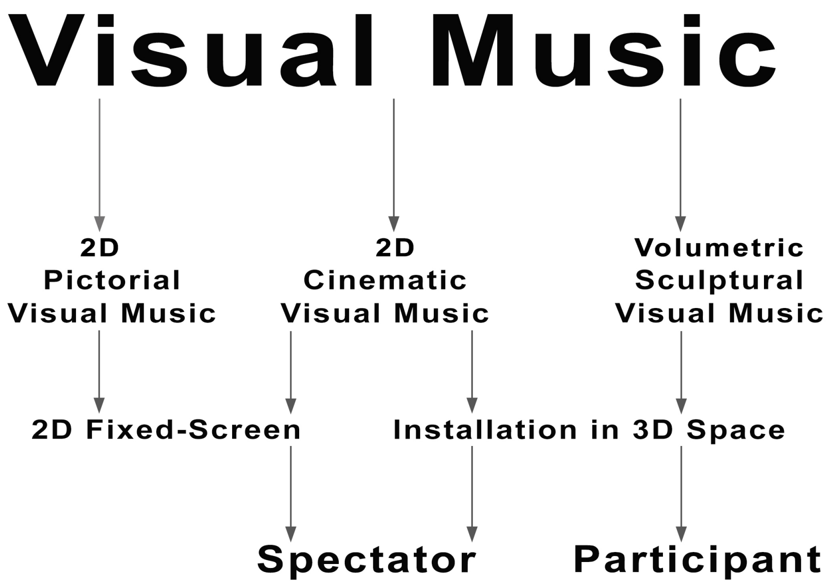



Figure 124. The display section of a framework for composing visual and expanded visual music

The composer needs to be aware of the different opportunities and challenges of display as they compose.[41] For example, haze is an immersive enveloping screen that displays volumetric light very well but only simple geometric shapes create tangible light tunnels (Figure 125 and Appendix C). In contrast, movie-canvas, negative-positive illusions and textural images work best by being projected across flags without using haze (Figure 126). Textural imagery from *Sky* was displayed in the same space as *Singing Light 1*. The black back curtain and translucent flags give depth in real space. This enables an immersive and interactive walk-through as the projections can be seen from any angle (Section 3.5) and flags and participants cast shadows that interact with the projections.

[41] Ideally compositions should be developed in their display space (Section 3.5 and Appendix C*)*

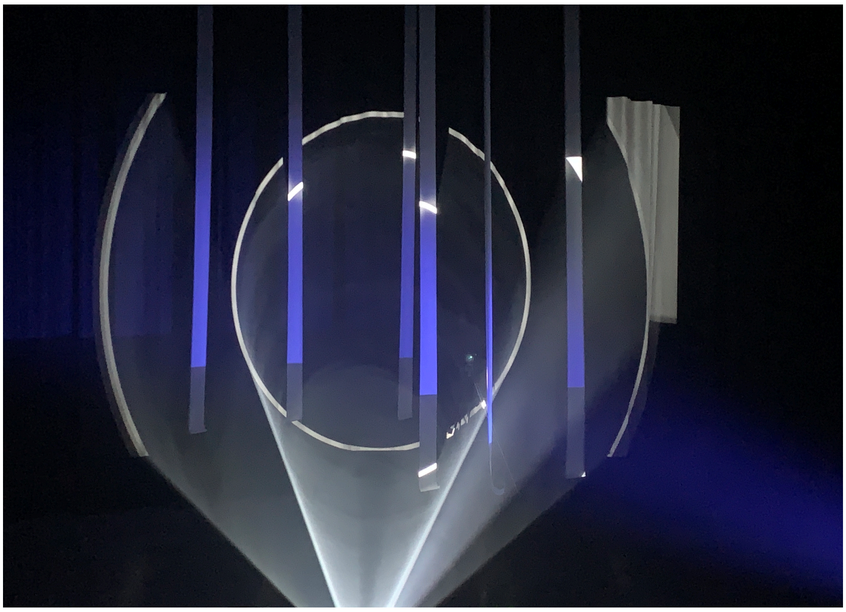


Figure 125. Physically mixing colours and volumetric light in haze, from *Singing Light 1*.

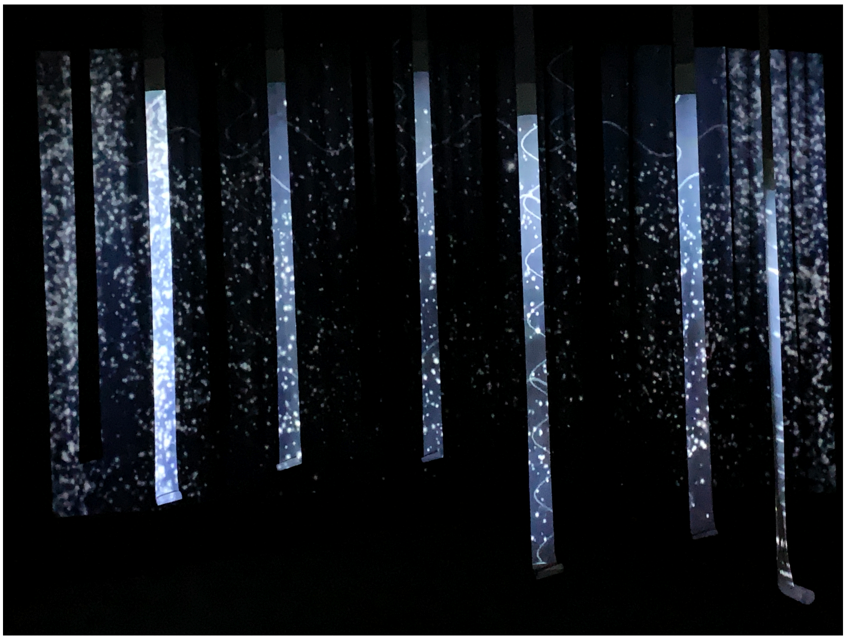


Figure 126. Exploration of textural projection across flags in real space.

The framework is open-ended, providing starting points from which to compose rather than rules; an approach inspired by Klee. One way of creating stylistic cohesion is by imposing limitations on the phenomenological inputs, for example taking the colours from the sky at a particular time (*Horizon*), or restricting human vocalisations to one pitch (*Singing Light 1*). This is analogous to McLaren creating a rich and cohesive animated world through concentrating on one technique (Section 2.4.4). McLaren's approach of enriching his work by pushing the technique or constraint to its limits is also good practice for visual and expanded visual music composition.

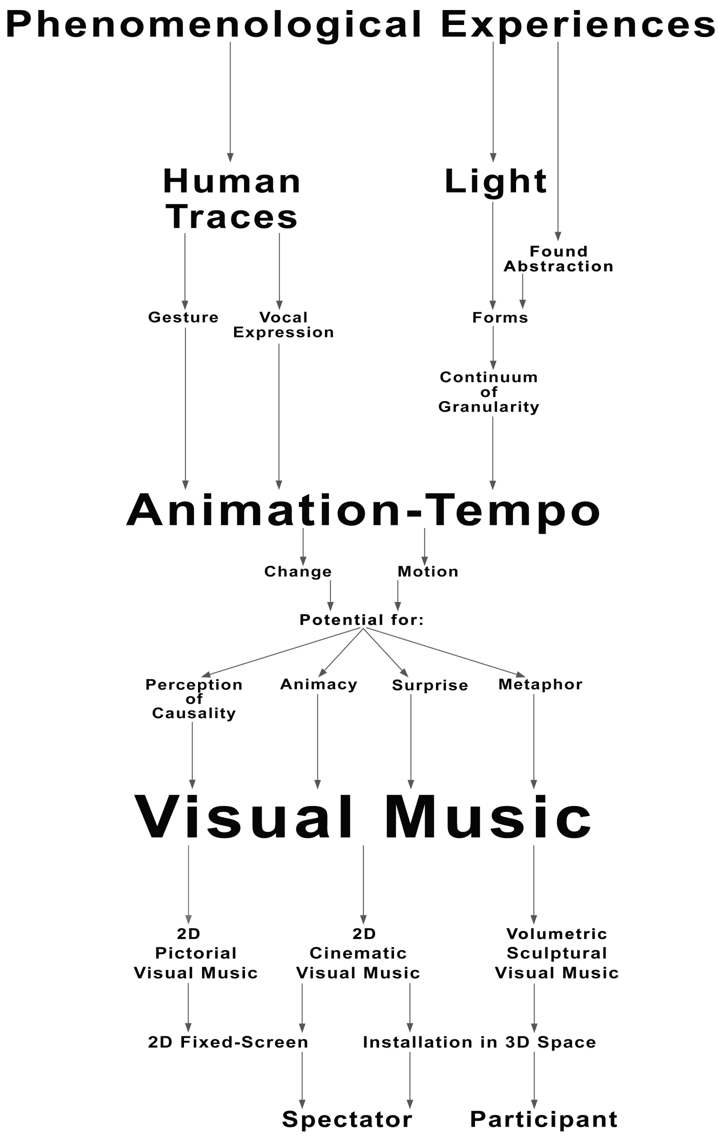



Figure 127. A framework for composing visual and expanded visual music

The full framework (Figure 127) shows the composition section (Figure 123) joined with the display section (Figure 124) giving a continuum from the input of the composer's phenomenological experiences to the output: the beholder synthesising visual and expanded visual music as spectator or participant.

## 4.2 The framework: visceral embodied affect

Visual and expanded visual music composition aims to elicit visceral embodied affect and thereby transcend the duality of eye and ear. This is supported throughout the process of composition in numerous ways. First, primacy is given to the phenomenological and the affective. Second, animation-tempo is at the heart of the composition, allowing composers to start from the premise of expression. Third, surprise, which is affective, is key. Fourth, an *acousmêtre's* human voice is the affective sonic element. Fifth, it enables fluxes in visual perception, which are affective. Sixth, inspired by slow cinema and soft fascination, the beholder is engaged in affective, contemplative looking. Seventh, scale and immersion is key in displaying the work affectively, and, finally, the affective experience of light is celebrated.

First, the framework recognises a central dichotomy in visual music. Both welcoming chaos and desiring order are expressed from within the canon of visual music and supported by wider artistic traditions. The non-perspectival view, with many perspectives merged together, is affecting. It has an impact on the nervous system as the virtual body imagines being in several places almost simultaneously. Surrendering to chaotic vision produced by a field of pure colour is affecting, as is creating your own constructions of the world through re-linking footage acquired as data. In all these experiences, there is a sense of seeing the world anew. These experiential, affective approaches to visual music stand in diametric contrast to the desire for order and for visual music to become a universal language, which stretches beyond the pioneering visual music films to Klee and other artists' visual frameworks, mappings and research into visualising vocalisations. A phenomenological methodology (*Horizon*, *Singing Light*) and the methodology of creating a library of animated-image-audio units (*Shadow Sounds*, *Sky, Continuous Punctuation*) were both researched here. The outcome is that primacy is given to the phenomenological and the affective; compositions are initiated by and grounded in phenomenological experiences.

Second, animation-tempo allows visual musicians to start from the premise of expression, obviating both modernist, formalist principles and rule-based composition. Thus, questions of how to animate to musical structures, or how to translate image to sound or sound to image, or map colour to pitch, are irrelevant. With animation-tempo at its heart, this framework transcends the mirrored strands of visual music defined as 1-A to 3-B (Section 2.1).

Third, surprise is affecting. Surprise is key. The framework leads to works that are unpredictable, with no musical or narrative structure with which to create overarching expectations of the piece. Additionally, there are no words or melody with which to create local predictions. But the human traces of vocal expression and visible gesture create resonances. The affective quality of human traces imbues moments with an innate 'rightness' (Section 2.4.4) or cohesiveness, and contributes stylistic cohesion. The framework allows the beholder to oscillate between an immersive, affective engagement with the immediate unpredictable scene – like a firework display – and seeing pockets that make sense because there is perception of causality, animacy or metaphor. As epitomised by McLaren's *Blinkity Blank* animation, surprise in a cohesive world has a viscerally affective strength. In my own work, there are moments of surprise underpinned by human traces, such as when the first particle trail cuts across *Sky* and we hear the singer's resonant tone. *Singing Light 1* has the visceral surprise of the singer's voice welling up out of the darkness, giving impetus to the animated motion of the line, that, through the haze, creates the physical surprise of the three-dimensionality of the tunnel of light. *Shadow Sounds 3* and *Continuous Punctuation* build on vocal animated surprises to form compositions.

Fourth, the framework recognises the human voice as the primordial, affective sonic element. This is supported in several ways. The singer is unseen, allowing the voice to be outside the visual frame, acousmatic, in a wider frame. The *acousmêtre* gives the vocal expression power and omniscience (*Sky*, *Continuous Punctuation*, *Shadow Sounds*). Using non-verbal vocals avoids the associations of words and allows the perceiver to connect directly with the virtual person within the voice (*Sky*). Expression is clearly conveyed precisely because the meaning is so imprecise. Because the sonic element is non-verbal, the beholder can make their own linkages (*Continuous Punctuation*). Limiting the vocals to a very narrow range of frequencies emphasises rhythm and prosodic qualities over pitch, avoiding melodic expectations and associations (*Sky*). However, unlike Pfenninger's technological art (Section 2.4.3), the vocal expression is powerfully individuating and affective. Further, by exploring musical suspension through using a very limited pitch range, the unpredictability of the composition is increased and wider opportunities for creating surprise are created. This sonic mode was arrived at in stages. Over the duration of the project, the sound was focused more and more – from soundscape (*Horizon*, *Reservoir*) to non-verbal traditional songs with a melody (*Ambience*), to non-verbal vocalisations (*Shadow Sounds*) to non-verbal vocalisations around one pitch (*Sky*, *Continuous Punctuation*, *Singing Light*).

Fifth, the flux between perceiving visuals as mimetic or abstract, foreground or background and illusory depth are all affective; as discussed in Chapter 2 in relation to Klee's paintings, cubist collage, Man Ray's rayographs, Strand's and Stieglitz' photographs. An outcome of developing the framework is a methodology for creating visual and expanded visual music compositions that elicit a constant flux between visuals being perceived as mimetic or abstract, underpinned by perceiving a continuum between the two. Working with found abstractions makes positive use of the tensions between the abstract and the mimetic, allowing the beholder to engage with abstract patterns and textures created by isolating elements of a mimetic image (Section 2.2.5). This methodology allows layering of imagery to create a time-collage (*Horizon*) and gathering footage-as-data, allowing a new experience to be retrieved or constructed by the viewer. The forms along the continuum of granularity can be treated individually, or linked. A special instance of linking the forms is treating the screen as, in Richter's term, a movie-canvas, i.e. treating the entire screen as a movable object, rather than a frame that holds objects.

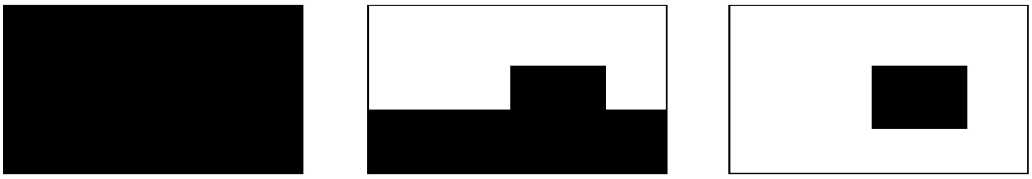


Figure 128. Three frames showing the progression of the movie-canvas down and out of screen, revealing a small black rectangle.

For example, a black object on a black screen is invisible, but as the full-frame movie-canvas in the foreground moves down and out of screen the black object appears against a frame of white (Figure 128). Richter's movie-canvas allows fundamental flexibilities: it facilitates changing background to foreground, changing negative to positive shapes and creating evanescent illusions of depth. Through animation all of these affective fluxes in perception: perceiving visuals as mimetic or abstract, foreground or background and illusory depth, are given the added dimension of time.

Sixth, inspired by slow cinema and soft fascination, the framework enriches the cinematic with the pictorial through engaging the beholder in contemplative looking. This phenomenological approach elicits the fluid perception given to movement-image in an almost-still image. The beholder re-links an 'empty' image so that it becomes 'full' (Deleuze in Section 2.3.4). Creating a composition of 'one long shot' with seamless transitions removes the metric effect of cuts and frees the composition from allusions to musical metrical structures (*Singing Light 1*). As Warhol's *Empire* demonstrates, the long duration leading up to an event (such as the lights coming on) gives the event a 'wow' factor. If you have not waited, the 'wow' factor is lost. The long duration scales up the event and the sense of surprise.

Seventh, the framework positions scale and immersion as key areas to create affective experiences. Immersion is supported by open-ended, long-duration performances in which you are free to walk in or out. Incomplete sound or image helps beholders to become more immersed, as these allow them to respond more actively. The beholder's imagination is freed to fill in the gaps for both fixed-screen and installations. Expanding audio-visual work from the fixed-screen frees the beholder's gaze, draws in the beholder and makes them more receptive to the work. Installations afford the attraction of being in the light in a big space; the physicality of being in the work creates a sense of immediacy and intensity, as each experience of the work is unique and unrepeatable. Being mobile inside the work fundamentally changes the relationship of the beholder of the work so that they become a spectator-participant in the work. Very slow change is key in enabling spectator-participants to feel free to move around the work and to interact with the installation. The participants can add their own human traces, their forms and shadows in the light, and interact with each other (*Singing Light 1*). Being able to touch and so affect the volumetric projection adds another level of interactivity. Wilfred likened the experience of his lumia to sunlight on skin (Section 2.2.4).

Finally, the framework celebrates light as a fundamental embodied experience by using light itself as a medium. Artworks in light create affective experiences and allow spectators to surrender to the beauty of light. Using light itself has long lineage in visual music and beyond, and has been developed through many different processes (Section 2.2.4, Section 2.5.1, *Singing Light 1,* Appendix C). Light as an affective phenomenological experience can be energising, surprising and sublime (Section 2.2.2) or a relaxing, soft fascination (Sections 2.3.4 and 3.1). Soft fascination, like slow cinema, supports contemplation. Contemplation is to be prized, because, as Bruce Elder states, contemplation is not normative today (Elder, 2010, xxvi).

## 4.3 Evaluation of meeting the aim and outcomes

This Practice as Research has taken a long journey from a traditional definition of visual music, to a mirrored definition that put visuals on an equal footing to audio, to finally arriving at a definition of, and framework for, composing visual and expanded visual music. This journey entailed contextualising visual music within wider artistic traditions, bringing ideas and approaches from outside the traditional visual music canon to inform creative practice and to question and define what contemporary visual music practice might be within the 21st century.

Re-framing visual music in relation to artistic traditions in animation, photography and painting provides fresh approaches to composing visual music in the 21st century and the basis of a new framework that is not a set of rules but a starting point for composers. Animation-tempo frees the framework from musical structures and opens it to include artists, experimental film-makers, animators, and performers, as well as musicians. Light art goes beyond the fixed-screen but often there is: no coloured light (McCall), no sonic component (Wilfred, Turrell) and no discernible animation-tempo. In contrast this framework encourages the creation of visual music compositions that go beyond the fixed-screen, in colour, with a sonic component and animation-tempo.

There are as many aims and approaches to being a composer of visual music grappling with the duality of eye and ear as there are practitioners. This research provides numerous approaches to transcending the duality of eye and ear by eliciting visceral embodied affect (Section 4.2). While composing visual music may be a means of making a statement about music, or image, or the synthesis of the two, it can also be a tool – a means of unleashing creativity to realise works with a broad conceptual reach.

This research was driven by a desire to expand on the concept of visual music and this was achieved through the development of a contemporary framework and evaluative tool for visual music composition[42] and a portfolio of works derived through the cyclical development patterns of Practice as Research. Thus, the project has met its aim and outcomes.

In 1748, David Hume noted: 'By the term impression, I mean all our more lively perceptions, when we hear, or see, or feel, or love or hate or desire or will' (Hume, quoted in Jacobi, 2017, 5). It is hoped that by elucidating an animator's perspective to composing visual music – and by creating a framework based on phenomenological experiences, human traces, light and animation-tempo – more embodied visceral affective visual music will be created that expresses our impressions.

[42] See discussion of the framework as evaluative tool in Section 4.4

## 4.4 Future work

From the alignment of my works to the framework (as detailed in Section 4.1), it can be seen that the framework was developed through the works and that much of the framework has been tested through creating works. However, some areas have yet to be comprehensively explored, notably: virtual zoom, movie-canvas and animation-tempo founded on visible gesture.

Future works will be installations rather than fixed-screen, in order to develop the sculptural, immersive aspect of visual music, and to keep the workings self-evident. Developing a more ‘broken’ screen, with more projectors and more speakers, would allow yet more-sculptural installations with greater visual and sonic depth. Each projector and sonic element could have its own independent cycle, making a collective cycle many hours long, thereby promoting the open-ended nature of future works.

There is an analogous potential for animacy in audio through sound-shapes moving in certain tempi, with dynamic relationships that cause us to perceive them as having personality, emotion, character and experiencing cause-and-effect. This would open up the framework to using other types of sound sources in place of the human voice, and gives the potential for more research.

Looking at the framework from the point of view of the beholder, it could be developed as a tool for analysing and evaluating audio-visual work. The phenomenological experience would be what happens to the beholder, who would then ask a series of questions that flow through the framework: what are the human traces? How is light being used? Colour? Was the experience more cinematic or more sculptural? And so on. The framework has been developed through my Practice as Research but could be more generalisable.

# References


Adcock, C.E., & Turrell, J. (1990). *James Turrell: the art of light and space*. Berkeley: University of California Press.

Aksnes, H., Godøy, R., Kvifte, T., & Ruud, E. (2007). The Musical Gestures Project 2004-2007. https://doi.org/10.1.1.590.8793

Angell, C. (1994). *The Films Of Andy Warhol : Part II*. New York: Whitney Museum of American Art.

Arnheim, R. (1974). *Art and visual perception: a psychology of the creative eye*. Berkeley, California: University of California Press.

Arnheim, R. (2007). *Film as art* (2). Berkeley, California: University of California Press.

Avant, L.L. (1965). Vision in the Ganzfeld. *Psychological Bulletin*, 64(4), 246–258. https://doi.org/10.1037/h0022208

Baker, S., L'Écotais, E. de, & Tate Modern (Eds.). (2018). *Shape of light: 100 years of photography and abstract art*. London: Tate Publishing.

Barker, J.M. (2009). *The tactile eye: touch and the cinematic experience*. Berkeley: University of California Press.

Basawapatna, A. (2016). Alexander meets Michotte: A simulation tool based on pattern programming and phenomenology. *Journal of Educational Technology & Society*, 19(1), 277–291.

Batchelor, D. (2007). Painting as a New Medium. *Art & Research: A Journal of Ideas, Context and Methods*, 1(Winter 2006/7). Retrieved from http://www.artandresearch.org.uk/v1n1/batchelor2.html

Bordwell, D. (1985). *Narration in the fiction film* (Nachdruck). Madison: University of Wisconsin Press.

Bowers, J. (1999). *Introduction to two-dimensional design: understanding form and function*. New York: Wiley.

Brakhage, S., & McPherson, B.R. (2001). *Essential Brakhage: selected writings on filmmaking* (1st ed). Kingston, New York: Documentext.

Braun, M. (1994). *Picturing time: the work of Etienne-Jules Marey (1830-1904)* (Paperback ed). Chicago: University of Chicago Press.

Bremner, A.J., Caparos, S., Davidoff, J., de Fockert, J., Linnell, K.J., & Spence, C. (2013). ‘Bouba’ and ‘Kiki’ in Namibia? A remote culture make similar shape–sound matches, but different shape–taste matches to Westerners. *Cognition*, 126(2), 165–172. https://doi.org/10.1016/j.cognition.2012.09.007

Brougher, K., Mattis, O., Museum of Contemporary Art (Los Angeles, California), & Hirshhorn Museum and Sculpture Garden (Eds.). (2005). *Visual music: synaesthesia in art and music since 1900*. [London]: Washington, D.C.: Los Angeles: Thames & Hudson; Hirshhorn Museum; Museum of Contemporary Art.

Burke, E., & Phillips, A. (2008). *A philosophical enquiry into the origin of our ideas of the sublime and beautiful*. Oxford: Oxford University Press.

Bute, M.E. (1954). Abstronics: An Experimental Filmmaker Photographs the Esthetics of the Oscillograph. *Films in Review*, 5(6). Retrieved from http://centerforvisualmusic.org/Abstronics.pdf

Cage, J. (1989). *An Autobiographical Statement*. Presented at the Kyoto Prize, Inamori Foundation, Kyoto, November 1989. Retrieved from http://johncage.org/autobiographical_statement.html

Caiger-Smith, M., & Gormley, A. (2010). *Antony Gormley*. London; New York: Tate; H.N. Abrams.

Chion, M., Gorbman, C., & Murch, W. (1994). *Audio-vision: sound on screen*. New York: Columbia University Press.

Choi, H., & Scholl, B. J. (2006). Perceiving Causality after the Fact: Postdiction in the Temporal Dynamics of Causal Perception. *Perception*, 35(3), 385–399. https://doi.org/10.1068/p5462

Chudy, M. (2016). *Discriminating music performers by timbre: On the relation between instrumental gesture, tone quality and perception in classical cello performance*. University of London, London.

Clark, M. (2014, November 2). *United Visual Artists: Momentum* Barbican Centre's YouTube Channel. [Video File]. Retrieved from https://www.youtube.com/watch?v=B5FjivaKSyA

Collopy, F. (2000). Color, Form, and Motion: Dimensions of a Musical Art of Light. *Leonardo*, 33(5), 355–360. https://doi.org/10.1162/002409400552829

Collopy, F. (2006). Playing (with) Color. *Glimpse: The Art and Science of Seeing*, 2(3), 62–67.

Cook, N. (2000). *Analysing musical multimedia*. Oxford: Oxford University Press.

Cooke, M. (2008). *A history of film music*. New York: Cambridge University Press.

Cox, A. (2001). The Mimetic Hypothesis and Embodied Musical Meaning. *Musicae Scientiae*, 5(2), 195–212. https://doi.org/10.1177/102986490100500204

Cox, C. (2011). Beyond Representation and Signification: Toward a Sonic Materialism. *Journal of Visual Culture*, 10(2), 145–161. https://doi.org/10.1177/1470412911402880

Csikszentmihalyi, M., & Robinson, R.E. (1990). *The art of seeing: an interpretation of the aesthetic encounter*. Malibu, California: Los Angeles, California: J.P. Getty Museum ; Getty Center for Education in the Arts.

Cuskley, C., Simner, J., & Kirby, S. (2017). Phonological and orthographic influences in the bouba–kiki effect. *Psychological Research*, 81(1), 119–130. https://doi.org/10.1007/s00426-015-0709-2

Darwin, C. (1890). *The expression of the emotions in man and animals* (2nd ed.). London: John Murray. Retrieved from http://darwin-online.org.uk/converted/published/1890_Expression_F1146/1890_Expression_F1146.html

Delaunay, R. (1912). *Windows Overlooking the City* [Oil on canvas].

Deleuze, G. (2005a). *Cinema 1*. London: Continuum.

Deleuze, G. (2005b). *Cinema. 2.* London: Continuum.

Deleuze, G., & Boyman, A. (2002). *Pure immanence: essays on a life* (2. print). New York: Zone Books.

Deleuze, G., & Guattari, F. (1994). *What is philosophy?* New York: Columbia University Press.

Deleuze, G., & Guattari, F. (2004). *A thousand plateaus: capitalism and schizophrenia*. London: Continuum.

Deleuze, G., & Guattari, F. (2013). *Anti-Oedipus: capitalism and schizophrenia*. London: Bloomsbury Academic.

Deleuze, G., Smith, D.W., & Conely, T. (2005). *Francis Bacon: The logic of sensation* Minneapolis: University of Minnesota Press.

Döbereiner, L. (2014, Juen). *How to Think Sound in Itself? Towards a Materialist Dialectic of Sound*. Presented at the Proceedings of the Electroacoustic Music Studies Network Conference Electroacoustic Music Beyond Performance, Berlin. Retrieved from http://www.ems-network.org/IMG/pdf_EMS14_doebereiner.pdf

Dobson, T. (1994). *The Film-Work of Norman McLaren*. University of Canterbury, Canterbury.

Düchting, H. (2012). *Paul Klee: painting music*. Munich; London: Prestel.

Edensor, T., & Holloway, J. (2008). Rhythmanalysing the coach tour: the Ring of Kerry, Ireland. *Transactions of the Institute of British Geographers*, 33(4), 483–501.

Eerola, T., Vuoskoski, J.K., Peltola, H.R., Putkinen, V., & Schäfer, K. (2017). An integrative review of the enjoyment of sadness associated with music. *Physics of Life Reviews*. https://doi.org/10.1016/j.plrev.2017.11.016

Eggeling, V. (1921). *Symphonie diagonale* [Pencil].

Eisenstein, S. (1942). *Film Sense*. New York: Harcourt.

Eisenstein, S. (1949). *Film Form*. New York: Harcourt.

Elder, R.B. (2010). *Harmony and Dissent: Film and Avant-garde Art Movements in the Early Twentieth Century*. Wilfrid Laurier University Press.

Enns, A., & Trower, S. (Eds.). (2013).*Vibratory Modernism*. Retrieved from http://link.springer.com/10.1057/9781137027252

Evans, B. (2005). Foundations of a Visual Music. *Computer Music Journal*, 29(4), 11–24.

Fara, P. (2015). Newton shows the light: a commentary on Newton (1672) ‘A letter... containing his new theory about light and colours...’ *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 373(2039), 20140213–20140213. https://doi.org/10.1098/rsta.2014.0213

Fauvel, J., Flood, R., & Wilson, R.J. (2006). *Music and Mathematics: From Pythagoras to Fractals*. Oxford University Press.

Finberg, A.J. (1910). *Turner’s Sketches and Drawings*. London: Methuen.

Fischinger, O. (1932). Sounding Ornaments. *Deutsche Allgemeine Zeitung & widely syndicated*. Retrieved from http://asmir.info/lib/fischinger.htm

Fischinger, O. (1937). *An Optical Poem*. Retrieved from https://vimeo.com/155998018

Flanagan, M. (2012). *‘Slow Cinema’: Temporality and Style in Contemporary Art and Experimental Film*. University of Exeter, Exeter.

Freedberg, D., & Gallese, V. (2007). Motion, emotion and empathy in esthetic experience. *Trends in Cognitive Sciences*, 11(5), 197–203. https://doi.org/10.1016/j.tics.2007.02.003

Fried, M. (1988). *Absorption and theatricality: painting and beholder in the age of Diderot*. Chicago: University of Chicago Press.

Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Sciences*, 2(12), 493–501.

Garro, D. (2005). *A glow on Pythagoras’ curtain. A composer’s perspective on Electroacoustic music with video*. Presented at the Electroacoustic Music Studies Conference – Sound in multimedia contexts, Montréal. Retrieved from http://www.ems-network.org/spip.php?article169

Garro, D. (2010). *Patah*. Retrieved from https://vimeo.com/14112798

Garro, D. (2014). On the Brink of (In) visibility-Granulation Techniques in Visual Music. *EContact!*, 4(15). Retrieved from http://cec.sonus.ca/econtact/15_4/garro_granulation.html

Gebauer, G., & Wulf, C. (1995). *Mimesis: culture, art, society*. Berkeley: University of California Press.

Geiger, J., & Littau, K. (Eds.). (2015). *Cinematicity in media history*. Edinburgh: Edinburgh University Press.

Gombrich, E.H. (1960). *Art and illusion: a study in the psychology of pictorial representation*. New York: Pantheon Books.

Gombrich, E.H. (1965). *Meditations on a hobby horse and other essays on the theory of art* (2. ed. 1965, reprinted). London: Phaidon.

Gombrich, E.H. (1979). *The sense of order: a study in the psychology of decorative art*. Oxford: Phaidon.

Grau, O. (2003). *Virtual art: from illusion to immersion*. Cambridge, Massachusetts: MIT Press.

Gregory, R.L. (1972). *Eye and brain; the psychology of seeing.* London: Weidenfeld and Nicolson.

Grewe, O., Nagel, F., Kopiez, R., & Altenmüller, E. (2007). Listening To Music As A Re-Creative Process: Physiological, Psychological, And Psychoacoustical Correlates Of Chills And Strong Emotions. *Music Perception: An Interdisciplinary Journal*, 24(3), 297–314. https://doi.org/10.1525/mp.2007.24.3.297

Griffiths, A. (2008). *Shivers down your spine: cinema, museums, and the immersive view*. New York: Columbia University Press.

Guggenheim. (n.d.). James Turrell Exhibition Website. Retrieved 3 July 2017, from http://web.guggenheim.org/exhibitions/turrell/

Gunzel, S. (2014). Deleuze and Phenomenology. *Metodo. International Studies in Phenomenology and Philosophy*, 2(2), 31–45.

Gurevitch, L. (2012). Computer Generated Animation as Product Design Engineered Culture, or Buzz Lightyear to the Sales Floor, to the Checkout and Beyond! *Animation*, 7(2), 131–149. https://doi.org/10.1177/1746847712438133

Halas, J. (1990). *A Memory of Moholy-Nagy* London John Halas, Educational Film Centre, Novotrade, Budapest. Retrieved 11 August 2016, from https://www.youtube.com/watch?v=ldvLkU_AqH8

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotional contagion*. Cambridge [U.K.]; Paris: Cambridge University Press ; Editions de la Maison des sciences de l'homme.

Haywood, N., & Cairns, P. (2006). Engagement with an Interactive Museum Exhibit. In T. McEwan, J. Gulliksen, & D. Benyon (Eds.), *People and Computers XIX – The Bigger Picture* (pp. 113–129). London: Springer London. https://doi.org/10.1007/1-84628-249-7_8

Heider, F., & Simmel, M. (1944). An Experimental Study of Apparent Behavior. *The American Journal of Psychology*, 57(2), 243. https://doi.org/10.2307/1416950

Herzog, T.R. and Strevey, S.J., 2008. Contact with nature, sense of humor, and psychological well-being. *Environment and Behavior*, 40(6), pp.747-776

Hill, A. (2013). *Interpreting Electroacoustic Audio-visual Music*. De Montfort University.

Hill, A. (2016). *Unpacking Audiovisual Phenomena*. Presented at *Seeing Sound,* 2016.

Hockney, D. (2001). *Secret knowledge: rediscovering the lost techniques of the old masters*. New York: Viking Studio.

Hockney, D. (2009). *Sunrise* [I-Pad]. Retrieved from https://obviousplace.wordpress.com/2010/10/20/contemporary-art-david-hockneys-ipad-drawings/

Hockney, D. (2017). *David Hockney*. Tate Britain. Retrieved from http://www.tate.org.uk/whats-on/tate-britain/exhibition/david-hockney

Hodgkinson, W. (2009). *The ballad of Britain: how music captured the soul of a nation*. London: Portico.

Honing, H. (2012). Without it no music: beat induction as a fundamental musical trait: Honing. *Annals of the New York Academy of Sciences*, 1252(1), 85–91. https://doi.org/10.1111/j.1749-6632.2011.06402.x

Honing, H. (2013). Structure and Interpretation of Rhythm in Music. In *The Psychology of Music* (pp. 369–404). Elsevier. https://doi.org/10.1016/B978-0-12-381460-9.00009-2

Hoormann, A. (2003). *Lichtspiele: zur Medienreflexion der Avantgarde in der Weimarer Republik*. München: Fink.

Howard, J. (2011). *How my voice looks and my writing sounds*. Retrieved from https://vimeo.com/30816709

Hugnet, G., Mare, A., & Hugnet, M. (2013). *Dictionnaire du dadaïsme: 1916-1922* (Éd. revue, augmentée et présentée par Alexandre Mare). Paris: Bartillat.

Huron, D. (2007). *Sweet anticipation: music and the psychology of expectation* (1. MIT Press paperb. ed). Cambridge, Massachusetts: MIT Press.

Hyde, J. (2012). Musique Concrète Thinking in Visual Music Practice: Audiovisual silence and noise, reduced listening and visual suspension. *Organised Sound*, 17(02), 170–178. https://doi.org/10.1017/S1355771812000106

Hyde, J., & Piché, J. (2014). Hear / See: a slow conversation on sound and moving image. *EContact!*, 15(4). Retrieved from https://econtact.ca/15_4/hyde-piche_videomusic.html

Hylton, W. (2013, June 13). How James Turrell Knocked the Art World Off Its Feet. *The New York Times*. Retrieved from http://c2.sausd.schoolwires.net/cms/lib5/CA01000471/Centricity/Domain/2316/HowJamesTurrellKnockedtheArtWorldOffItsFeetJune2013.pdf

Ihde, D. (2007). *Listening and voice: phenomenologies of sound* (2nd ed). Albany: State University of New York Press.

Itti, L., & Baldi, P. (2009). Bayesian surprise attracts human attention. *Vision Research*, 49(10), 1295–1306. https://doi.org/10.1016/j.visres.2008.09.007

Iwanaga, M. (1995). Relationship between Heart Rate and Preference for Tempo of Music <sup/>. *Perceptual and Motor Skills*, 81(2), 435–440. https://doi.org/10.1177/003151259508100215

Jacobi, C. (2017). *Impressionists*.

James, D.E. (1995). The Warhol screenplays: an interview with Ronald Tavel. *Persistence of Vision*, 11, 45–64.

Juslin, P.N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? *Psychological Bulletin*, 129(5), 770–814. https://doi.org/10.1037/0033-2909.129.5.770

Kaduri, Y. (Ed.). (2016). *The Oxford handbook of sound and image in Western art*. New York: Oxford University Press.

Kandinsky, W. (1977). *Concerning the spiritual in art*. New York: Dover Publications

Kanellos, E. (2018). Visual Trends in Contemporary Visual Music Practice. *Body, Space & Technology Journal*, 17(1).

Kant, I., & Pluhar, W.S. (1987). *Critique of judgment*. Indianapolis, Indiana: Hackett Publishing Co.

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective.* New York: Cambridge University Press.

Kaplan, S. (1992). The Restorative Environment: Nature and Human Experience. In D. Relf (Ed.), *The Role of horticulture in human well-being and social development: a national symposium, 19-21 April 1990, Arlington, Virginia* (pp. 134–142). Portland, Oregon: Timber Press. Retrieved from http://www.mairibudreau.com/uploads/1/2/2/4/12240077/nature_and_the_human_experience_the_restorative_environmnetkaplan-1992.pdf

Kepes, G. (Ed.). (1966). *Vision + Value Series: Module, proportion, symmetry, rhythm*. G. Braziller.

Kim, T. (2018). Reflection of Light as a Methodology for New Lumia. Presented at *Seeing Sound 2018, Bath Spa University*.

Klee, P. (1921). *Fuge in Rot* [Watercolour and pencil on paper]. Retrieved from https://commons.wikimedia.org/wiki/File:Paul_Klee_Fuge_in_Rot.jpg

Klee, P. (1927). *Historic Site* [Watercolour and ink on paper on board]. Retrieved from https://www.tate.org.uk/art/artworks/klee-historical-site-t06797

Klee, P. (1915). *Overgrown Houses* [Chalk & Watercolour]

Klee, P. (1929). *Castle of Chivalric Order* [Pen and ink]

Klee, P. (1930). *Polyphonic Setting for White* [Watercolour and pencil on paper].

Klee, P. (1932). *Two Ways* [Watercolour]

Klee, P. (1961). *Paul Klee: the thinking eye*. London : Lund Humphries.

Klee, P. (1992). *Paul Klee Notebooks Volume 2*. London: Lund Humphries.

Klee, P., & Findlay, P. (1966). *On modern art*. London: Faber.

Klee, P., & Moholy-Nagy, S. (2000). *Pedagogical sketchbook*. London: Faber and Faber.

Köhler, W. (1929). *Gestalt Psychology*. New York: Liveright.

Köhler, W. (1947). *Gestalt Psychology* (2nd ed.). New York: Liveright.

Koriat, A., & Levy, I. (1977). The symbolic implications of vowels and of their orthographic representations in two natural languages. *Journal of Psycholinguistic Research*, 6(2), 93–103. https://doi.org/10.1007/BF01074374

Kozel, S. (2007). *Closer: performance, technologies, phenomenology*. Cambridge, Massachusetts: MIT Press.

Kuivila, R., & Behrman, D. (1998). Composing with Shifting Sand: A Conversation between Ron Kuivila and David Behrman on Electronic Music and the Ephemerality of Technology. *Leonardo Music Journal*, 8, 13. https://doi.org/10.2307/1513392

Kurtenbacn, G., & Hulteen, E. (1990). Gestures in Human-Computer Communication. In *The Art and Science of Interface Design* (pp. 309–317). Reading, Massachusetts: Addison-Wesley Publishing Co.

Langer, S.K. (1993). *Philosophy in a new key: a study in the symbolism of reason, rite and art* (3. ed). Cambridge, Massachusetts: Harvard University Press.

Latinus, M., & Belin, P. (2011). Human voice perception. *Current Biology*, *21*(4), 143–145

Le Grice, M. (2009). *Experimental cinema in the digital age* (1. publication, reprinted). London: BFI Publishing.

Leman, M. (2008). *Embodied music cognition and mediation technology*. Cambridge, Massachusetts: MIT Press.

Leonard, D., & Sensiper, S. (1998). The Role of Tacit Knowledge in Group Innovation. *California Management Review*, 40(3), 112–132. https://doi.org/10.2307/41165946

Levin, G. (1994). *Painterly Interfaces for Audiovisual Performance*. Massachusetts Institute of Technology, Massachusetts.

Levin, T. (2003). 'Tones from out of Nowhere': Rudolph Pfenninger and the Archaeology of Synthetic Sound. *Grey Room*, 12, 32–79.

Lindsay, R. C. and Vergo, P. (Eds.) (1994). *Kandinsky: Complete Writings on Art*. New York: Da Capo Press.

Lipsey, R. (1988). *An art of our own: the spiritual in twentieth-century art* (1st ed). Boston: [New York]: Shambhala; Random House.

Livingstone, M. (2002). *Vision and art: the biology of seeing*. New York, N.Y: Harry N. Abrams.

Long, P. (2017). Spatio-temporal Suspension and Imagery in Popular Music Recordings. *Iaspm@journal*, 7(2). Retrieved from https://www.researchgate.net/profile/Peter_Long4/publication/321871770_Spatio-Temporal_Suspension_and_Imagery_in_Popular_Music/links/5a5307c30f7e9bbc10567c2e/Spatio-Temporal-Suspension-and-Imagery-in-Popular-Music.pdf

Lumière, R. (2011). *Encuentro Con Guy Sherwin: Short Film Series*. Retrieved from https://vimeo.com/28717998

Lund, C., & Lund, H. (Eds.). (2009). *Audio visual: on visual music and related media*. Stuttgart: Arnoldsche Art Publishers.

Lye, L., Curnow, W., & Horrocks, R. (1984). *Figures of motion: Len Lye, selected writings*. Auckland: Auckland University Press : Oxford University Press.

Marshall, S.K., & Cohen, A.J. (1988). Effects of musical soundtracks on attitudes toward animated geometric figures. *Music Perception*, 95–112.

Massumi, B. (2002). *Parables for the virtual: movement, affect, sensation*. Durham, North Carolina: Duke University Press.
McAleer, P., & Pollick, F.E. (2008). Understanding intention from minimal displays of human activity. *Behavior Research Methods*, 40(3), 830–839. https://doi.org/10.3758/BRM.40.3.830
McCall, A. (1973). *Line Describing A Cone* [Installation, video projector, computer, digital file, haze machine].
McCall, A. (1974). *Long Film For Four Projectors* [Installation, video projector, computer, digital file, haze machine].
McCall, A. (2005). *Breath III* [Installation, video projector, computer, digital file, haze machine].
McCall, A. (2003). Line Describing a Cone and Related Films. *October*, 103, 42–62. https://doi.org/10.1162/016228703762874214
McCall, A. (2014). Artist Talk. In *Anthony McCall – Solid Light Films and Other Works (1971-2014)*. Amsterdam: Vimeo. Retrieved from https://vimeo.com/140631580
McDonnell, M. (2007, April). *Visual Music*. 15, 1–19. eContact!
McLaren, N. (1955). *Blinkity Blank*. [Animation] Retrieved from https://vimeo.com/29387787
McLaren, N. (1970). *Synchromy* [DVD]. The National Film Board of Canada.
McLaren, N., & Lambert, E. (1949). *Begone Dull Care.*
McLaren, N., McWilliams, D., Verrall, D., & Huycke, S. (2002). *Norman McLaren*. National Film Board of Canada.
McLaren, N., & Munro, G. (1976). *Animated Motion* [DVD]. National Film Board of Canada. Retrieved from https://www.nfb.ca/film/animated_motion_1/
McShine, K., & Rosenblum, R. (1989). *Andy Warhol: A Retrospective*. New York, N.Y: Museum of Modern Art.
McWilliams, D. (1990). *Creative Process* [Documentary, DVD]. Retrieved from https://www.nfb.ca/film/creative_process_norman_mclaren/
Mehrabian, A. (1971). *Silent messages*. Belmont, California: Wadsworth Publishing

Melberg, A. (1995). *Theories of mimesis*. Cambridge [England] ; New York: Cambridge University Press.

Merleau-Ponty, M. (2014). *Phenomenology of perception*. (D. Landes, Trans.). Oxon: Routledge.

Merleau-Ponty, M., & Edie, J.M. (1971). *The primacy of perception: and other essays on phenomenological psychology, the philosophy of art, history and politics* (2. paperback print). Evanston, Ill.: Northwestern University Press.

Michotte, A. (1963). *The Perception of causality*. London: Methuen.

Miller, G. (1970). *The Eye Hears The Ear Sees: Norman McLaren Film maker* [DVD]. BBC & The National Film Board of Canada.

Mitry, J. (1997). *The aesthetics and psychology of the cinema*. Bloomington: Indiana University Press.

Moholy-Nagy, László. (1922). *Light-Space Modulator* [Replica 1970].

Moholy-Nagy, Laszlo. (1923). Light: A Medium of Plastic Expresssion. *Broom: An International Magazine of the Arts*, 4(4), 283–284.

Moholy-Nagy, László. (1925). *Untitled* [Gelatin silver print].

Moholy-Nagy, Laszlo. (1947). *Vision in Motion*. Chicago: Paul Theobald & Co.

Moholy-Nagy, László. (1987). *Painting, photography, film*. Cambridge, Massachusetts: MIT Press.

Moravcsik, J.M.E., & Temko, P. (Eds.). (1982). *Plato on beauty, wisdom, and the arts*. Totowa, N.J: Rowman and Littlefield.

Morita, J., Nagai, Y., & Moritsu, T. (2013). Relations between Body Motion and Emotion: Analysis based on Laban Movement Analysis. In *Proceedings of the 35th Annual Meeting of the Cognitive Science Society* (pp. 1026–1031). Retrieved from http://csjarchive.cogsci.rpi.edu/Proceedings/2013/papers/0202/paper0202.pdf

Moritz, W. (1985). Who's Who in Filmmaking: James Whitney. *Sightlines*, 19(2). Retrieved from http://www.centerforvisualmusic.org/WM_JWsight.pdf

Moritz, W. (1989). *Abstract Films of the 1920s*. Retrieved from http://www.centerforvisualmusic.org/Moritz1920sAb.htm

Moritz, W. (2004). *Optical poetry: the life and work of Oskar Fischinger*. Bloomington: Indiana University Press.

Mortiz, W. (1988). *Some Observations on Non-Objective and Non-Linear Animation*. Retrieved from http://www.centerforvisualmusic.org/library/ObservNonObj.htm

Nicolaïdes, K. (2008). *The natural way to draw: a working plan for art study*. London: Souvenir Press.

Nelson, R. (2013). *Practice as Research in the arts: principles, protocols, pedagogies, resistances*. Houndmills, Basingstoke, Hampshire ; New York: Palgrave Macmillan.

Noever, P., & Turrell, J. (Eds.). (2002). *James Turrell, The Other Horizon: Katalog zur Ausstellung im MAK Wien, 1998/1999* (Neuaufl.). s.l: Cantz.

Noland, C., & Ness, S.A. (Eds.). (2008). *Migrations of gesture*. Minneapolis: University of Minnesota Press.

Norman, K. (1996). A Poetry of Reality: Composing with Recorded Sound. *Contemporary Music Review*, 15(1–2), 1–57.

Ong, W.J. (2001). *The presence of the word: some prolegomena for cultural and religious history*. New Haven, Conn.: Yale University Press.

Orgeman, K., Turrell, J., & Borgen, M. (2017). *Lumia: Thomas Wilfred and the art of light*. New Haven, Connecticut: Yale University Art Gallery.

Ox, J., & Keefer, C. (2008). On Curating Recent Digital Abstract Visual Music. *Abstract Visual Music*, (2006–2008). Retrieved from http://www.centerforvisualmusic.org/Ox_Keefer_VM.htm

Patel, A.D. (2008). *Music, language, and the brain*. New York: Oxford University Press.

Peacock, K. (1988). Instruments to Perform COlor-Music:Two Centruries of Technological Experiementation. *Leonardo*, 21, 397–406.

Picasso, P. (1913). *Guitar*.

Pietrowicz, M. (2017). *Exposing the Hidden Vocal Channel: Analysis of Vocal Expression*. University of Illinois, Urbana, Illinois.

Pietrowicz, M., & Karahalios, K.G. (2014). Visualizing vocal expression. In *Proceedings of the extended abstracts of the 32nd annual ACM conference on Human factors in computing systems – CHI EA '14* (pp. 1369–1374). Toronto, Ontario, Canada: ACM Press. https://doi.org/10.1145/2559206.2581331

Pine, J., & Gilmore, J. (1998). Welcome to the Experience Economy. *Harvard Business Review*, 76, 97–105.

Potter, J., & Sorrell, N. (2012). *A history of singing*. Cambridge: Cambridge University Press.

Ramachandran, V., & Hubbard, E. (2001). Synaesthesia--a window into perception, thought and language. *Journal of Consciousness Studies*, 8(12), 3–34.

Ray, M. (1922). *Rayograph* [Gelatin silver print].

Rees, A.L. (2011). *A history of experimental film and video: from the canonical avant-garde to contemporary British practice* (2nd ed). [Houndmills, Basingstoke, Hampshire] : London: Palgrave Macmillan ; British Film Institute.

Rees, R. (1982). Constable, Turner, and Views of Nature in the Nineteenth Century. *Geographical Review*, 72(3), 253–269.

Respini, E., Charlesworth, S., Crosby, E., Marcoci, R., Quaytman, R. H., Tillman, L., Institute of Contemporary Art (Boston, Massachusetts) (Eds.). (2016). *Liz Deschenes*. Munich: DelMonico Books.

Rewald, S., & Klee, P. (1988). *Paul Klee: the Berggruen Klee collection in the Metropolitan Museum of Art*. New York: Metropolitan Museum of Art: H.N. Abrams.

Richter, H. (1921). *Rhythmus 21*. Reel Images. Retrieved from https://vimeo.com/42339457

Richter, H. (1951). The Film as an Original Art Form. *College Art Journal*, 10(2), 157. https://doi.org/10.2307/772314

Richter, H. (1952). Easel-Scroll-Film. *Magazine of Art*, (February).

Rizzolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience*, 2(9), 661–670. https://doi.org/10.1038/35090060

Rouzic, M. (2008). *Photosounder*. Retrieved from http://photosounder.com/

Ruskin, J. (1897). *Modern Painters* (Vol. 6). G. Allen.

Russett, R., & Starr, C. (1988). *Experimental animation: origins of a new art*. New York: Da Capo Press.

Ruttmann, W. (1921). *Lichtspiel Opus I*.

Ruttmann, W. (1924). *Opus III*.

Ruttmann, W. (1925). *Opus IV*.

Saxe, R., & Carey, S. (2006). The perception of causality in infancy. *Acta Psychologica*, 123(1–2), 144–165. https://doi.org/10.1016/j.actpsy.2006.05.005

Schad, C. (1918). *Amourette* [Gelatin silver].

Schafer, R.M. (1993). *The soundscape: our sonic environment and the tuning of the world*. Rochester: Destiny Books

Scholl, B.J., & Tremoulet, P.D. (2000). Perceptual causality and animacy. *Trends in Cognitive Sciences*, 4(8), 299–309. https://doi.org/10.1016/S1364-6613(00)01506-0

Schwerdtfeger, K. (1922). *Reflecting Light Games*.

Sergio, G., Rammohan, M., Jun-Su, K., & Minho, L. (2015). Generating Music from an Image. In *Proceedings of the 3rd International Conference on Human-Agent Interaction* (pp. 213–216). Daegu, Kyungpook, Republic of Korea: ACM Press. https://doi.org/10.1145/2814940.2814978

Sherwin, G., Hegarty, S., & LUX (Organization). (2007). *Optical sound films 1971-2007*.

Shimojo, S. (2001). Sensory modalities are not separate modalities: Plasticity and interactions. *Current Opinion in Neurobiology*, *11*(4), 505–509. https://doi.org/10.1016/S0959-4388(00)00241-5

Shouse, E. (2005). Feeling, Emotion, Affect. *M/C Journal*, 8(6). Retrieved from http://journal.media-culture.org.au/0512/03-shouse.php

Singh, J. (2012). *Paint2sound*. Retrieved from http://flexibeatz.weebly.com/paint2sound.html

Sitney, P.A. (2002). *Visionary film: the American avant-garde, 1943-2000* (3rd ed). Oxford; New York: Oxford University Press.

Smalley, D. (1997). Spectromorphology: explaining sound-shapes. *Organised Sound*, 2(2), 107–126. https://doi.org/10.1017/S1355771897009059

Smirnov, A. (2013). *Sound in Z: experiments in sound and electronic music in early 20th-century Russia*. London: Sound and Music.

Snow, M. (1967). *Wavelength*.

Snyder, B. (2000). *Music and memory: an introduction*. Cambridge, Massachusetts: MIT Press.

Sontag, S. (2008). *On photography* (Reissued). London New York Toronto: Penguin Books.

Steeves, J.B., & DePaul University. (2001). The Virtual Body: Merleau-Ponty's Early Philosophy Of Imagination. *Philosophy Today*, 45(4), 370–380. https://doi.org/10.5840/philtoday200145424

Steeves, J.B. (2004). *Imagining bodies: Merleau-Ponty's philosophy of imagination*. Pittsburgh, Pennsylvania: Duquesne University Press.

Stieglitz, A. (1929). *Equivalent* [Photograph]. Retrieved from http://www.phillipscollection.org/research/american_art/artwork/Stieglitz-Equivalent1843+.htm

Stieglitz, A., Greenough, S., & Hamilton, J. (1983). *Alfred Stieglitz, photographs & writings* (1st ed). Washington: National Gallery of Art.

Stone, M., DeCarlo, D., Oh, I., Rodriguez, C., Stere, A., Lees, A., & Bregler, C. (2004). Speaking with hands: creating animated conversational characters from recordings of human performance (p. 506). ACM Press. https://doi.org/10.1145/1186562.1015753

Strand, P. (1916). *Porch Shadows* [Photograph].

Survage, L. (1913). *Colored Rhythm: Study for the Film* [Watercolour and black ink on paper]. Retrieved from https://www.moma.org/collection/works/85489

Sykes, L. (2015). *The Augmented Tonoscope Towards a Deeper Understanding of the Interplay between Sound and Image in Visual Music*. Manchester Metropolitan University, Manchester.

Thayer, J., & Levenson, R. (1983). Effects of music on phychophysiological responses to a stressful film. *Psychomusicology: A Journal of Research in Music Cognition*, 3(1), 44–52.

Tomkins, S.S., & Demos, E.V. (1995). *Exploring affect: the selected writings of Silvan S. Tomkins*. Cambridge [England] ; New York : Paris: Cambridge University Press ; Editions de la Maison des sciences de l'homme.

Truax, B. (2001). *Acoustic communication* (2nd ed). Westport, Connecticut: Ablex.

Truax, B. (2017). Retrospective. Presented at *Sound Design*, University of Greenwich.

Turner, J.M.W. (1840). *Rough Sea* [Oil paint on canvas]. Retrieved from http://www.tate.org.uk/art/artworks/turner-rough-sea-n05479

Turrell, J. (1974). *Wedgework iii* [Light]. Retrieved from http://jamesturrell.com/wp-content/uploads/2013/03/wedgework_iii_19691.jpg

Turrell, J. (1976). *Ganzfeld Pieces* [Light].

Turrell, J. (1983). *Dark Spaces* [Light].

Turrell, J., & Holborn, M. (1993). *Air mass*. London: South Bank Centre.

van der Zwaag, M.D., Westerink, J.H.D.M., & van den Broek, E.L. (2011). Emotional and psychophysiological responses to tempo, mode, and percussiveness. *Musicae Scientiae*, 15(2), 250–269. https://doi.org/10.1177/1029864911403364

Turrell, J. (2013). *James Turrell* [Video File]. Retrieved from http://web.guggenheim.org/exhibitions/turrell/

Vidler, A., Gormley, A., Stewart, S., & Mitchell, W.J.T. (2007). *Antony Gormley: blind light*. London; New York: Southbank Centre; Hayward Publishing

Wagemans, J., van Lier, R., & Scholl, B.J. (2006). Introduction to Michotte's heritage in perception and cognition research. *Acta Psychologica*, *123*(1–2), 1–19. https://doi.org/10.1016/j.actpsy.2006.06.003

Walley, J. (2004). An Interview with Anthony McCall. *The Velvet Light Trap*, 54(1), 65–75.

Warhol, A. (1964). *Empire* [16mm (black and white, silent)]. Retrieved from https://www.moma.org/collection/works/89507

Warhol, A., Aquin, S., Lavigne, E., Musée des beaux-arts de Montréal, Fine Arts Museums of San Francisco, Andy Warhol Museum, & Exhibition Warhol Live: Music and Dance in Andy Warhol's Work (Eds.). (2008). *Warhol live; music and dance in Andy Warhol's work* München: Prestel.

Watkins, J. (2014a). *Horizon*.

Watkins, J. (2014b). *Margate Sky* [Digital Footage].

Watkins, J. (2015a). *Reservoir*.

Watkins, J. (2015b). *Shadow Sounds 1*.

Watkins, J. (2015c). *Song Series*.

Watkins, J. (2016a). *Ambience 1*.

Watkins, J. (2016b). *Ambience 2*.

Watkins, J. (2016c). *Ambience 3*.

Watkins, J. (2016d). *Animacy, motion, emotion and empathy in visual music: Enhancing appreciation of abstracted animation through wordless song.* Body, Space & Technology, 15 (22)

Watkins, J. (2017a). *An investigation into composing visual music today.* Body,Space & Technology, 16 (02):09.

Watkins, J. (2017b). *Sky*.

Watkins, J. (2018a). *AnimatedShapes.*

Watkins, J. (2018b). *Composing Visual Music: visual music practice at the intersection of technology, audio-visual rhythms and human traces.* Body, Space & Technology.

Watkins, J. (2018c). *Continuous Punctuation*.

Watkins, J. (2018d) *Creating Affective Visual Music*: Electronic Visualisation and the Arts, 2018, 70.

Watkins, J. (2018e). *Shadow Sounds 2*.

Watkins, J. (2018f). *Shadow Sounds 3*.

Watkins, J. (2018g). *Singing Light 1*

Watkins, J. (2018h). *Sky 2.*

Wertheimer, M. (1938). *A Source Book of Gestalt Psychology*. London: Routledge & Kegan Paul Ltd.

White, D. (2011). *Sonicphoto*.

Whitney, J. (1980). *Digital harmony: on the complementarity of music and visual art*. Peterborough, New Hampshire: Byte Books.

Whitney, J. (1994). To Paint on Water: The Audiovisual Duet of Complementarity. *Computer Music Journal*, 18(3), 45–52.

Wilfred, T. (1940). *Lumia Diagram* [Ink on Paper].

Wilfred, T. (1947). Light and The Artist. *Journal of Aesthetics and Art Criticism*, 5(4), 247–255.

Wilfred, T. (1948). *Lumia compostions Opus 140*. Retrieved from https://www.youtube.com/watch?v=k3__CoJitqI&frags=pl%2Cwn

Wilton, A. (1987). *Turner in his time*. London: Thames and Hudson.

Wishart, T. (1994). *Audible design: sound examples*. York: Orpheus the Pantomime.

Wishart, T., & Emmerson, S. (1996). *On sonic art* (New and rev. ed). Amsterdam: Harwood Academic Publishers.

Witkovsky, M.S., Eliel, C.S., Vail, K.P.B., Solomon R. Guggenheim Museum, Art Institute of Chicago, & Los Angeles County Museum of Art (Eds.). (2016). *Moholy-Nagy: future present* (First edition). Chicago: Art Institute of Chicago.

Young, J. (1996). Imagining the Source: The Interplay of Realism and Abstraction in Electroacoustic Music. *Contemporary Music Review*, 15(1–2), 73–93. https://doi.org/10.1080/07494469608629690

Youngblood, G. (1970). *Expanded cinema* (1st ed.). New York: Dutton.

Zajec, E. (1988). Orphics: Computer Graphics and the Shaping of Time with Color. *Leonardo*, 21(supp), 111–116.

# Appendix A: Key terms

**Abstract animation**: time-based abstract images.

**Abstract images**: images of intangible things, and images that have been ‘abstracted’ by removing or mapping elements. There is a continuum between mimetic and abstract images: where an image falls along this continuum depends on the observer.

**Acousmatic** sounds are defined by Pierre Schaeffer as ‘sounds one hears without seeing their originating cause’ (Schaeffer quoted in Chion et al., 1994, 71).

***Acousmêtre***

> [An] acousmatic character whose relationship to the screen involves a specific kind of ambiguity and oscillation… We may define it as neither inside nor outside the image. It is not inside, because the image of the voice's source – the body, the mouth – is not included. Nor is it outside, since it is not clearly positioned offscreen.
> (Chion et al., 1994, 129)

**Affect** is used in its philosophical meaning, to emphasise embodied experience. Affect indicates a change in the experience of a body and a change in being-able-to. It is pre-reflective. Massumi writes:

> *L’affect* (Spinoza’s *affectus*) is an ability to affect and be affected. It is a prepersonal intensity corresponding to the passage from one experiential state of the body to another and implying an augmentation or diminution in that body’s capacity to act.
> (Massumi cited in Deleuze & Guattari, 2004, xvii)

**Animacy:** a form of anthropomorphism perceived in abstract animation; the shapes appear to be animate, motivated or expressing emotion.

**Animated-image-audio unit:** here, unit refers to a single, indivisible entity of animated images always seen with the same audio.

**Animation-tempo:** (after McLaren's tempo) is timing – not metric time, not a pulse – but rate of change. For example, the animation-tempo of a punch may be defined as a specific acceleration. Animation-tempo is made visible as movement: change of colour (hue, saturation and tone), opacity, texture and motion. Tempo is *the* key expressive tool of an animator (McLaren & Munro, 1976).

**Audio-visual contract:** '[we perceive] the elements of sound and image to be participating in one and the same entity or world' (Chion et al., 1994, 222).

**Cinematic:** 'all art that foregrounds time, or movement, or both' (McCall in Walley, 2004, 67)

**Compound motion:** is the combining of different motions (after McLaren).

**Continuum of granularity:** smear, particles, groups, individual within a group, individual object.

**Creative play:** is trying out different intuitive solutions suggested by a composition as it progresses.

**Differential dynamics:** are linked, nested or interrelated motion paths, the result of which is that shapes are overlaid, creating harmonic visual patterns via computer algorithms. Differential dynamics was developed by John Whitney.

**Digital-artisan:** someone who uses contemporary and legacy materials and processes with an awareness of their original contexts and significance.

**Dividual** (after Klee)**:** repeated structural elements that can be divided or added to without changing the structure they form. *See also* **Individual**.

**Embodiment (**as proposed by the French phenomenological philosopher Maurice Merleau-Ponty): that there is no difference between perception and experience; we experience the things that we perceive, directly. We do not receive information and then process it. This undermines the distinction between the subject and the object (Merleau-Ponty, 2014).

**Emotions:** socially displayed feelings (Shouse, 2005).

**Engaged:** to be involved in an activity. *See also* **Immersed**.

**Expanded cinema:** cinema as an artform for an expanded consciousness in which the artist is an ecologist who designs environments (Youngblood, 1970).

**Feelings:** interpreted and named sensations, individualised by experience and memory (Shouse, 2005).

**Footage-as-data:** a mode of gathering material so that the visual can be abstracted as data to become the artistic material that enables new experiences. Gathering footage-as-data is much more far-reaching than creating new processes; it allows new and different ways of seeing.

**Found abstraction:** excluding the context of images and thereby emphasising rhythm, pattern and texture.

**Gesture:** 'a movement of the body that contains information' (Kurtenbacn & Hulteen, 1990, 309)

**Haptic vision:** viewing with a sense of depth and contour but without discerning any perspective.

**Human trace:** the record of a gesture, including vocal expression, or anthropomorphic information: animacy or perception of causality.

**Immersed:** being completely involved in an activity to the extent of lacking a sense of time passing or awareness of the world outside the activity. *See also* **Engaged**.

**Individual** (after Klee): individual and dividual structures are not fixed; they are a matter of perception and value judgements – in contrast to structural elements that are patterns such as a cross, in which if a part is added or subtracted it no longer forms the same pattern. *See also* **Dividual.**

**Metaphorical synaesthesia:** an emerging mode of perception that transcends the duality of eye and ear. *See also* **Synaesthesia**.

**Metaphorical sync:** we often perceive non-synchronised or randomly synchronised stimuli as synchronous, whereby we create a metaphorical sync.

**Mimesis:** from the Greek *mimeisthai*, to imitate – the attempt to reproduce reality, a fundamental concept in the creation of art.

**Motion:** 'a change of location in two- or three-dimensional space' (McLaren & Munro, 1976)

**Motivations for narrative:** compositional motivation (its relevance to plot), realistic motivation (how credible it seems), transtextual motivation (or genre expectations), artistic motivation (the content itself is the motivation). Based on Bordwell (1985, 40).

**Movement-image:**

> [C]inema does not give us an image to which movement is added, it immediately gives us a movement-image. It does give us a section, but

> a section which is mobile, not an immobile section + abstract movement.
> (Deleuze, 2005a, 2-3)

**Movie-canvas:** the shape of the screen, and may be either foreground or background; it is treated like a painter's canvas.

**Musical rhythm:** consists of meter (a beat, either single or compound), rhythmical structure (shorter groups of sequential patterns of emphasised beats that are grouped into a long, hierarchically based grouping of groups), tempo (the impression of speed or change of speed) and timing (nuances of when notes are played, slightly 'early' or 'late' or mechanically regular). Based on Honing (2013).

**New objectivity** in photography: capturing unexpected views and patterns with a camera.

**New vision:** after the First World War, artists, through selection, aspired to re-present the world, to create a new vision. This led to found abstraction.

**Non-objective animation**, also known as **non-objective film:**

> [N]on-objective animation is the purest and most difficult form of animation. Anyone can learn to 'muybridge' the illusion of representational life, but inventing interesting forms, shapes and colors, creating new, imaginative and expressive motions 'the absolute creation: the true creation,' as Fischinger termed it (Fischinger, 1947) requires the highest mental and spiritual faculties, as well as the most sensitive talents of hand.
> (Moritz, 1988, Center for Visual Music website)

**Non-phonetic vocalisation:** silence, sighs, groans, laughter.

**Perception of causality:** the perception that one event causes another event. For example, when one object strikes another and the second object moves, most observers perceive that the first object caused the second to move.

**Percussive synchronisation point:** a sync point on percussive audio, often with high-contrast visuals, resulting in a particularly strong audio-visual bond and embodied visceral affect.

**Phenomenological Experiences:** are experiences that we have as a result of embodiment. *See also* **Embodiment.**

**Phonation types:** examples include low and breathy or nasal or creaky.

**Pictorial:** 'work connected to the making of images' (McCall in Walley, 2004, 67)

**Prosodic:** qualities of speech: intonation, stress, pitch, loudness, tempo and rhythm.

**Reality and abstraction:** 'Reality' and 'abstraction' are notional absolutes' (Young, 1996, 83).

**Sculptural:** 'work that addresses issues of form in space' (McCall in Walley, 2004, 67).

**Slow cinema:**

> the application of the long take, an undramatic narrative or non-narrative structure, a tendency toward realist or hyperrealist representation, and a pronounced stillness of composition and visual content.
> (Flanagan, 2012, 2)

**Soft fascination:** (after Kaplan) Soft fascination is attention held in a natural setting, by experiences such clouds moving or the sun setting, but, unlike the sublime, without dramatic force.

**Sublime** (after Burke): of darkness, obscurity, privation, vastness, magnificence, loudness and suddenness; Burke cited terror, the strongest passion, as the most effective route to the sublime (Burke & Phillips, 2008).

**Surprise:** Surprise is a 'failure of expectation' (Huron, 2007, 21) that results in arousal, increased attention on the event, and, if the surprise appeared at first to be a feared outcome and was then understood to be harmless, the opiates the body releases will result in a feeling of happiness. Huron links surprise to Burke's definition of the sublime: 'The aesthetic experience of the sublime depends on an initial sensation of fear that is ultimately appraised as inconsequential' (Huron, 2007, 25).

**Synaesthesia:** an involuntary response in one sense, such as sight, triggered by the stimulation of another sense, such as hearing.

**Timbre:** the quality that differentiates one sound from another, even if the sounds have the same pitch and amplitude. Differences in timbres are caused by the fundamental pitch having different overtones, which can be modelled as spectro-temporal envelopes.

**Virtual body:** '[A]n imaginative ability to consider alternative uses of the body and to assume different perspectives from which to observe a situation' (Steeves, 2004, 22).

**Visual and expanded visual music:** a form of abstract animation with expressive movement in animation-tempo and affective non-verbal, sonic element vocalised by an *acousmêtre*. Visual and expanded visual music aims to reach beyond the duality of eye and ear by giving primacy to the phenomenological and affective. The aim is for the beholder to complete the open-ended composition by synthesising visual and expanded visual music through their experience of visceral embodied affect arising from their perception of causality, animacy, metaphor or surprise. *See also* **Abstract animation, *Acousmêtre*, Affect, Animacy, Animation-tempo, Embodiment, Perception of causality, Phenomenological experiences, and Surprise.**

**Vocal expression:** consists of timbre, prosodic, phonation type and non-phonetic vocalisation.

# Appendix B: Adding movement – animated studies inspired by Survage, Klee and McLaren

## B.1 Survage: animating *Colored Rhythm*

To create his experiment, *Colored Rhythm*, in 1912–13, Léopold Survage used the mode of creation that he knew best, painting. He chose his materials carefully: a really smooth paper, black ink and vibrant watercolours. To make his moving paintings, he started by creating a form in black ink, working the edges of the composition first and then filling in washes of colour using watercolour. As the ink was not water-soluble it was unaffected by this application of watercolour. He managed to create the sensation of light, even glow, through surrounding the bright, luminous colours with his painted black background (see Figure 39 in Section 2.3.4 above).

Exploring how to animate stills created by Survage – stills he created as a study for a film – may reveal some of the tensions between still and time-based imagery. To get some sense of these images as a moving sequence, albeit in animatic form rather than full-up animation, I dissolved the stills together with constant rhythm of 2 seconds of cross-fade, 1 second of still. The tone of the black area was enhanced, by increasing the saturation a little, to preserve the effect of luminosity through the transitions. Using dissolves works with the painterly textures, which are an essential element of the work. The regularly spaced dissolves give the viewer time to imagine the animation that Survage might have intended (see Figure 40). Where the frames almost line up, this starts to look like the beginnings of motion-painting. See *Survage Animation 1*.

Figure B1 is one example of a sequence of four images that aligned well together and began to give the impression of animation. Dissolving the red-and-blue-on-white shapes gives some sense of colour in motion as the scale of the shapes is fairly similar and the changing positions work in a kind of organic rotation.

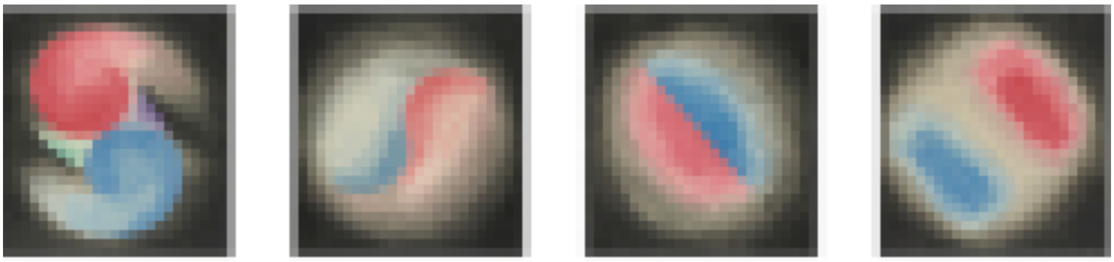


Figure B1. *Coloured Rhythm: Study for the Film* (Survage, 1913): four images that align well together

Figure B2 is another example of a sequence of four frames that animated through dissolve. A painterly sun blossomed out of the black, almost Turner-esque, gradually becoming more abstract and more graphic, like Robert Delaunay's *Circular Forms*, as a rainbow of colours emerges.

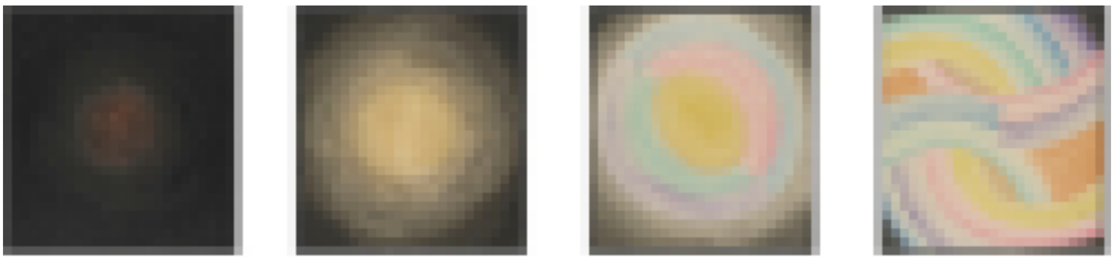


Figure B2. *Coloured Rhythm: Study for the Film* (Survage, 1913): four images aligned to animate through a dissolve

A further test was made to make the images into a more flowing animatic, using soft-edged masks, scale and rotation, virtual camera moves and varying the durations of images and transitions. On one hand, these add dynamics and give more of a sense of painting in three-dimensional space and scale; on the other hand, some of the transitions need to be much more finely applied, colour by colour, to come to life. See *Survage Animation 2*.

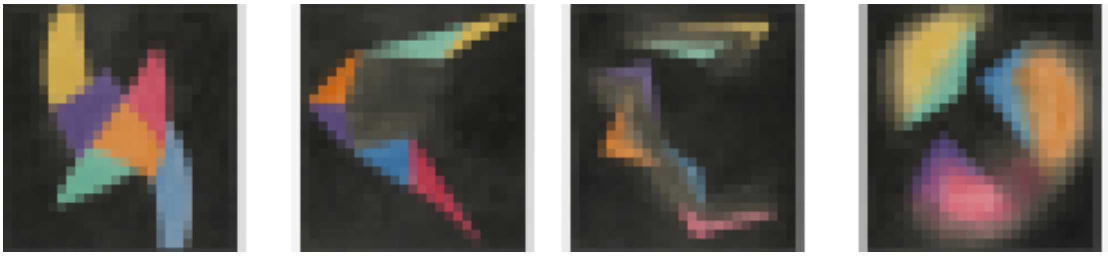


Figure B3. *Coloured Rhythm: Study for the Film* (Survage, 1913): four images that worked less well when dissolved together

The images in Figure B3 worked less well as dissolves but lent themselves to motion imagined against a vast black background. A virtual camera was ‘moved down’ to ‘find’ the second form and to the right to ‘find’ the third. Then the third form was rotated into the fourth, to emphasise the circle that is almost created by the fourth form.

**Key findings**

The images are formed from simple shapes but the rich colours and painterly textures predicate against animacy, i.e. predicate against the personification of the movement of simple shapes. Having explored creating motion with these images, different ways of rendering a more detailed animation have become apparent. The engaging human traces apparent in Survage’s images are gestures of mark-making. One impulse is to remain faithful to the painterly quality and re-build the images as strokes of colour, layering these into black space in the same way that Survage created the painted images. However, this would raise the same problems as Golan Levin’s system (discussed in Section 2.4.4).

A second impulse is to re-imagine the final piece animated using today’s technology, to use the frames as a coloured storyboard. It could be the starting point for a final digital piece made from streams of glowing particles in 3D space, with a dynamic moving camera swooping down ribbons of colour as the particles swirl and colours morph from one shape to the next. This would work well for Strand 3-B of visual music, i.e. music created to pre-existing images. Animating these still images made it clear that a different methodology for composing visual music is needed for creating visual music in Strand 1-A i.e. visual music in which the visual structure informs the composition of both image and sound.

## B.2 Line studies inspired by McLaren

I started with animation studies of line, as line is a fundamental formal element (Section 2.3.3). To isolate animation as a single parameter, all the lines were white against black and hard-edged. Klee makes a fundamental distinction between vertical and horizontal lines, McLaren, arguably influenced by Klee, explored differences in animating vertical and horizontal lines. I started by comparing horizontal and vertical effects in animation (Figure B4).

1. One horizontal line moves randomly up and down.
2. A thicker line moves up and down more quickly than a thinner line
3. One vertical line moves randomly from side to side
4. A thicker line moves side to side more quickly than a thinner line

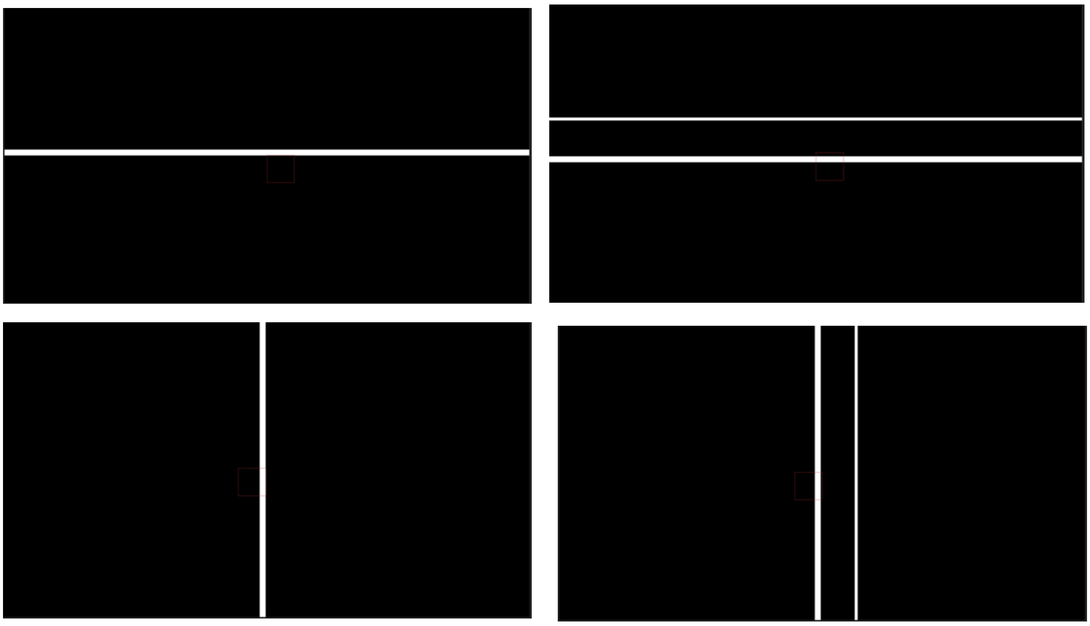


Figure B4. Stills from animated line tests inspired by McLaren

**Key findings**
Like Norman McLaren, I found a great difference between vertical and horizontal lines: the horizontal lines appear to be affected by gravity and float up and down, whereas the vertical lines seem to have their own agency. By making the thick line move more quickly than the slow line, the thick line appeared closer, i.e. perspective was created in the image-plane. The sense of perspectival depth is more obvious with the two horizontal lines.

# B3. Line studies inspired by Klee

Paul Klee referred to a line as a way of measuring, like a plumb-line or a vertical line dropping down (Section 2.3.3). These studies start with a plumb-line and go on to a line of growth, a line that grows up from the bottom, which was also very important to Klee. Klee made a great distinction between horizontal and vertical lines. The series of vertical studies is repeated in the horizontal, as the horizon-line is vital to my work, as can be seen in *Horizon* and *Singing Light 1*. In the manner of Klee's studies, the studies are iterative and build in complexity. Two iterations of each line are animated to create a pattern of animation that is easier to see. Norman McLaren defined five categories of motion: constant, accelerated, decelerated, zero and irregular (McLaren et al., 2002, 94). In order to limit the number of permutations, all lines here have all been animated with constant motion. This contrasts with the zero motion of the flashing rectangle and the irregular rotation of study. In total, there are 144 variations, with a total duration of 56 minutes.

## Developing 36 line studies

3 plumb-lines:

1. Vertical, thin white line enters from the top of frame and cuts off when it reaches the bottom of frame, duration 3 seconds.
2. Vertical, thin white line enters from the top of frame and moves through frame, duration 6 seconds.
3. Vertical, thin white line enters from the top of frame, stays on screen, and then moves through frame, duration 8.5 seconds – illusion of a longer line moving through frame.

3 growth lines: as plumb-lines but growing up from the bottom of the screen.

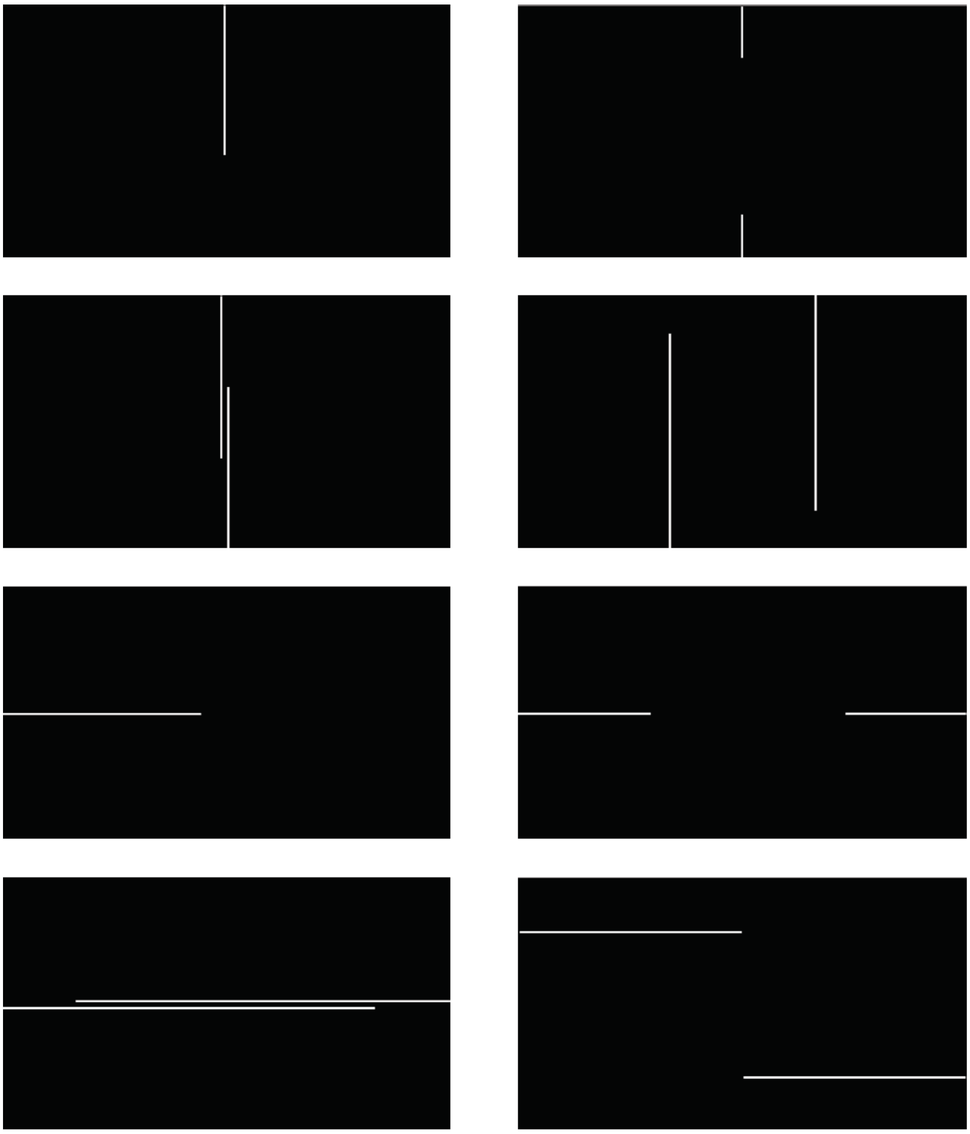


Figure B5. Stills from meeting-lines tests inspired by Klee

3 meeting lines (Figure B5):

1 Plumb and growth lines superimposed and meet in the middle of the frame.
2 Parallel: plumb and growth lines in parallel, with a line's space between them
3 Parallel 2: plumb and growth lines in parallel, dividing the screen into three parts

36 line studies in total (Figure B6):

- All 9 vertical line studies but animated horizontally.

- The 9 vertical and 9 horizontal superimposed; they animate to become a cross meeting in the middle of the screen.
- The 9 vertical and horizontal superimposed, doubled again with random rotation of up to 3 degrees – this creates more animacy in the lines.

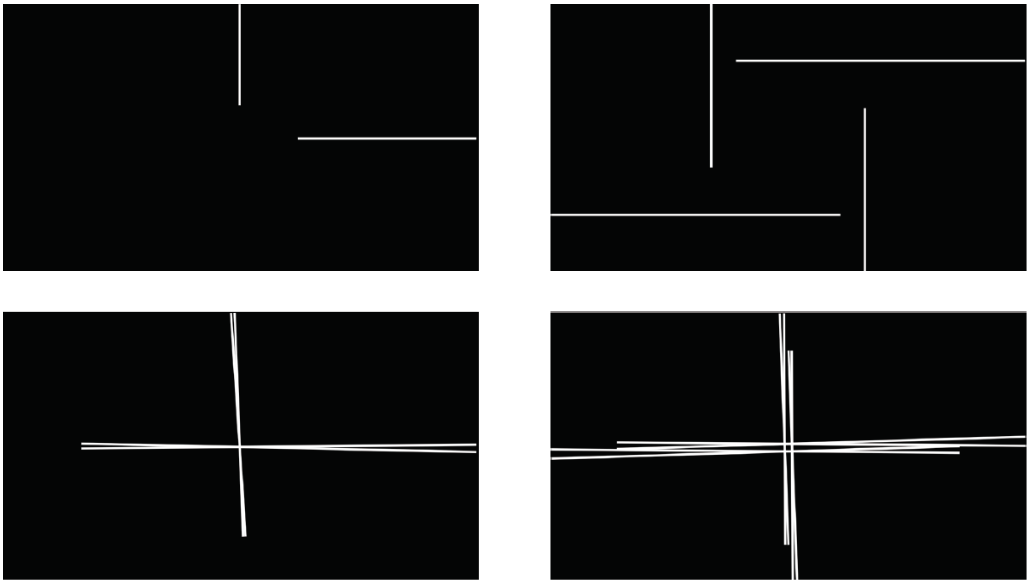


Figure B6. Examples of 9 vertical and 9 horizontal, superimposed

## Line-invert tones: 36 studies

All 36 studies repeated, with an inversion of background and line across the central third of the screen, dividing it into three bands. The inversion fades up over one iteration, and down over the next; giving fade up over plumb-lines, fade down over plumb-lines. Horizontally: fade up over superimposed lines creating a cross, and fade down over doubled-up cross with rotation (Figure B7).

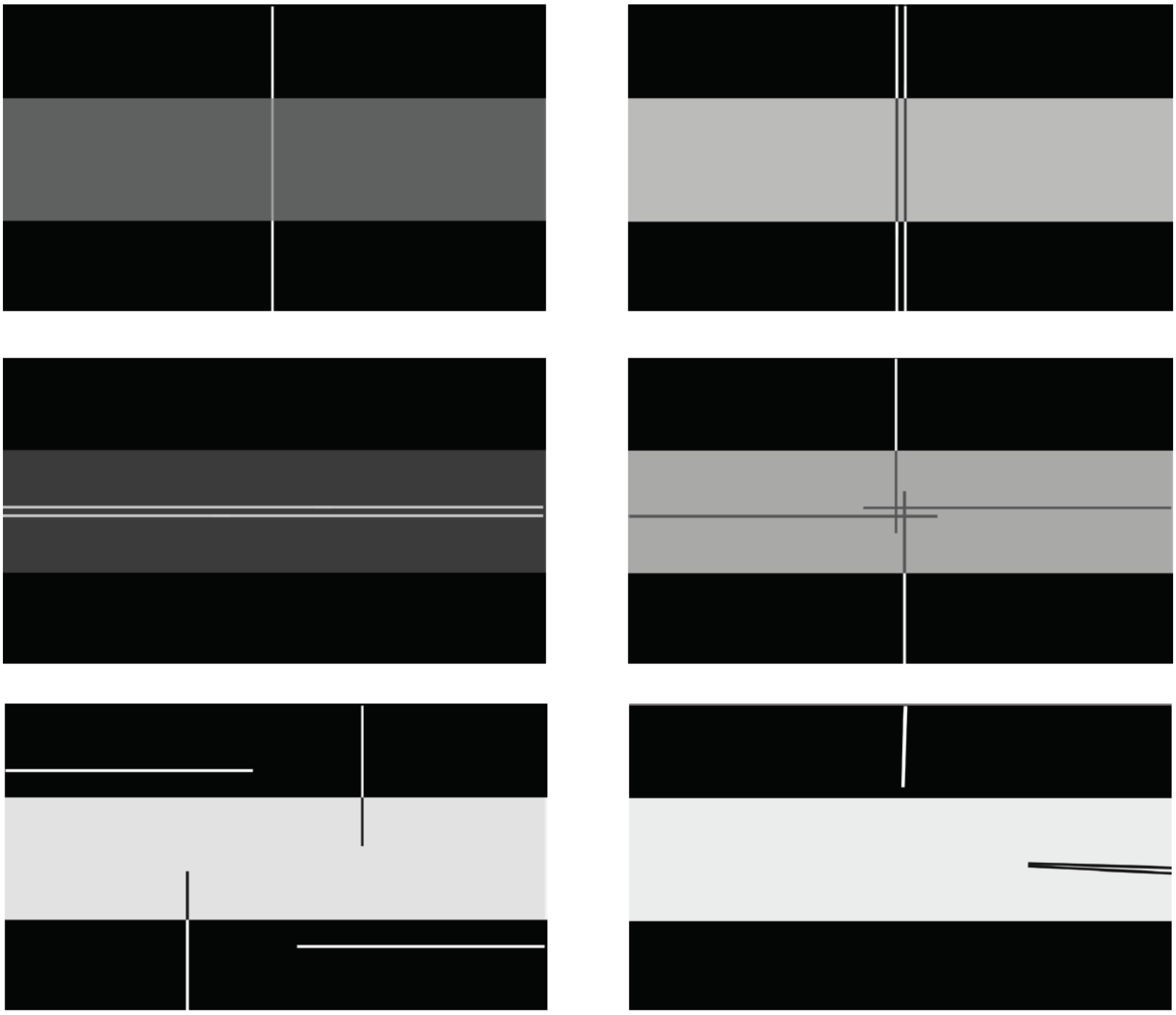


Figure B7. Examples from line-invert tones tests

## Line interference: 36 studies

All 36 studies again, with a randomly flashing small white rectangle: at points in the sequence, this is exactly in sync with a change. At some points, it evokes an eye. The flashing rectangle draws the attention away from the animating lines unless they are also randomly rotating.

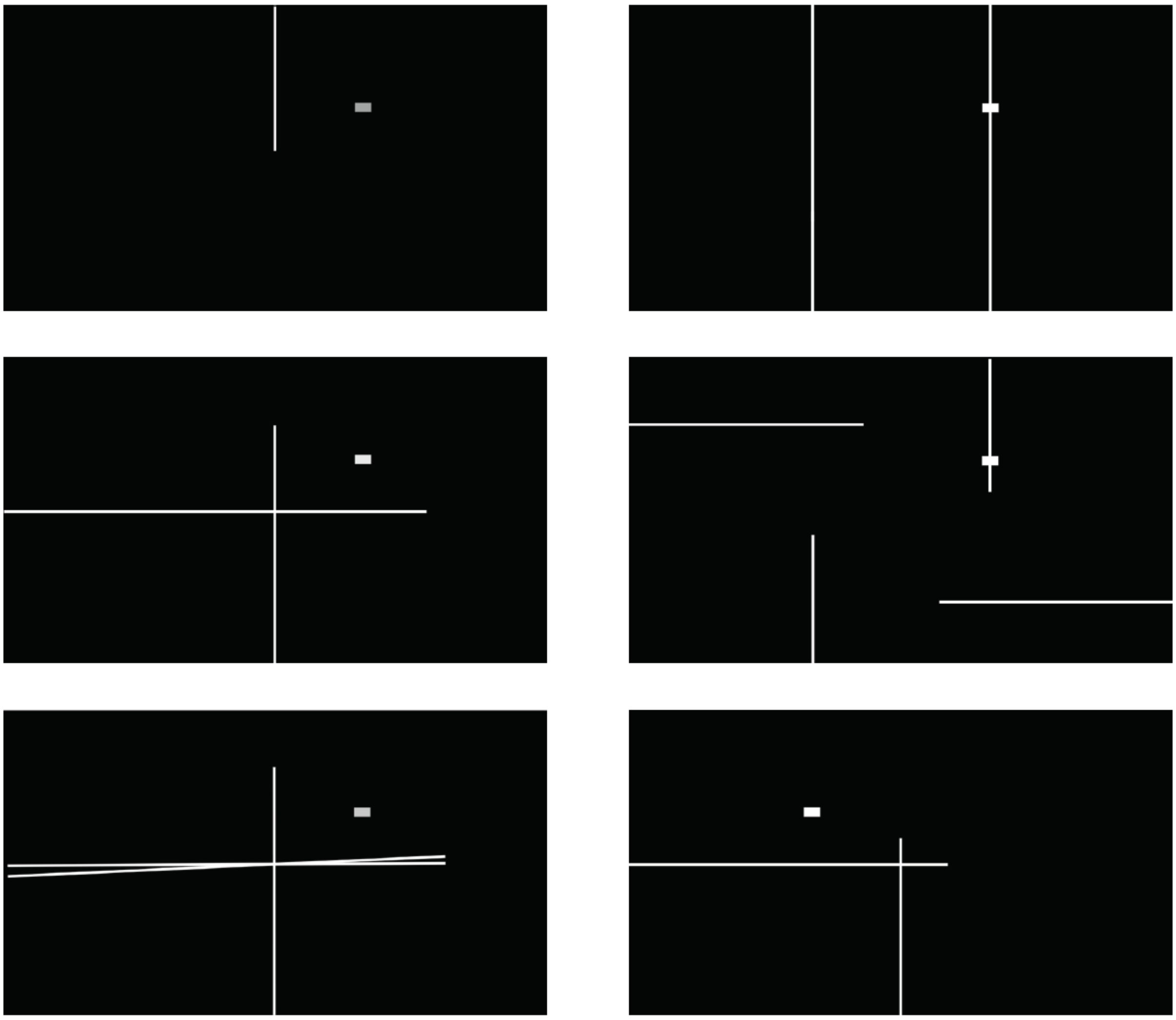


Figure B8. Examples from line-moving Interference tests

## Line moving interference: 36 studies

All 36 studies again, with a randomly flashing small white rectangle that changes from one side to the other and back, at points in exactly in sync with the animation (Figure B8). ‘Hold’ keyframes are used so that the rectangle cuts rather than animates. The rules are: the rectangle can move when vertical lines are level or touching the eye, or when horizontal lines have completely exited the screen, or when the lines touch in the middle of the screen. But the rectangle doesn’t always move and so increases the sense of anticipation: the lines are coming together; will it jump sideways or not? Figure B9 shows how the keyframes are scattered down the timeline, rather than obeying every instance when the rectangle could change position. The flashing rectangle draws attention away from the animating lines including when they are also randomly rotating. At points, it evokes eyes opening and closing, increasing the sense of animacy.

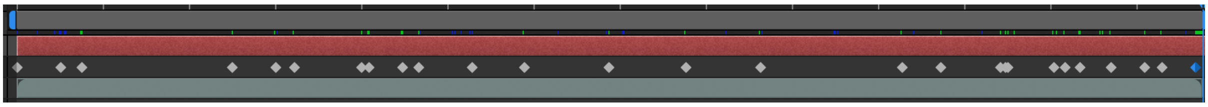


Figure B9. Timeline showing keyframes for position

**Key findings**

When a line travels through the centre of the screen with a black ground all around it, it is seen as moving through the scene. When any edge (top, bottom, left or right) is disappearing off-frame, the line flip-flops between travelling through and being wiped off by the black ground. In other words, there is positive-negative or foreground-background ambiguity and reversal (Figure B10).

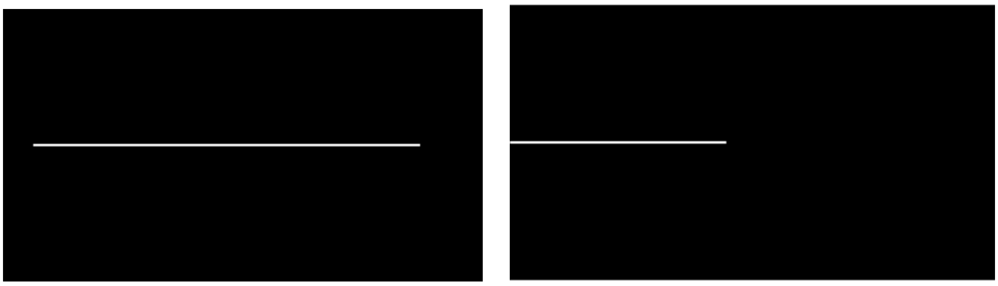


Figure B10. Horizontal line travel versus wiping off

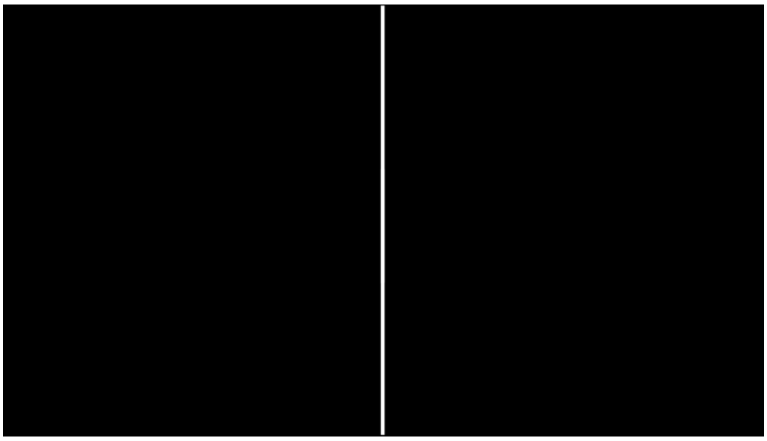


Figure B11. A static line creating tension

A static line or a hold on an empty black frame creates tension until it is broken with movement (Figure B11).

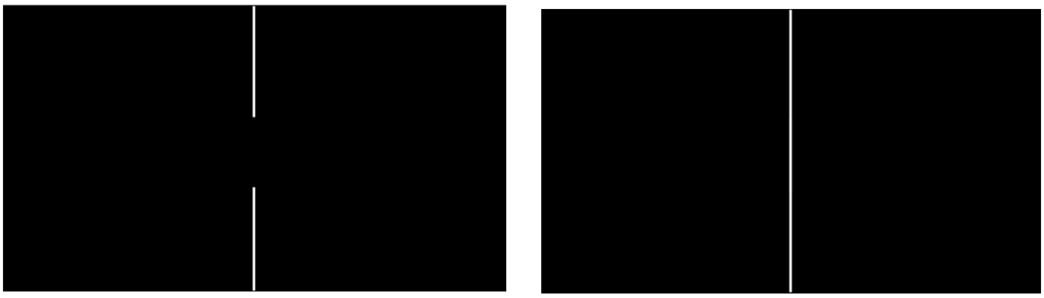


Figure B12. Seeing two lines and seeing one line

When two lines meet, they are seen as one line (Figure B12). And, conversely, when there is black breaking the white line, there appear to be two lines, rather than a growing line of black in the middle.

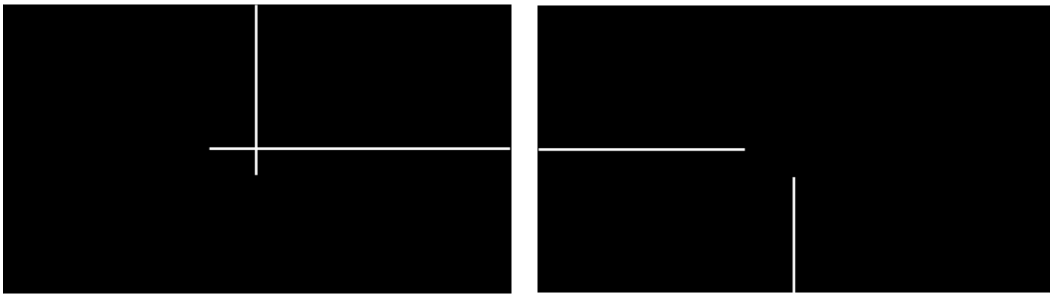


Figure B13. Positive and negative shapes following each other

If a shape, such as a cross, has been formed, the negative of that shape is seen as the lines animate out of screen (Figure B13).

Figure B14. Lines attracting each other

When two lines pass each other, they are clearly parallel; when they are separated, the eye draws them into the centre of the screen (Figure B14).

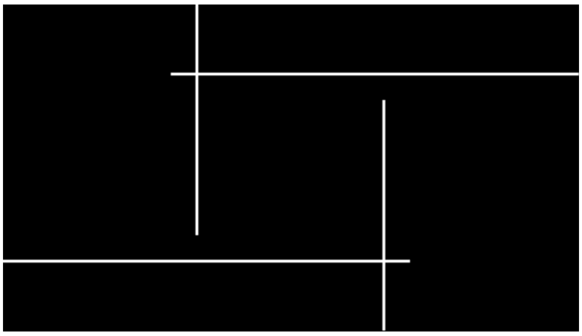


Figure B15. Tendency to create continuous motion, such as a spiral

When the lines are wider apart, they seem to spiral in and out; the symmetry makes a quasi-circle of the square (Figure B15).

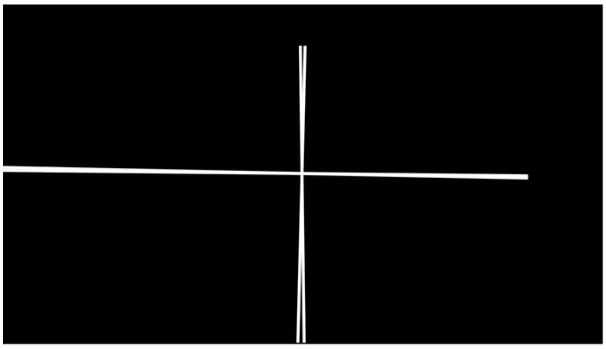


Figure B16. Animacy achieved through random motion

When the lines ‘jiggle’, i.e. randomly rotate (in McLaren’s terms ‘irregular motion’), they immediately gain animacy (Figure B16).

Figure B17. Fast lines with agency

Quickly animating lines seem to invoke the brightening: there is a sense of the lines having agency (Figure B17).

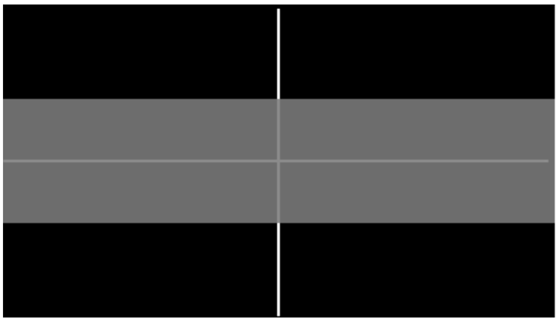


Figure B18. Lines sliding under the grey

The lines appear to slide under the grey. When the grey is at about 50%, the line is more transparent and seems thinner (Figure B18).

Figure B19. Optical meniscus effect where the lines cross

There is an optical meniscus effect where the lines cross, i.e. the eye does not perceive a straight line across where the tones change (Figure B19).

Figure B20. Smooth high-contrast lines; less-smooth transparency change

When lines travel very smoothly, one concentrates on the lines, and an optical effect occurs on the transparency change which is perceived as less smooth.

The higher contrast of the lines and their fast speed in relation to the slower changing of brightness plays into this effect (Figure B20).

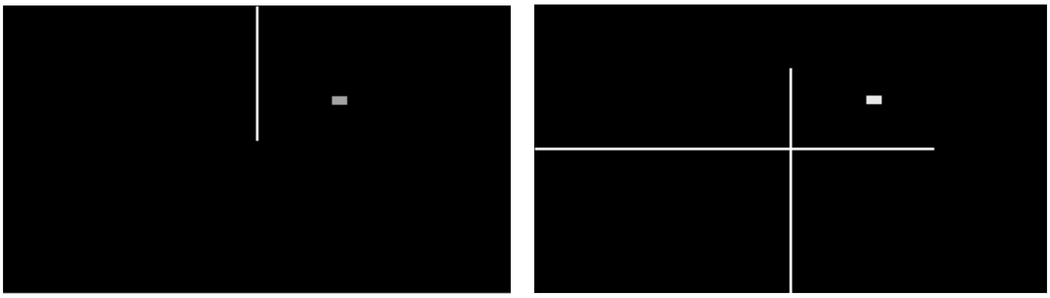


Figure B21. Pareidolia comes and goes

The pulse of the flashing rectangle grabs attention away from the smoothly sliding lines. The rectangle is read as an eye when the line could be a nose. If the rectangle is seen as an eye, pareidolia makes the marks resemble a face (Figure 21).

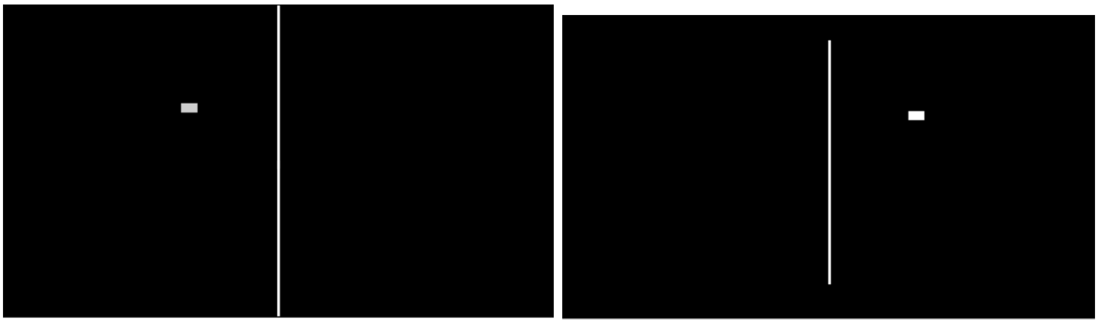


Figure B22. One eye or two eyes with one eye closed

As soon as the rectangle flashes on to the other side, a negative or closed eye is established in its absence, i.e. there appear to be two eyes, even though only one is seen at a time (Figure 22). This is reinforced by the rectangles being equidistant from the middle of the screen.

## B.4 Tonal studies

Klee's *Two Ways* (1932) creates a dancing effect; at first glance it appears to be overlaid rectangles but then it becomes clear that two overlaid spirals, one complex and one simple, were drawn and the spaces created were filled with carefully measured tone. This creates both an illusion and a unique bridge between line and tone. I analysed the shapes and created an analogue of the original using transparent rectangles. Norman McLaren defined change as 'change in the amount and colour of light within an otherwise static screen' (McLaren et al., 2002, 94). As McLaren noted, animators usually combine change with motion. In *Tonal Study 001*, there is change without motion, whereas *Tonal Study 002* uses constant motion to bring the rectangles on and off screen (Figure B23).

*Tonal Study 001* (duration 1 minute) is an animation of the rectangles from 0% to 15% transparency, layering up from the largest to the smallest; then, once they are all present, dissolving off the largest down to the smallest.

*Tonal Study 002* (duration 1 minute) is an animation of the transparent rectangles from off-screen to on-screen, layering up from the largest to the smallest; then, once they are all present, holding for five seconds and then animating off the largest down to the smallest.

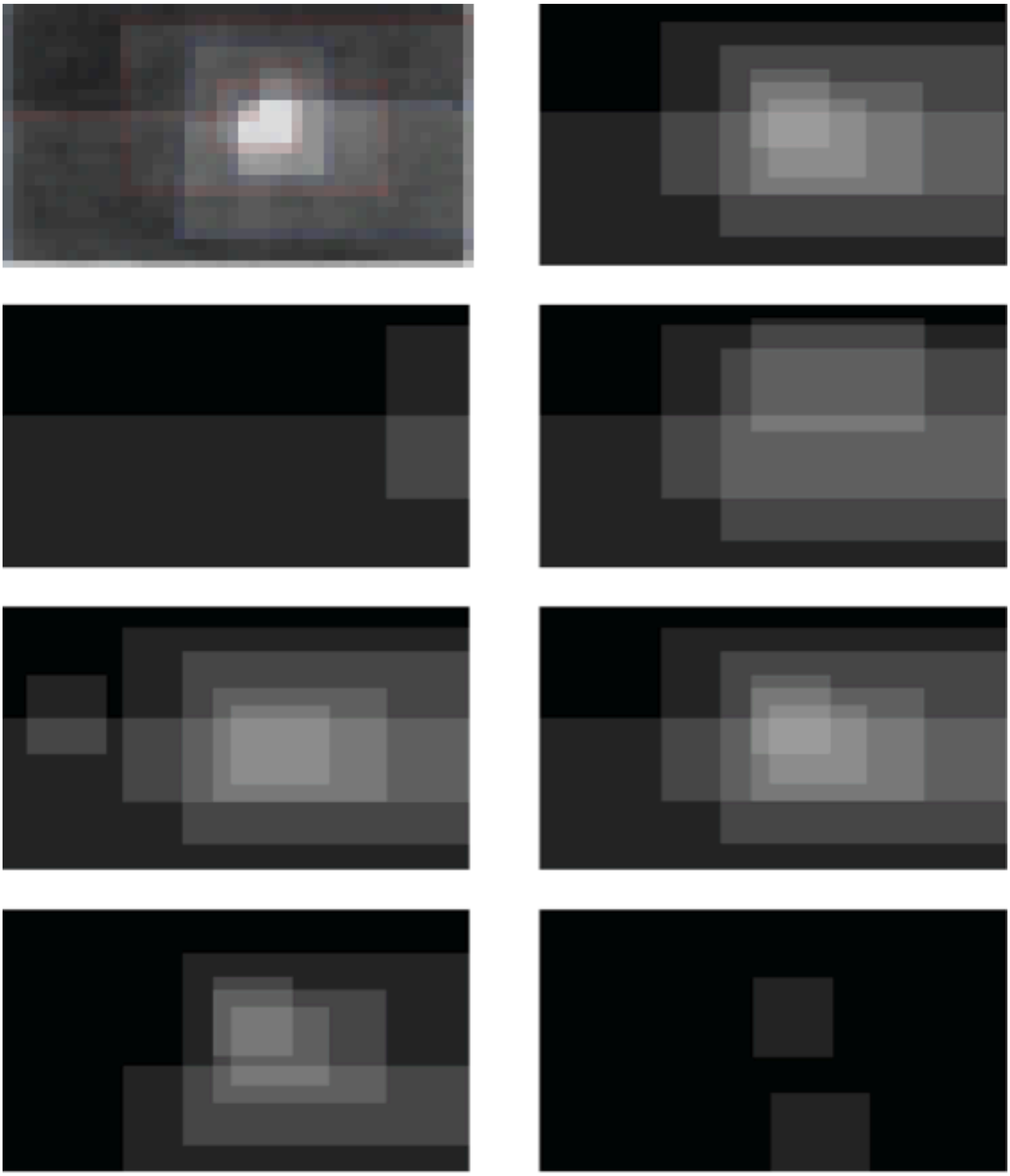


Figure B23. Stills from *Tonal Study 001* and *Tonal Study 002*

**Key findings**

*Tonal Study 001* keeps the unique bridge between line and tone and reveals nuances of tonality as the shapes dissolve up and down. However, it is somewhat static. In contrast, *Tonal Study 002* is dynamic: multiple compositions are created as the transparent tonal rectangles slide in and out. Both *Tonal Study 001* and *Tonal Study 002* have been created digitally, with a clean precision. This emphasises the aspects of formal composition and nuances of areas of exact tones overlaid in multiple combinations. It loses the painterly watercolour textures of the original, however, and the mathematical, idealised nature of the digital tones is highlighted by the contrast. There are ways to soften this effect, to blend in painterly textures (see *Horizon*) or to break it up into mark-making textures (see *Continuous Punctuation*), or to obscure the layers by adding feathered edges. But, given that the original is a kind of illusion based on line, the clean digital shapes seem appropriate in this instance.

## B.5 Colour studies

Klee's *Polyphonic Setting for White* (1930) is luminous; it is analogous to creating additive colours of light out of watercolour (Figure 37). The overall effect inspired a composition with overlapping rectangles using different blending modes – overlay and screen – that allow the underlying colours to affect the layers on top.

In *Colour Study 001* (duration 1 minute), the coloured rectangles animate into position with constant motion, building up over 30 seconds and then animate off (Figure B24).

In *Colour Study 002* (duration 1 minute), the first study is speeded up and layered over itself several times, reversed in time, rotated 180 degrees, slipped in time, and so on. This creates a faster and busier animation (Figure B25).

**Key findings**

In both studies, there are a great number of changes, too many to count, as the transparent rectangles with additive colours slide over each other. They come in and fit together like a puzzle, which is satisfying. It is impossible to visually disentangle the separate shapes from the completed whole, until a shape moves. The colours do not mix, no matter how fast and how busy the animation becomes. At the fastest point in the second study (busier animation), the colours have a sense of moving flow and the transparent rectangles seem to flock into place. Very many layers are needed to achieve this effect.

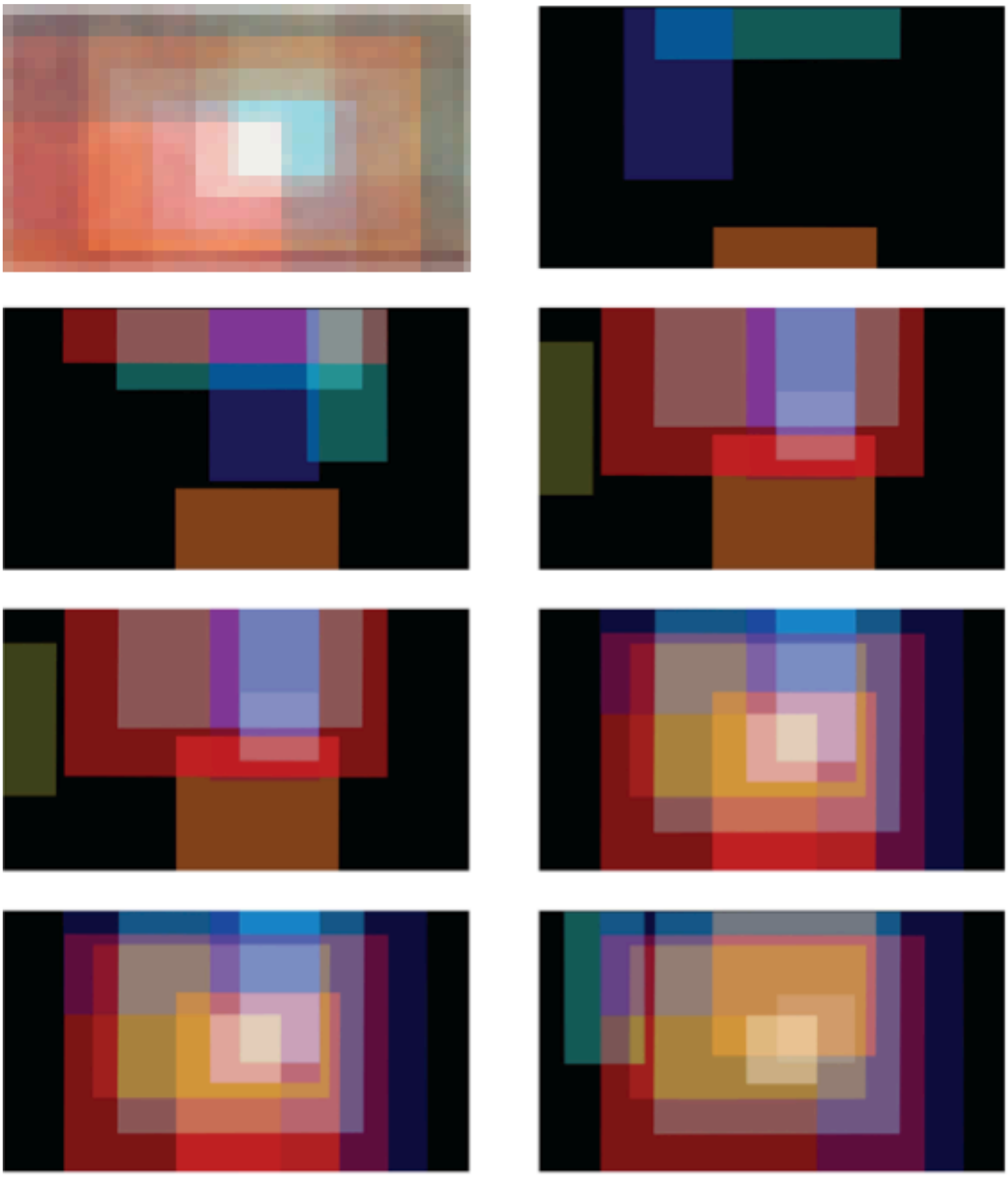


Figure B24. Klee's *Polyphonic Setting for White* (1930) (top left); stills from additive colour animation *Colour Study 001*

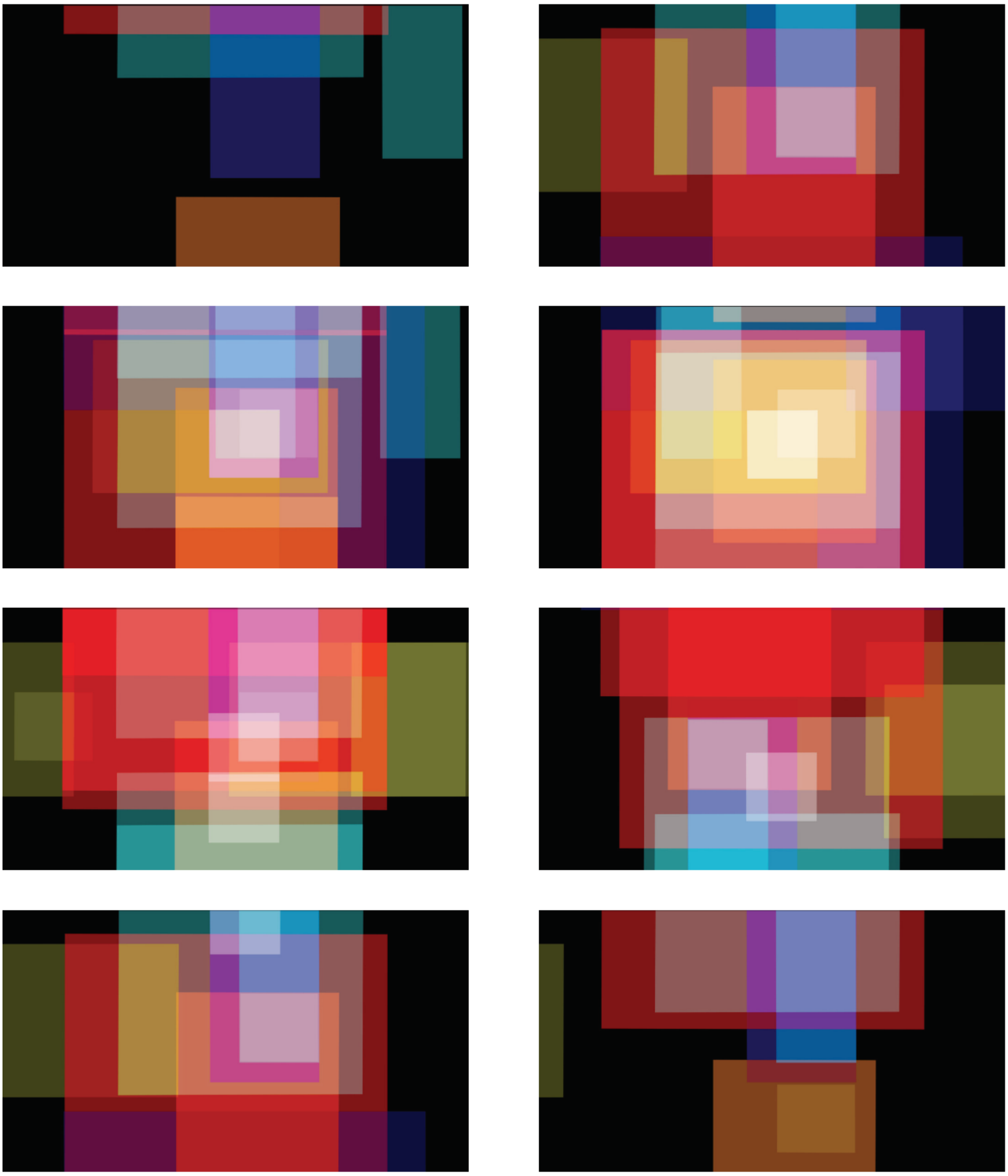


Figure B25. Stills from more-layered additive colour animation, *Colour Study 002*

# Appendix C: Development of *Singing Light 1*

## C.1 Key findings, Session 1

My starting point was to create a horizon line. The line is given substance by the haze, which has its own texture and density (Figures C1 to C3).

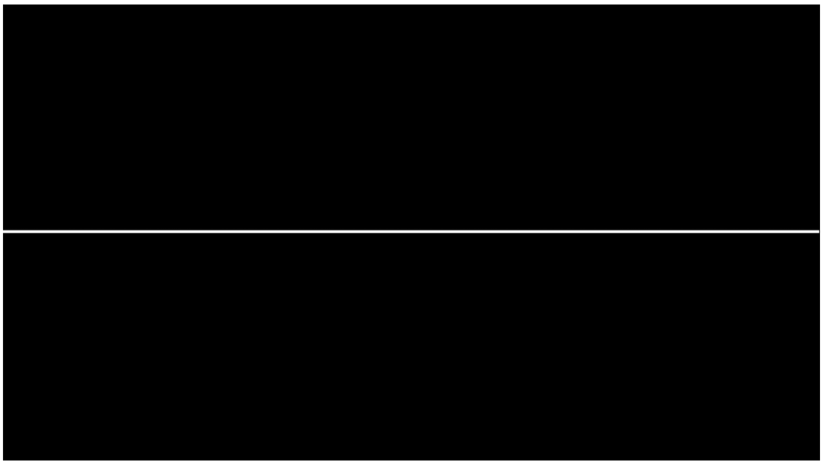


Figure C1. Projected line

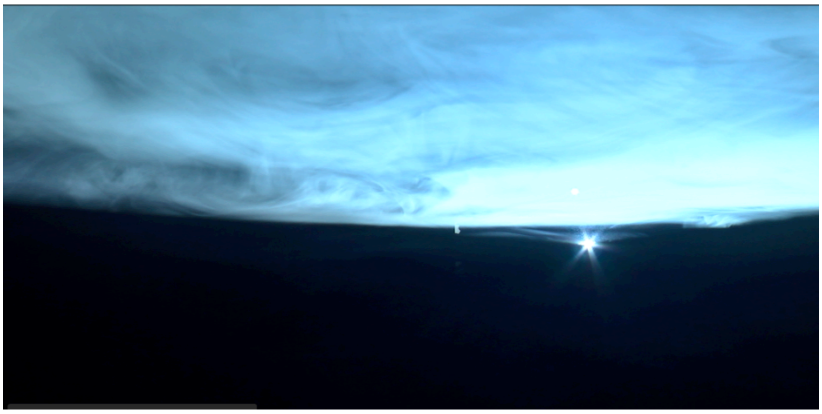


Figure C2. Looking back at the projector

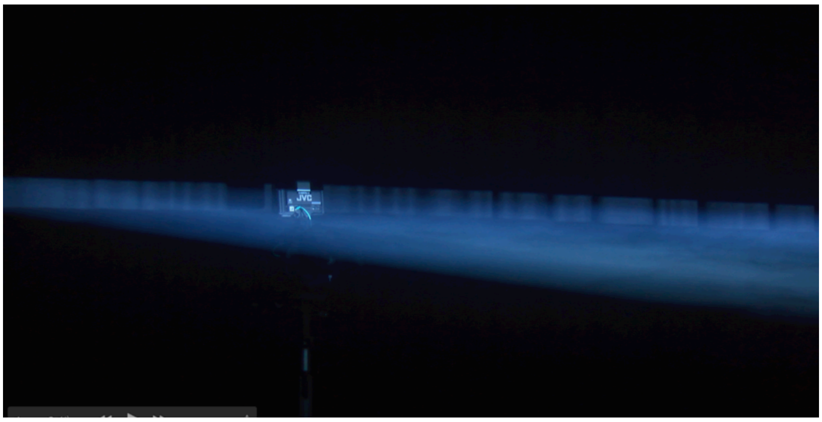


Figure C3. Looking across the projected line away from the projector

I tried projecting many lines with different characteristics, in part influenced by Klee (Section 2.3.3): from the straight to the knobbly-organic, from the curved to the angled, thick lines, thin lines, one line and many lines (Figures C4 to C7).

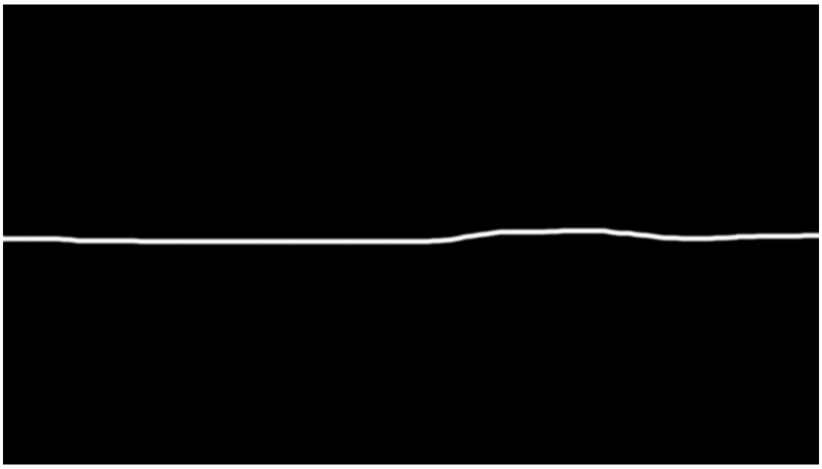


Figure C4. Knobbly-organic line

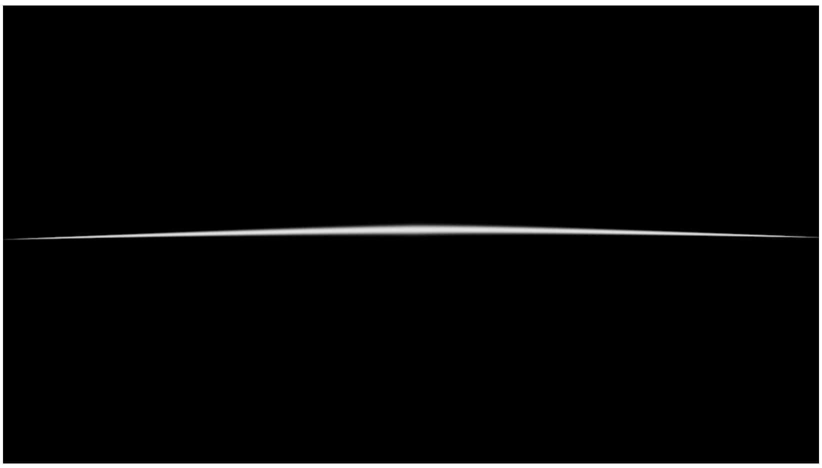


Figure C5. Curved line with varying thickness

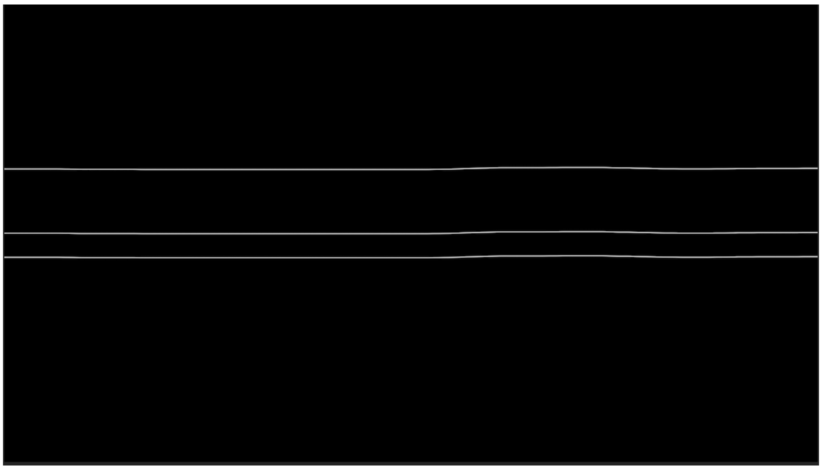


Figure C6. Many lines

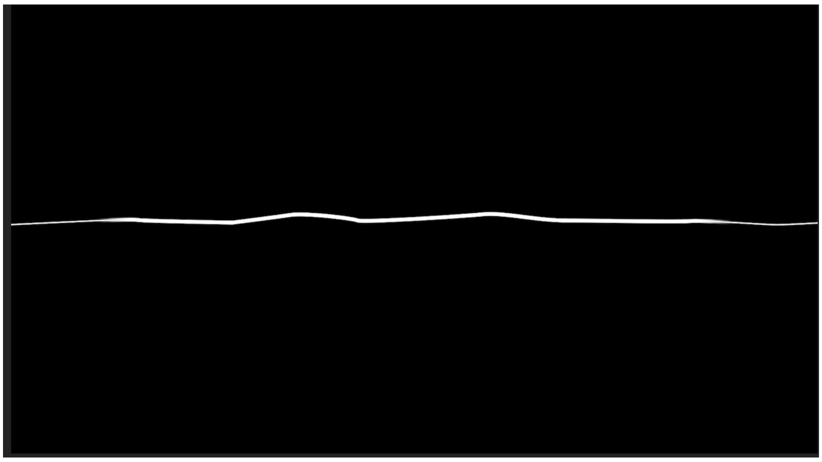


Figure C7. Angular line

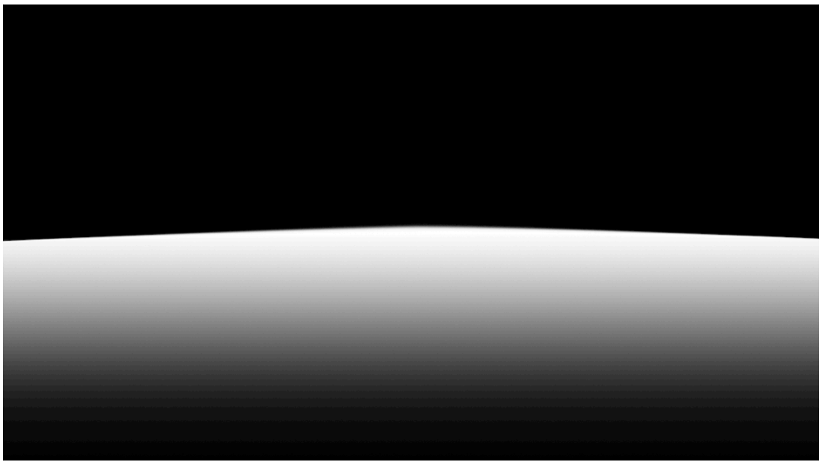


Figure C8. Graduated plane

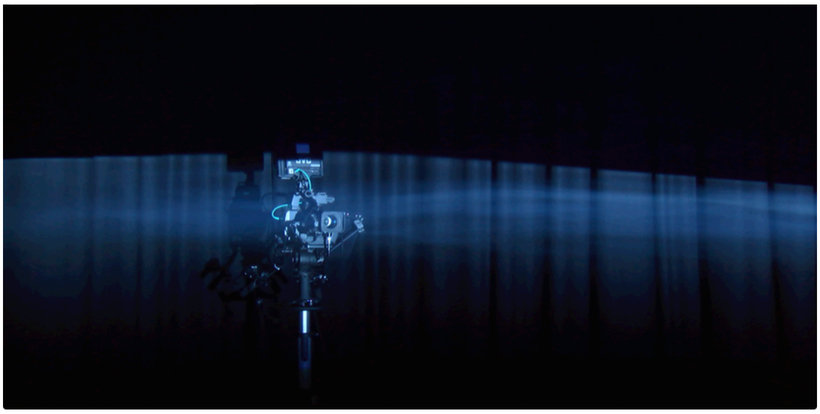


Figure C9. Graduated plane projected through haze

A wide graduated plane dissolved-off the projected light. This, in combination with the hard leading edge created a cut-edge and a drop-off. The graphic style did not read well in real 3D-space (Figures C8 and C9).

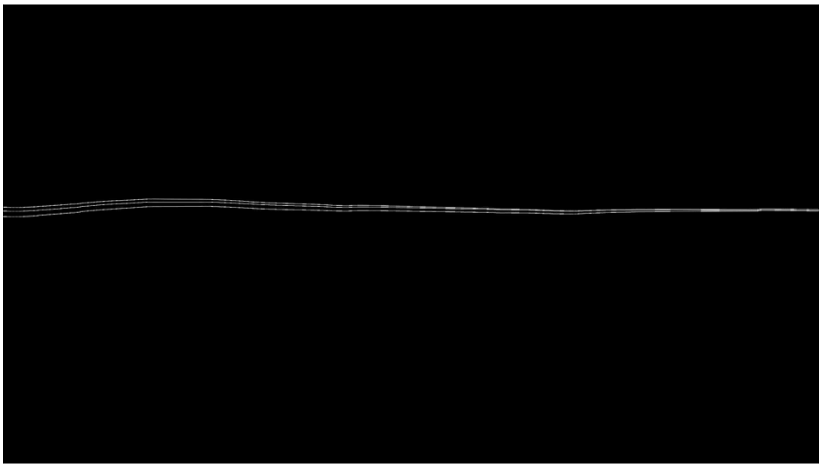


Figure C10. Fine lines animated


Figure C11. Fine lines projected through the haze

Figure C12. Thicker lines also acted as cutting lines

The projections showed the great variety of the animated lines. However, the lines did not evoke a horizon line but a cutting line, or blade of light, as they cut the through the space *and* across the spectator-participant's body (Figures C10 to C12). Testing lines allowed the definition of lines with optimum thickness and brightness. One parameter at a time was given limits. These were used when testing other shapes. Shapes, both hard-edged and soft were tested and colour-mixing was explored.

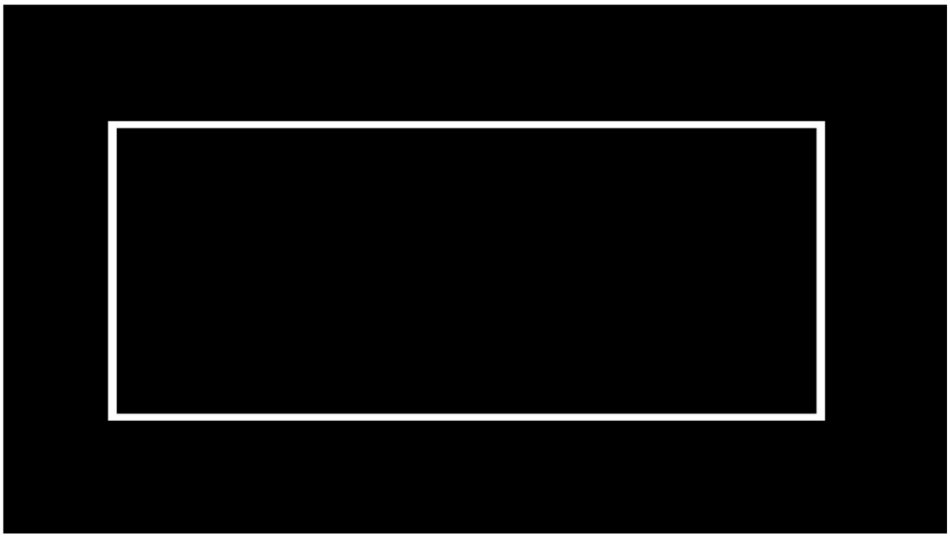


Figure C13. Rectangle animated

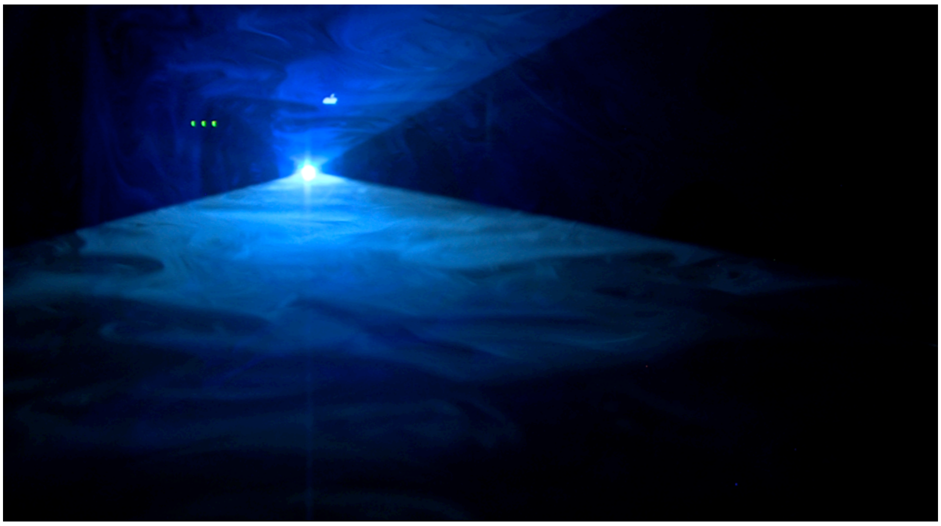


Figure C14. Rectangle through the haze

Geometric shapes were tried: triangle, square, circle, rendered in line and fill, and with both hard and soft edges (Figures C13 and C14). The hard-outline shapes created a sense of space, scale and volume. The projected volume creates spaces within the environment for the spectator-participant to step in and out of.

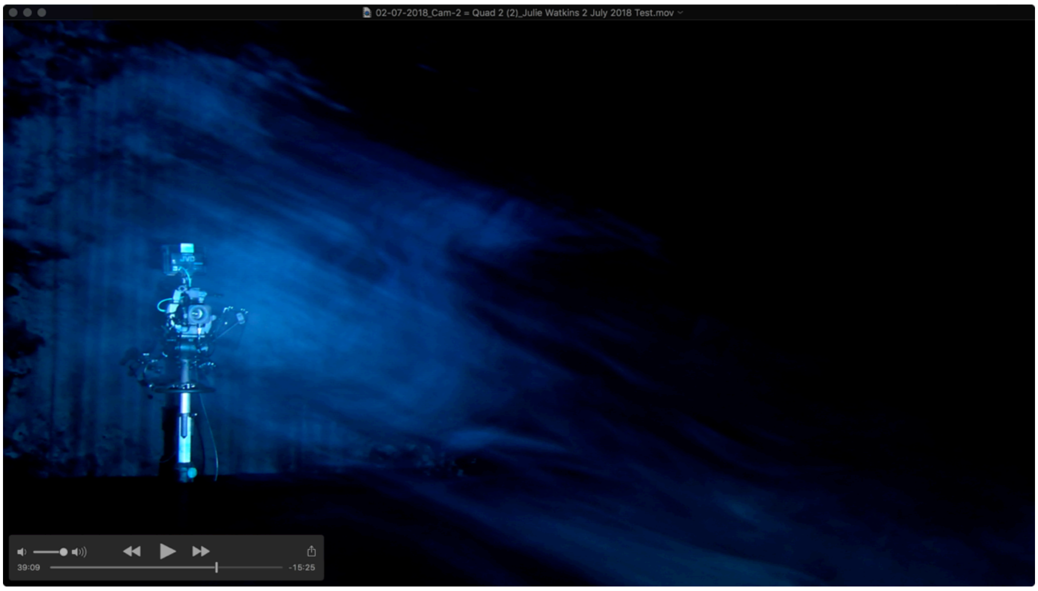



Figure C15. Projection of moving textures

Softer moving textures were projected: a moss wall and waves. Their nebulous shapes were made more vague in the changing haze, resulting in colour drifting in the haze (Figure C15). The sense of space, scale and volume was lost.


Figure C16. Colour-blending in the haze, using two projectors stacked vertically

By using two projectors stacked vertically, playing different-coloured animations, the colour begins to blend in a new mode of colour mixing (Figure C16). But the concept of a colour hanging in space with a separate horizon line, i.e. planar projected depths, is not achieved.

# C.2 Key findings, Session 2

The geometric shapes gave the greatest sense of space in the haze. I augmented this by draping five long flags of white paper from ceiling to floor to produce bright focal points that receded into the distance. This gave visual cues to multiple planar depths, contrasting with the nebulous depth created by the haze (Figure C17). The depth cues remained clear with projected colours, geometric shapes (Figure C18), and even textural projections such as *Water*. Using *Water* integrated the nebulous shape of the haze, and the strong verticals of the flags showed up especially well, evoking an underwater forest (Figure C19).

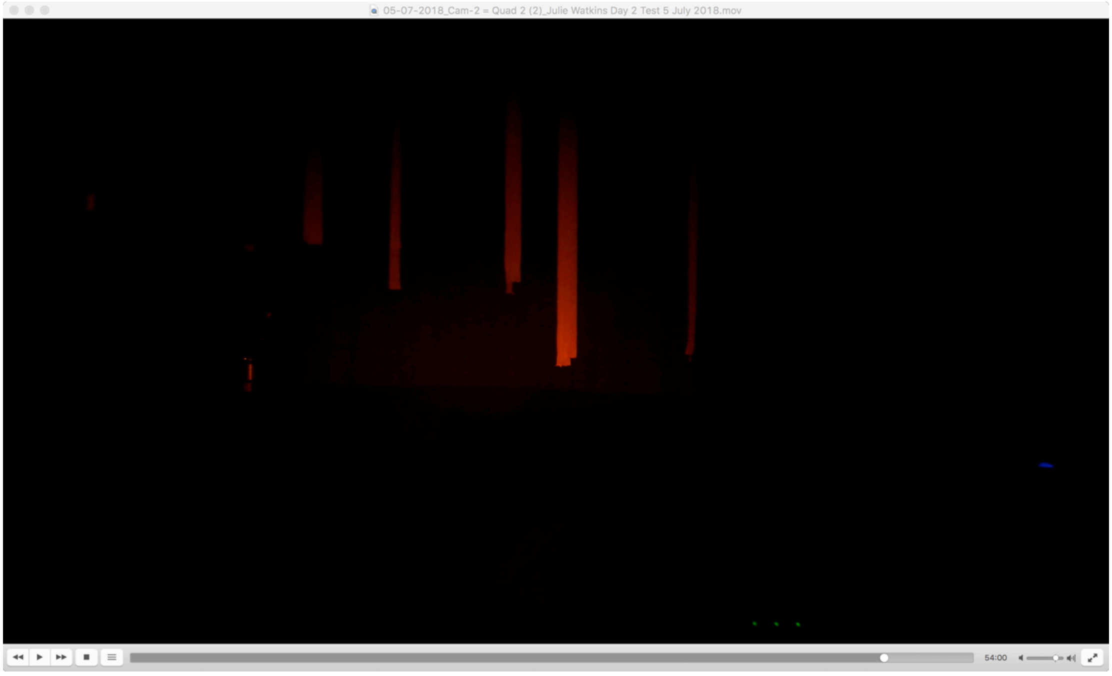



Figure C17. Projecting *Volumetric Colours* in the space, flags picking out the colours


Figure C18. Projecting *ShapeAnimation*

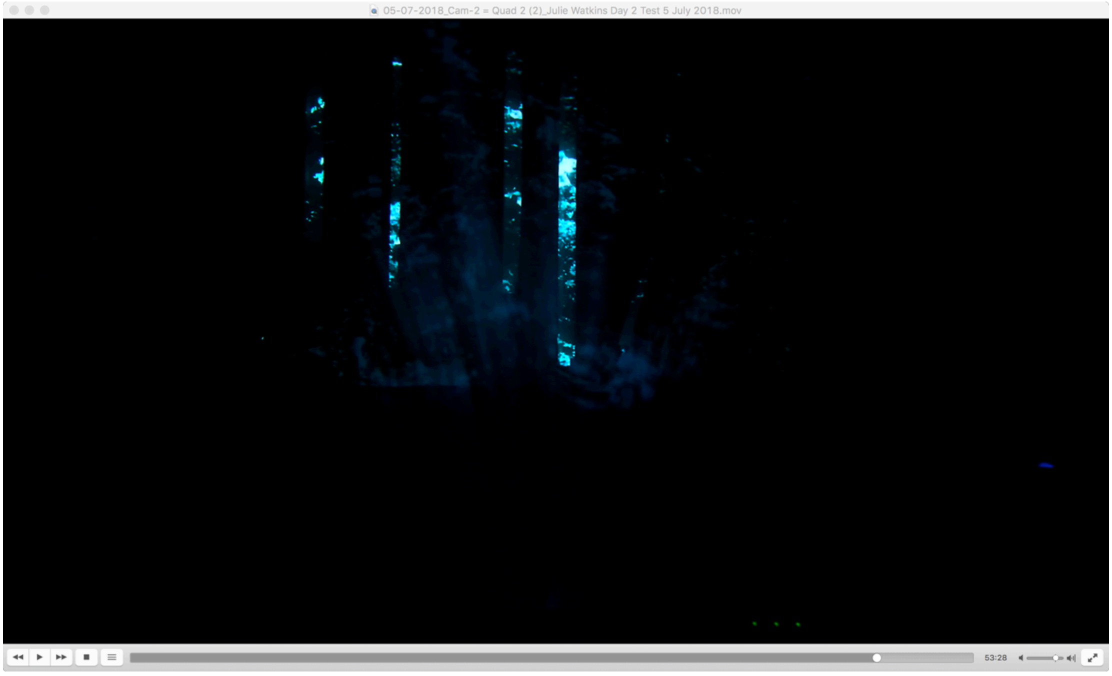


Figure C19. Projecting *Water*

## C.3 Key findings, Session 3

Reflections on the works of Wilfred and McCall and the results of the first session gave rise to developing a piece that has a flow of changing coloured light in motion. This explores volumetric light that would be impossible to create if the light were physically shaped, i.e. the images morph as only animation can (Figures C20 and C21).

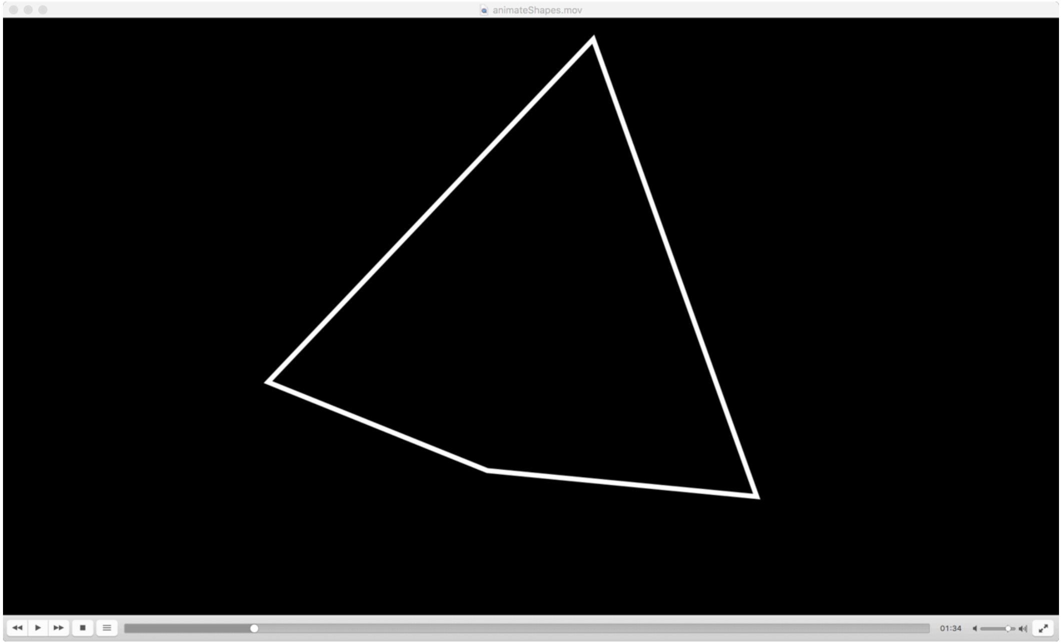


Figure C20. A triangle fluidly morphing into a square – impossible to achieve with metal barn-doors (from *AnimatedShapes,* 2018a)

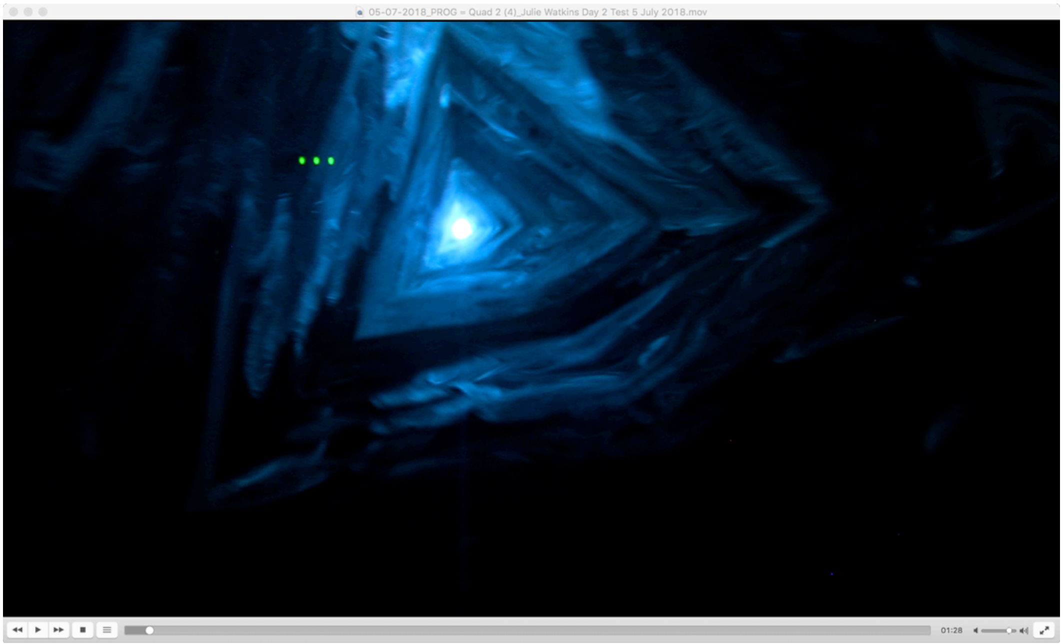


Figure C21. Looking towards the projector through the haze

Klee's dividual-individual shapes were explored. Circles were divided and augmented with rotating circle segments, thus integrating hard-edged linear 'dividual' elements with the smooth cone (Figures C22 and C23).

Figure C22. Testing dividual-individual shapes: *RingSegments* projected in the haze, looking back at the projector

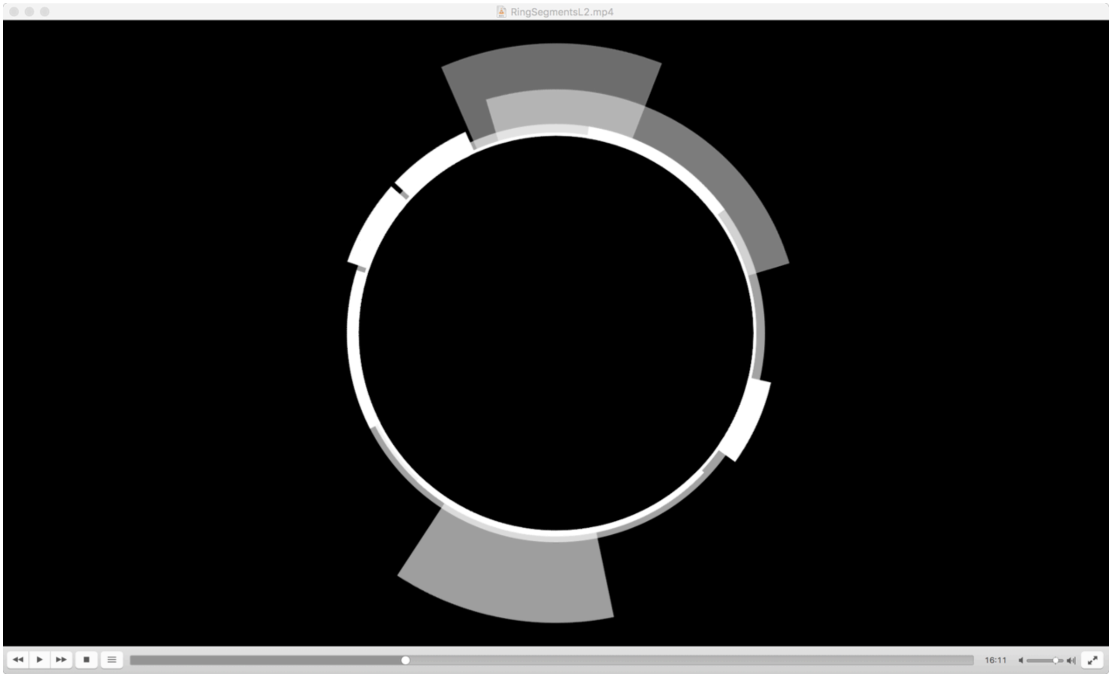


Figure C23. *RingSegments* animation

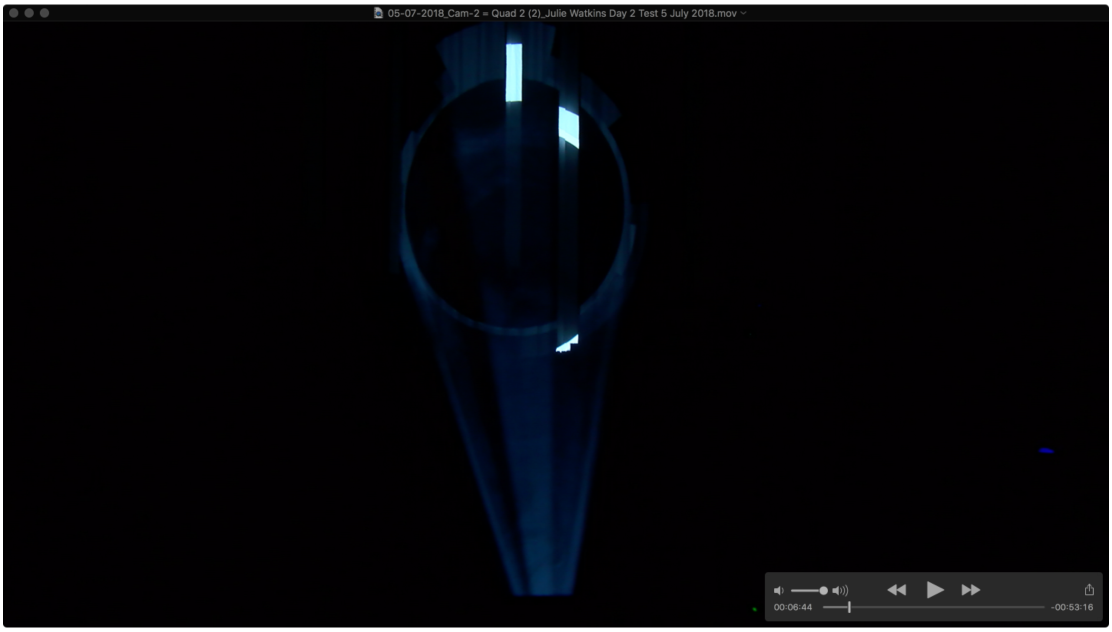


Figure C24. *RingSegments* projected in the haze and highlighted by flags

The projection was also broken into planes, using flags. This created a more definite sense of depth (Figure C24).

Rectangles were divided and augmented by animating smaller rectangles (Figure C25).

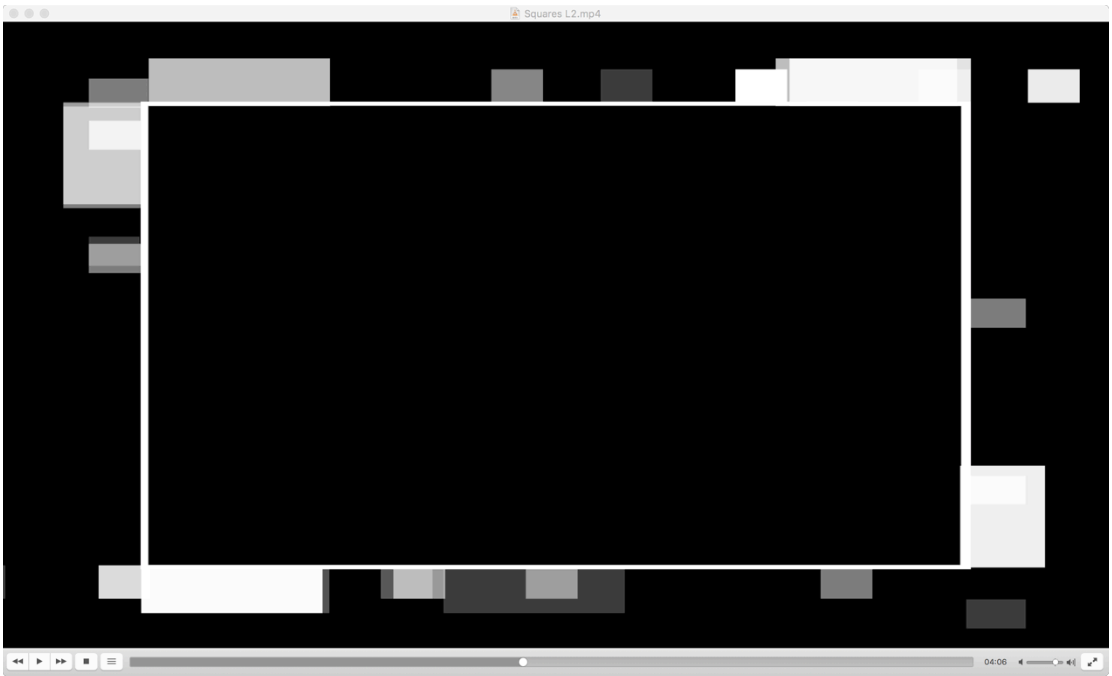



Figure C25. *Squares_L2*

Both shapes were tried in colour, as a form of projected colour-mixing. The rings were tried with closer hues (Figure C26) and the rectangles with a rainbow of colours. The swirling colours began to show colour-mixing (Figure C27).

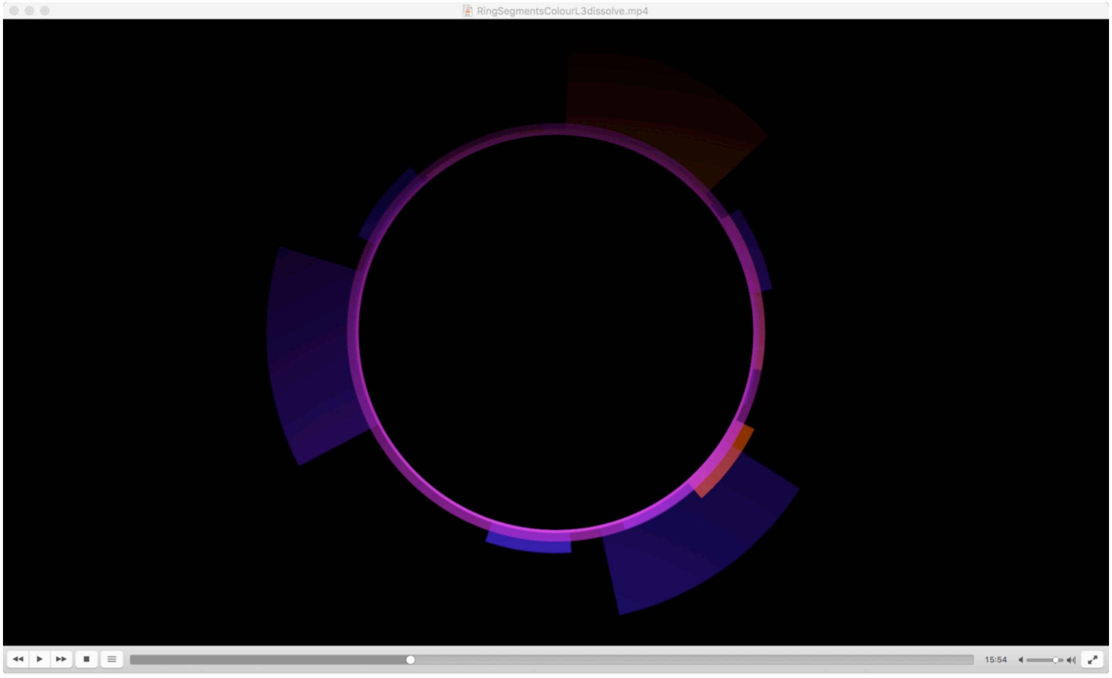


Figure C26. *RingSegmentsColourL3*

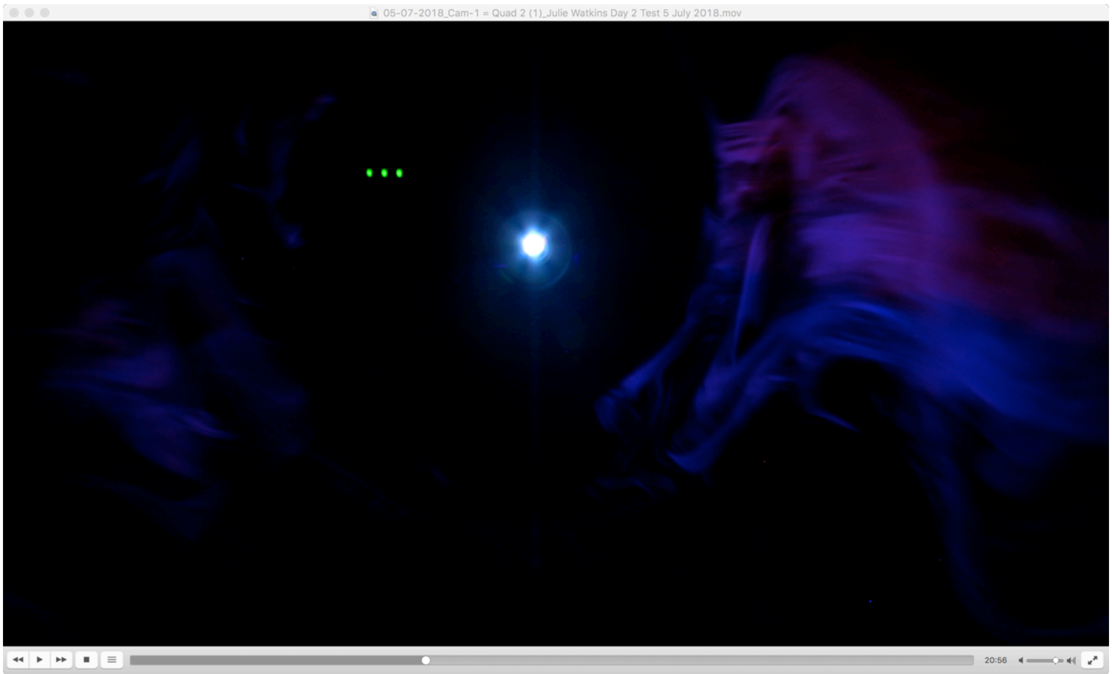


Figure C27. Projected into the haze, the colours swirl

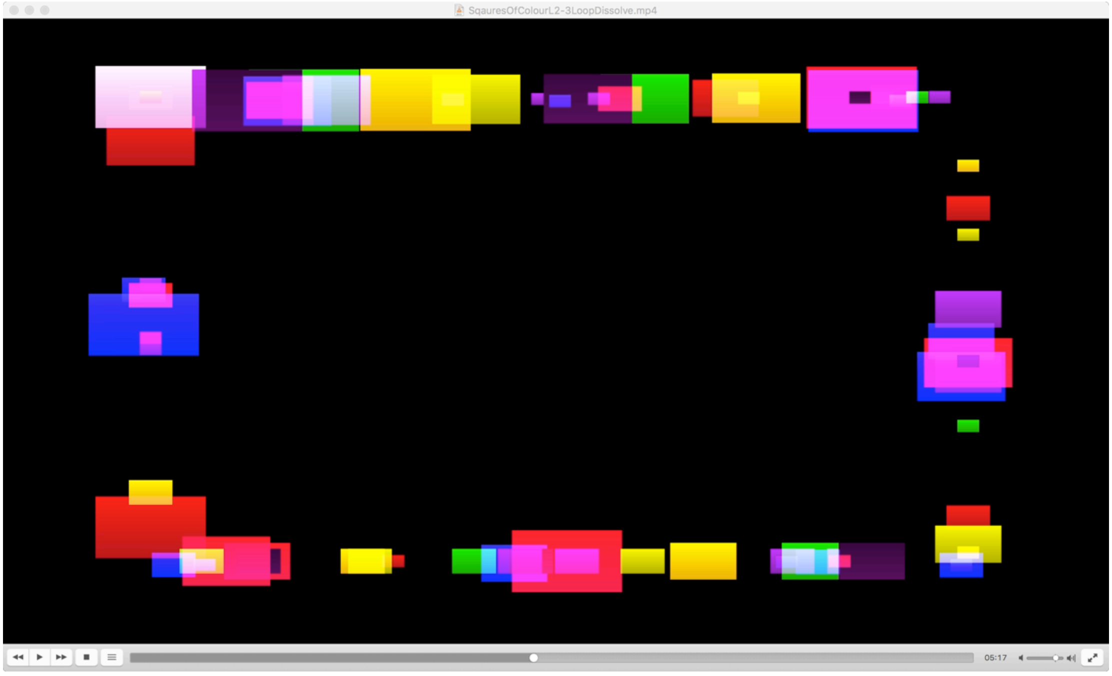



Figure C28. *SquaresOfColour_L2*

The colours are layered together in screen mode so that they affect each other as the layers slide over each other, building in brightness (Figure C28).

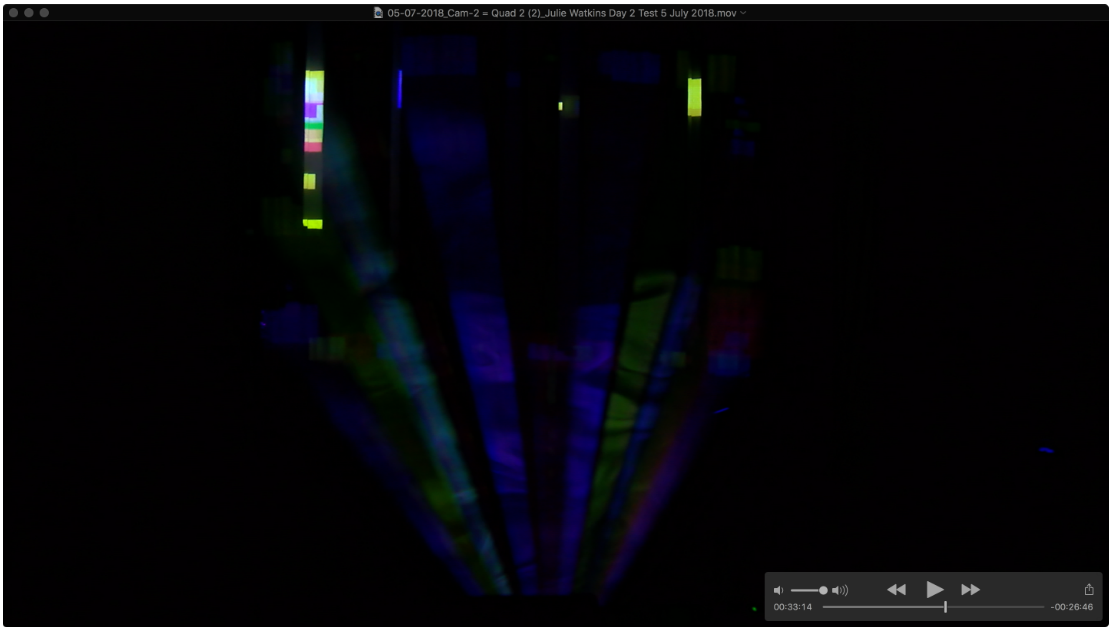



Figure C29. *SquaresOfColour_L2* projected in the haze and highlighted by flags

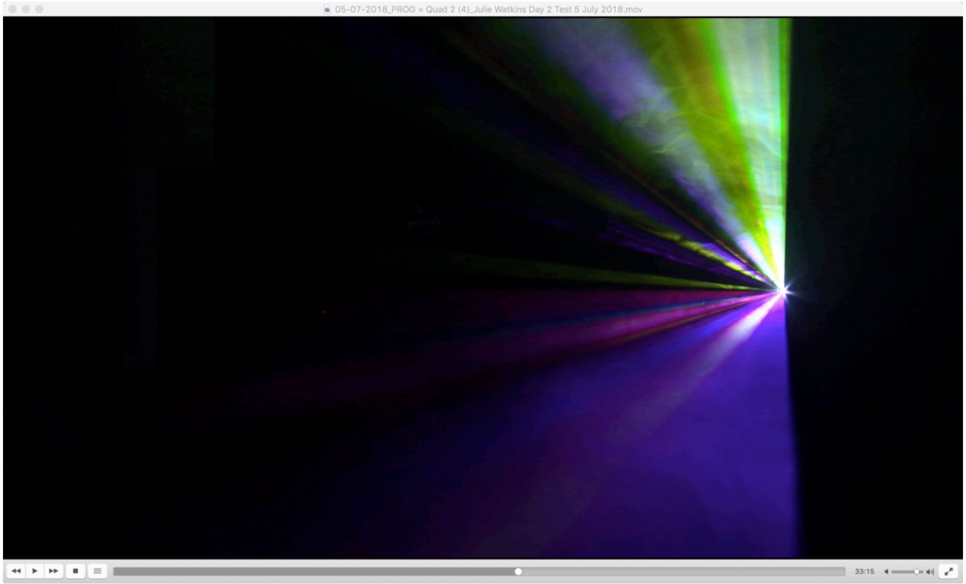


Figure C30. *SquaresOfColour_L2* looking back at the projector from off-centre

The broad colour palette in the transparent overlapping rectangles does not mix in the same way as the colours in the ring (Figures C29 and C30).

As in Klee's work, the interplay tonal density, seen here as degrees of opacity and transparency, brings the animation to life by giving endless variations in a manner analogous to the ever-changing play of dappled shadows, or caustic light ripples (which have similarities to Wilfred's lumia).

Unlike the close-hued swirling colour-mixing of the rings, the broad range of hues in the rectangles gives very limited colour mixing. The transparent colours sliding over each other add interest, but this broad colour palette is not giving the nuance tested when animating rectangles similar to those in Klee's *Polyphonic Setting for White*.

Integrating hard-edged linear 'dividual' elements within the smooth cone was successful. Using flags to create definite planes of depth, receding into the furthest distance, successfully increased the sense of depth overall. The fall-off of the projection by itself is more nebulous. The balance between the volumetric projection and the image on the far wall needs more investigation.

## C.4 Key findings, Session 4

I explored the balance between the volumetric projection and the image on the far wall. I created a wall of colour using a second projector behind a back-projection screen (Figure C31).

Figure C31. The two projectors pointing at each other with the projection screen between them (Front projector 13,000 lumens, back projector 3,000 lumens)

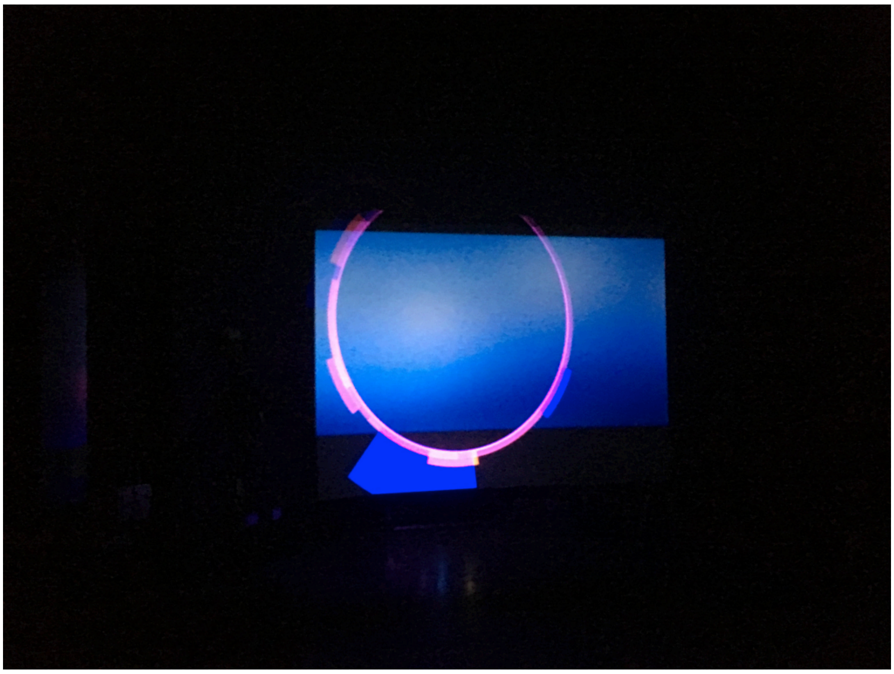


Figure C32. Separate front and back projections

The projections on the screen (front – ring, back – blue rectangle) dominated the space and the sense of volume and depth was lost (Figure C32). I removed the screen from the space and immediately the sense of volume was regained (Figure C33). Projecting onto the black walls allowed the colours to show in the haze.

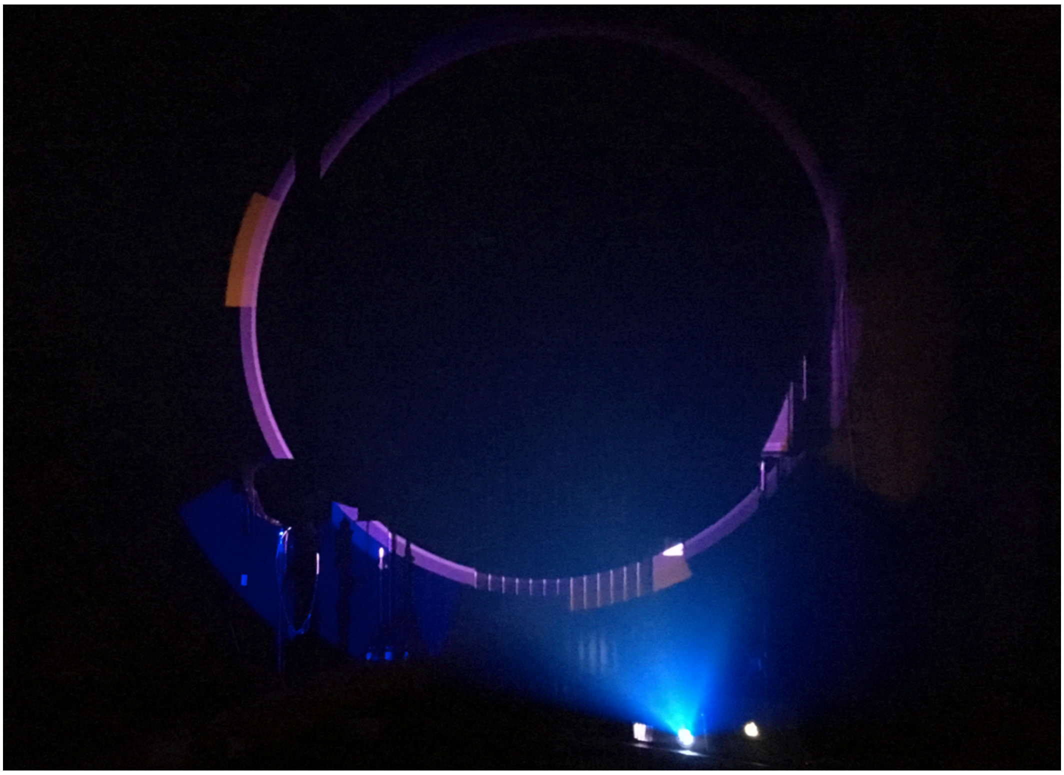


Figure C33. Projection on to black walls

I explored creating a horizon line and a separate blue frame, projecting the animations at each other (Figures C34 to C36). The white horizon line dominated and the frame disappeared. Textures such as *Water* were tried, to see if more full-frame colour would give the desired effect but the projection was too dim.

I animated the horizon line up and down within a blue frame. The three horizontal lines became the most dominant, the outer edges of the frame almost disappeared. Projection into haze of mid-tone colours is much less than half the brightness of white.

Figure C34. *BlueFrameHorizon*

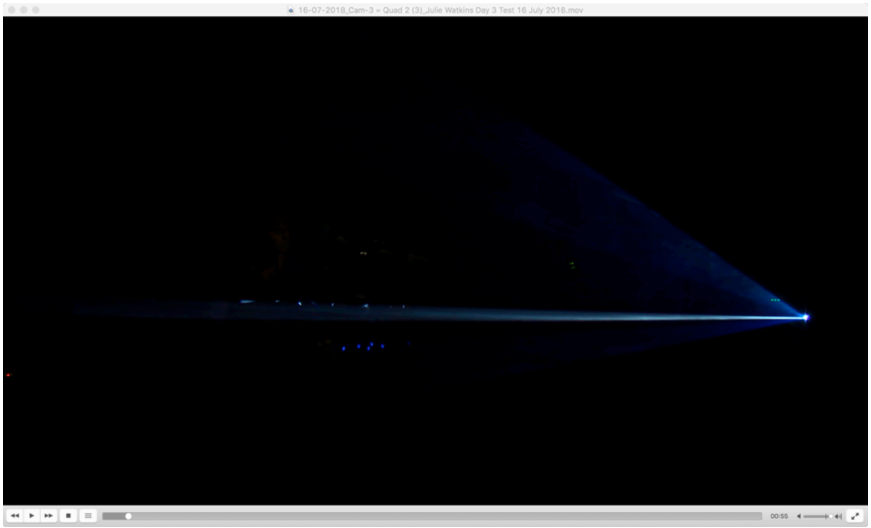


Figure C35. *BlueFrameHorizon*, projection from the side

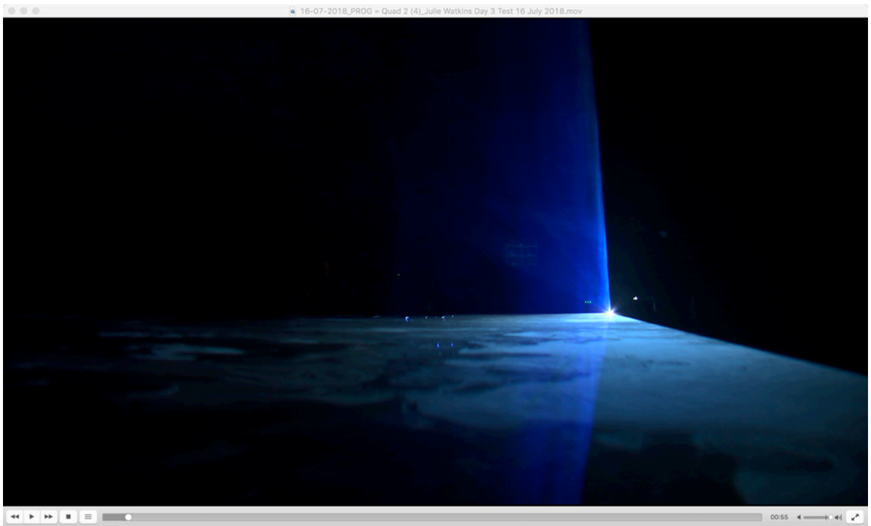


Figure C36. *BlueFrameHorizon*, projection looking back at the projector

From this angle (Figure C37), there is a sense of one colour overlaying another in the haze – the effect I was aiming at. However, this was the only angle that produced this result. This light interacts with the projected *BlueFrameHorizon*.

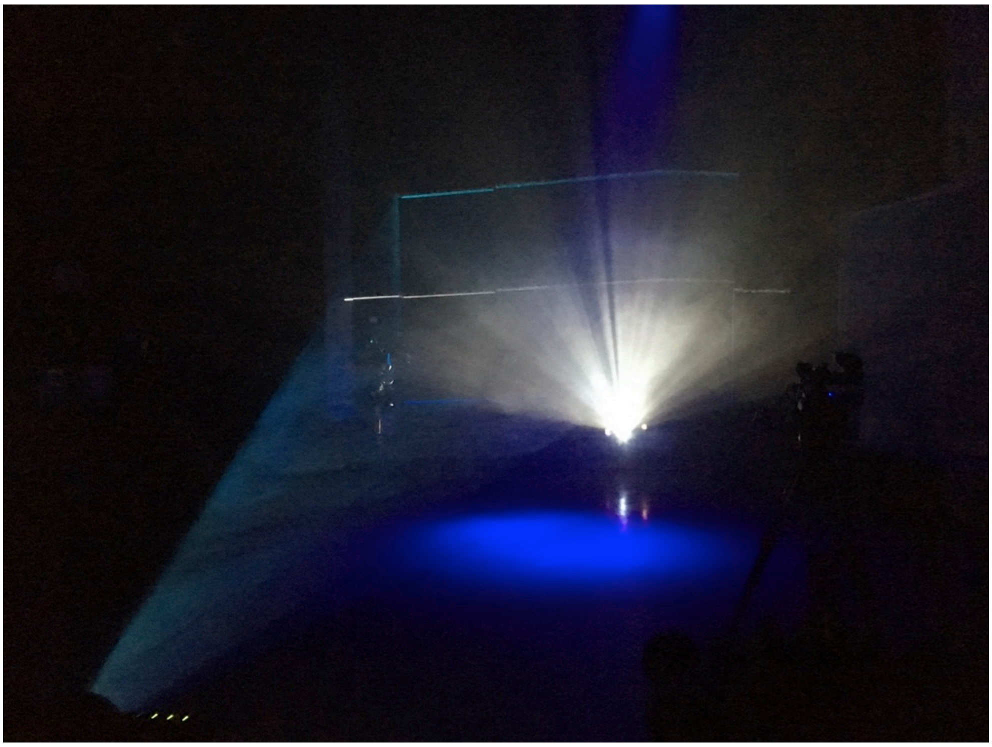


Figure C37. Projecting a blue studio light downwards into the haze

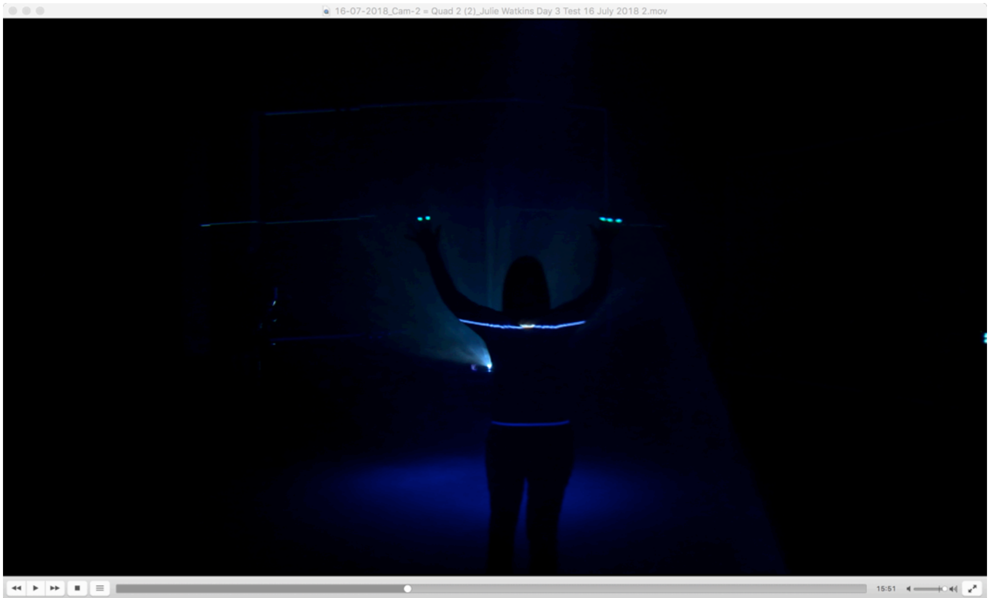



Figure C38. *BlueFrameHorizon* projection with blue studio light in the background

The three dominant horizontal lines cut across spectator-participants, the projection interacts with them and, in the volume projection, they have space in which to interact (Figure C38).

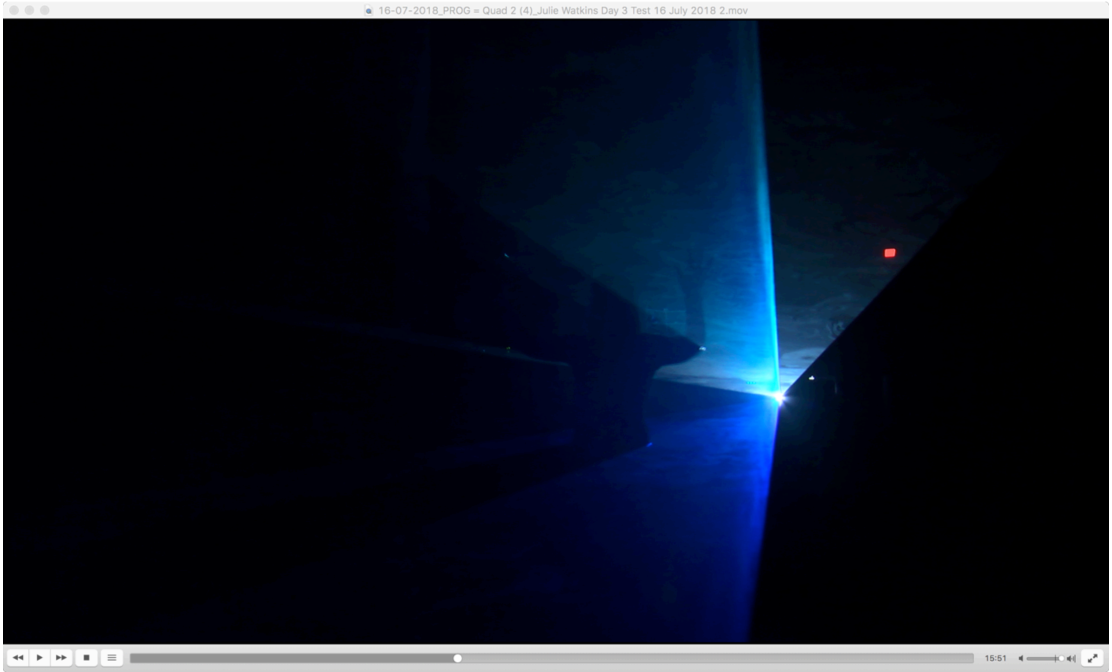


Figure C39. *BlueFrameHorizon* projection looking back towards the projector

With a Spectator-participant enveloped in the light (Figure C39).

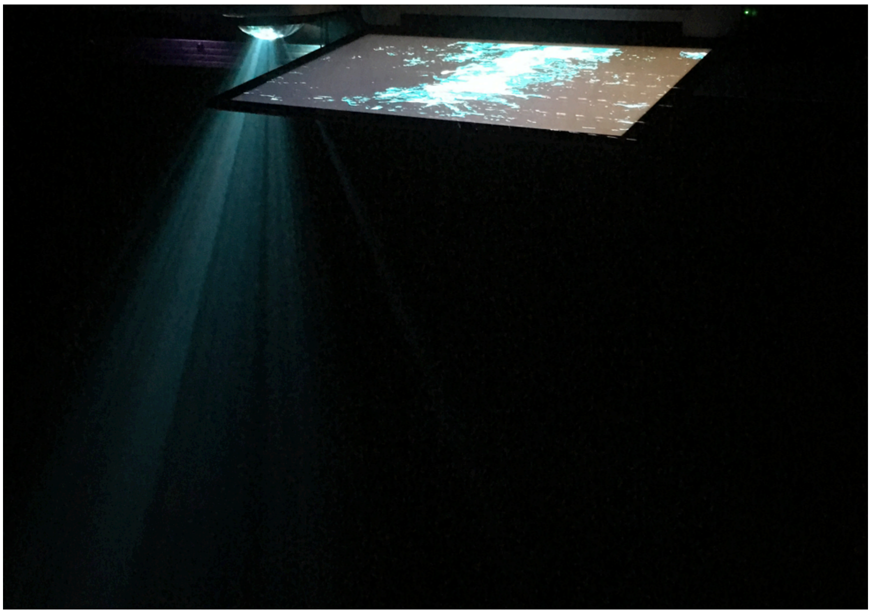


Figure C40. *Water* projected upwards

Using the full space by projecting vertically as well as horizontally, and looking up to the ceiling as well as across the space (Figure C40).

Figure C41. Using the full space, vertically as well as horizontally

The resulting projection evokes water or dappled shadows as it is broken by the shapes hanging from the ceiling (Figure C41). The broken planes of the ceiling, and random reflectivity, add more life to the projections.

Figure C42. Testing studio lights for adding colour

Moving from projected light to adding studio lighting for colour. Adding a red light with a gobo (Figure C42). The lights start to mix from some angles (Figure C43).

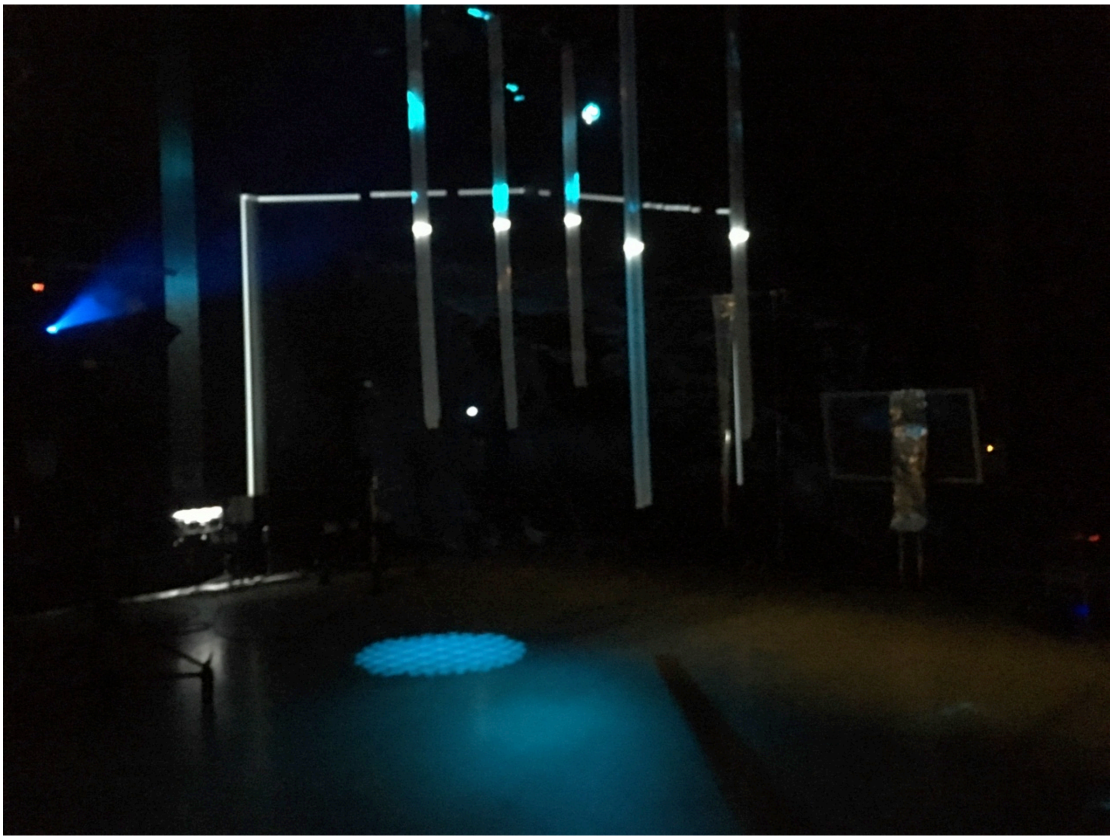


Figure C43. Integrating studio lighting into the projection

As shown in Figure C44, I used Datamoon lights [DM], two moving-head Martin Mac lights with start gobo pointing up at the wall [79] and lattice gobo down at floor [73], and Coemer moving-head 25% brightness blue wash pointing down at the floor [61].

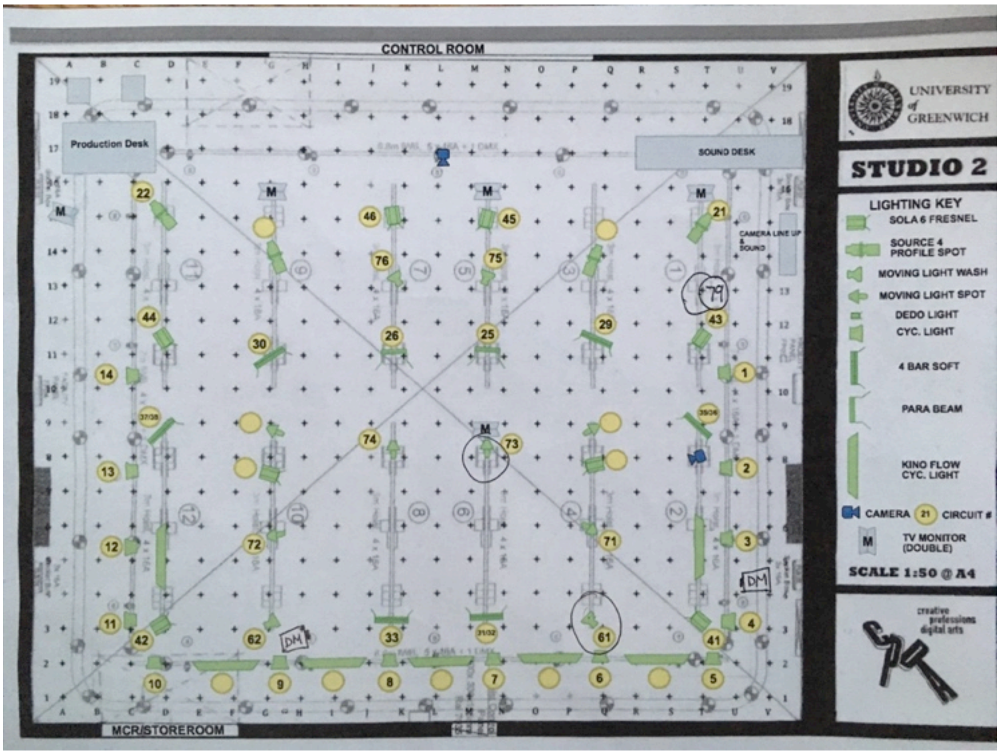


Figure C44. Lighting plan

The flags interact with the projection on the furthest wall, creating brighter chevrons of highlights and casting dark shadows that break up the animated shapes. The animation becomes multi-planar and deep space is created by the placement of the hanging flags. Given that looking at the screen is ingrained in the viewer, the screen needs to be pulled away from just being the back wall. I wanted it to become diffuse, created in the air and on the hanging flags, broken by the cast shadows of flags and the spectator-participants. Creating one integrated environment is also aided by ‘dimming’ the brightness of the projection on the wall by introducing the brightness of other lights (Figure C45).

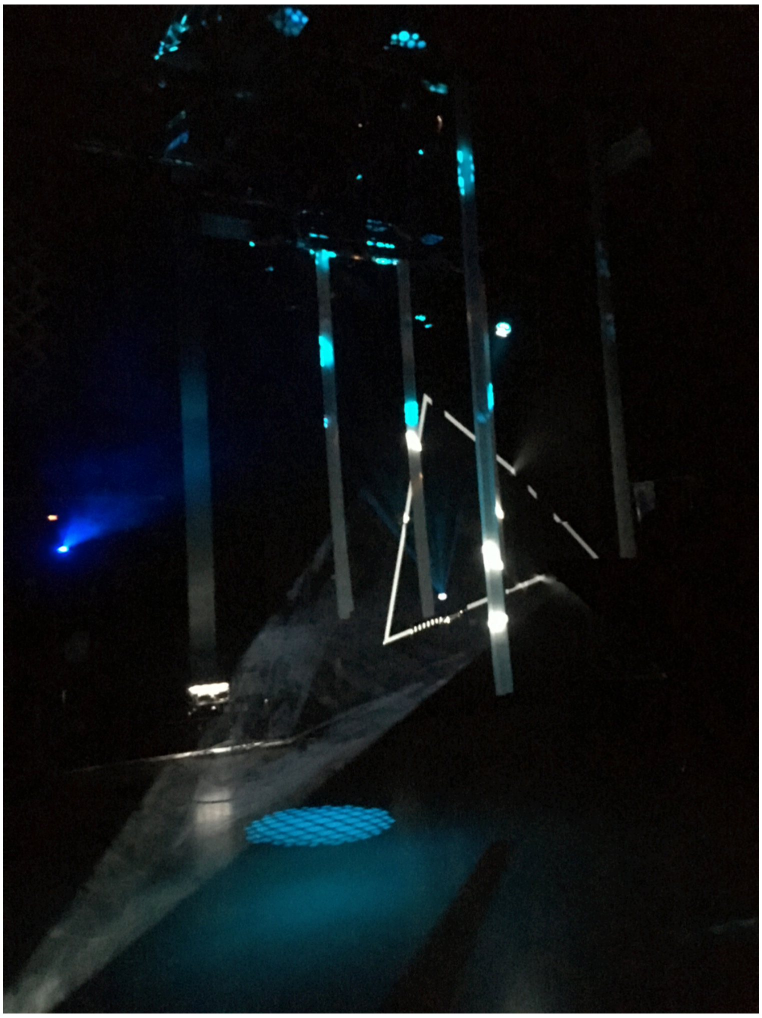


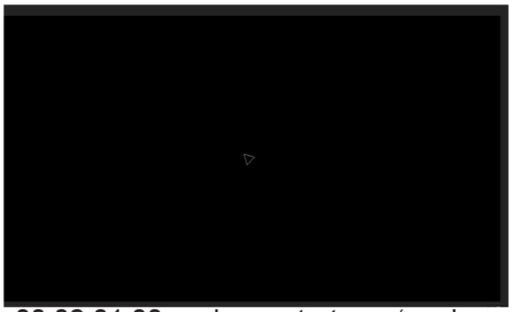
Figure C45. Creating an integrated environment

Figure C46. Entering or leaving the dark space, light from the doorway

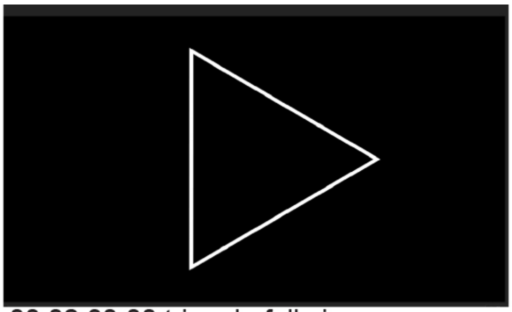
Looking back towards the projector as a spectator-participant enters the space. The light from the door and silhouettes of visitors entering and leaving will be part of the environment (Figures C46 and C47).


Figure C47. Close-up of interacting with the projection

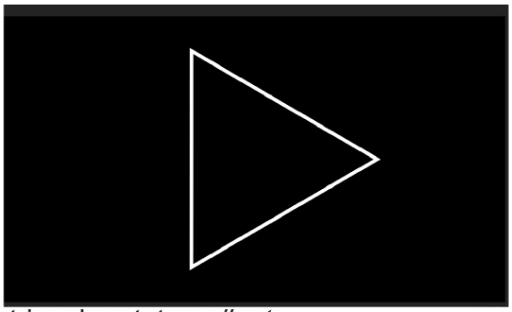
I created a loopable, hour-long animation, *AnimatedShapes* (2018). I created animated-image-audio units by consistently associating certain sounds with particular animations (Figure C48).



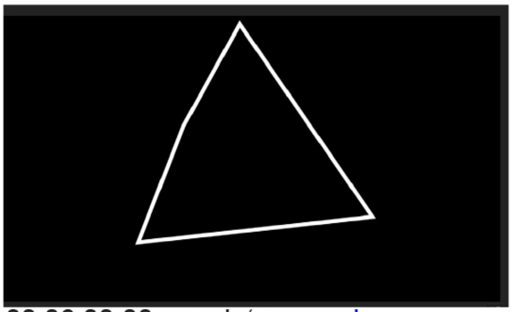
00.02.01.00 scale-up starts on ‘ooo’



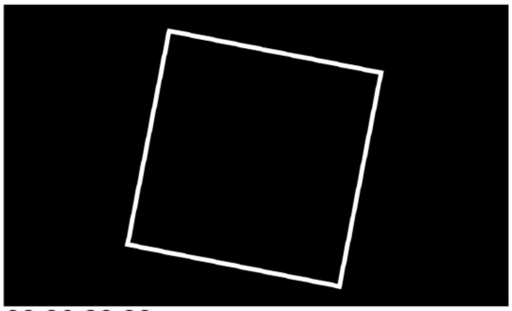
00.02.30.00 triangle full size



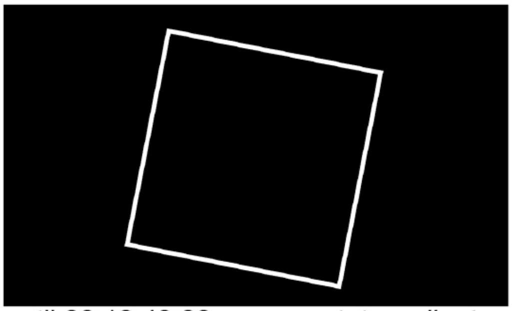
triangle rotates *silent*



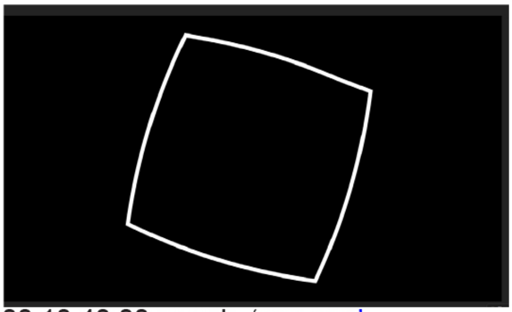
00.06.00.00 morph ‘zoo-ooz’



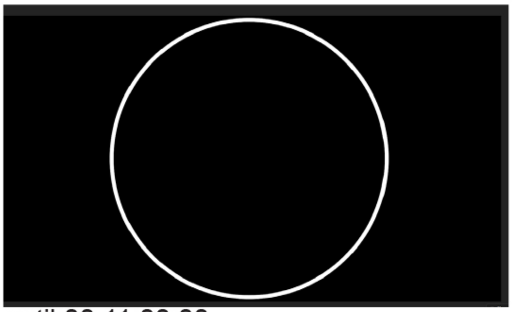
00.06.20.00 square



until 00.10.40.00 square rotates *silent*

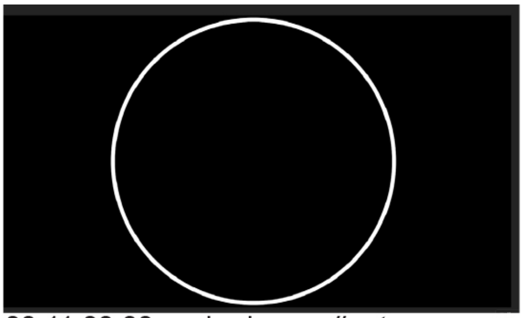


00.10.40.00 morph ‘zoo-ooz’

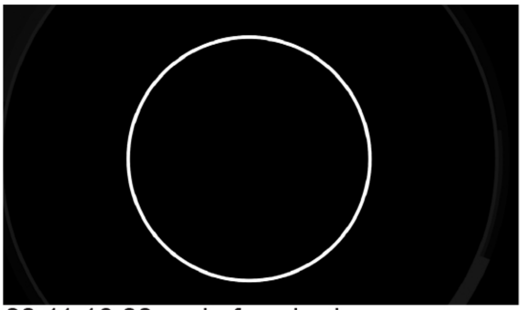


until 00.11.00.00

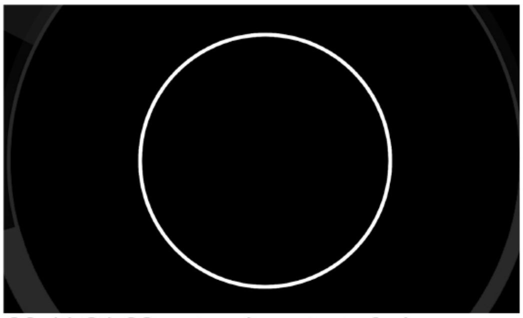
Figure C48. Keyframes from *AnimatedShapes* (Watkins, 2018a)



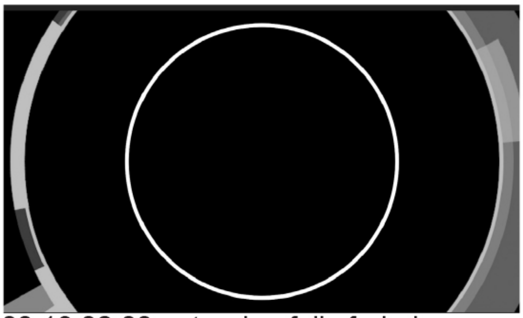
00.11.00.00 scale-down *silent*



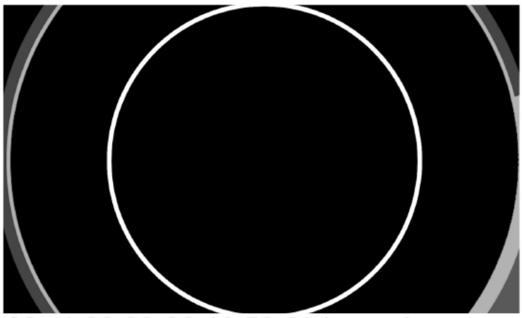
00.11.16.00 end of scale-down



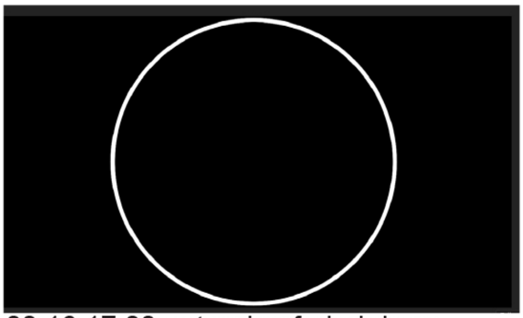
00.11.01.00 outer ring starts fade up overlapping with inner ring scale *silent*



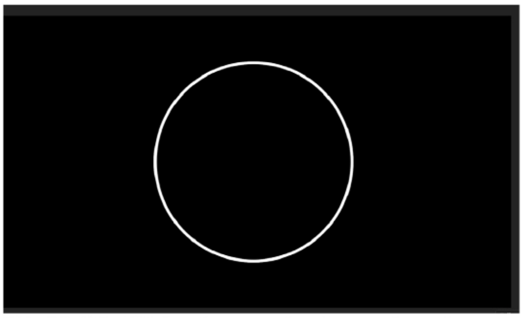
00.13.02.00 outer ring fully faded up (75%) *silent*



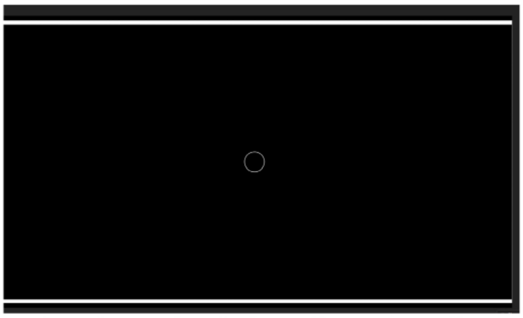
00.11.20.00-00.13.58.00 inner ring slowly scales up *silent*



00.16.17.00 outer ring faded down inner ring slowly scales down *silent*



00.16.21.18 faster scale-down 'ooo'



rectangle scales in from the edge of frame *silent*

00.16.28.00 rectangle static *silent*

00.17.18.00 draw-off, ‘ooo’ on each line

00.20.38.00 draw-on, ‘ooo’ on each line

00.21.58.00-00.23.02.00 static rectangle, *silent* (just over 1 minute)

00.23.02.00 shake-out elements ‘voo-oov’ gets louder

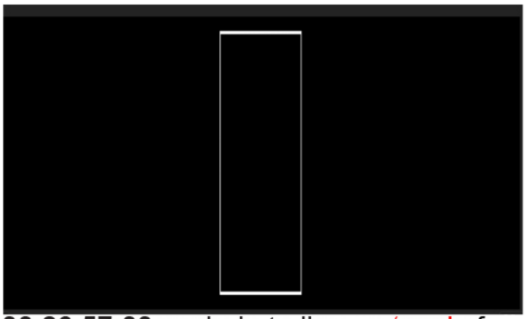
00.23.21.00 shake-back elements ‘voo-oov’ gets quieter

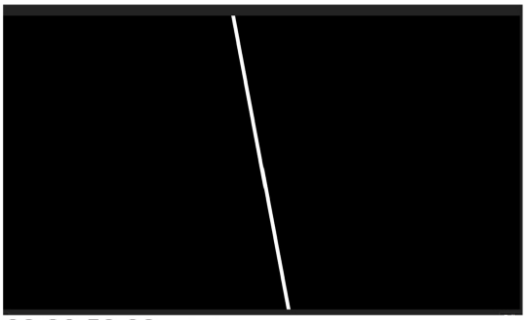
00.23.53.00-00.26.00.13 static rectangle, *silent* (just over 1 minute)

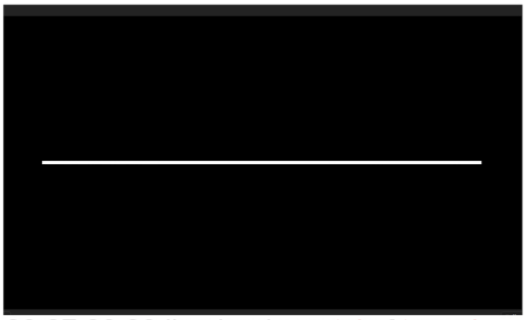
00.26.06.13 shake-out elements ‘voo-oov’ gets louder

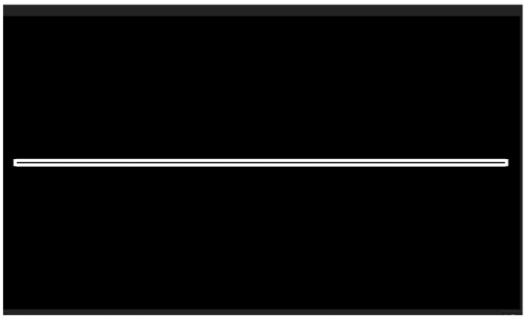

00.26.16.00 shake-back elements 'voo-oov' gets quieter


00.26.51.13-00.26.57.00 static rectangle, *silent*

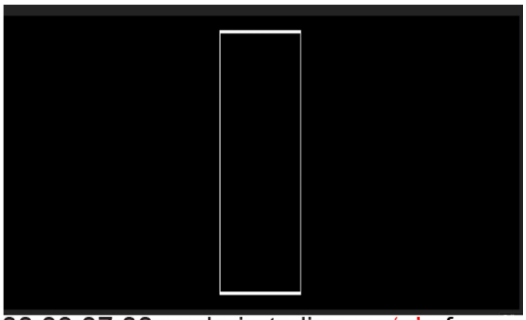

00.26.57.00 scale-in to line on 'ooo' of 'ooog'

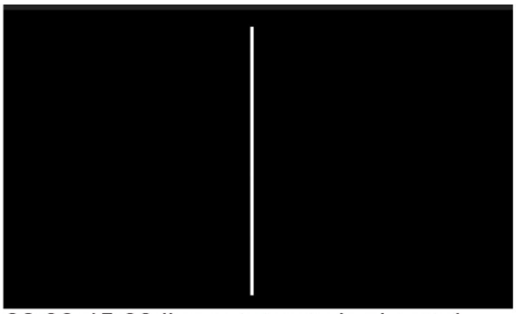

00.26.58.00 rotate


00.27.00.00 line lands on 'g' of 'ooog'

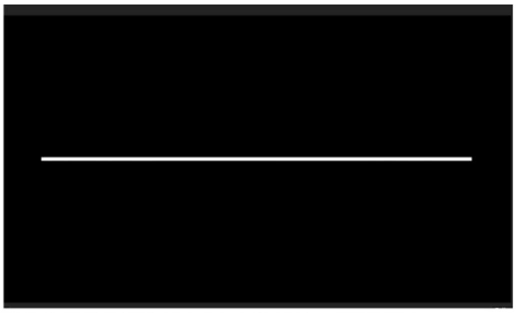

00.27.00.00 line scales into rectangle *silent*


00.33.37.00 full rectangle

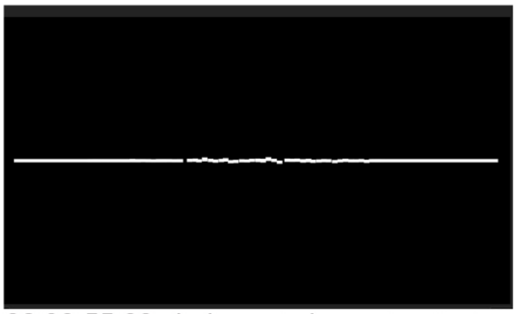

00.33.37.00 scale-in to line on 'g' of 'gooo'



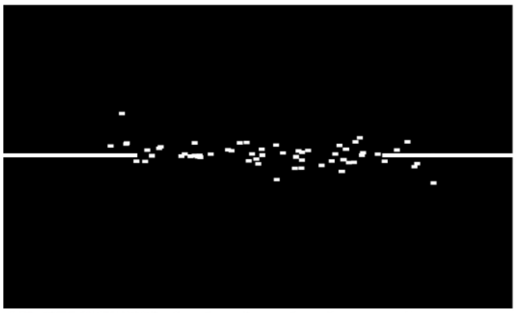
00.33.45.08 line rotates to horizontal



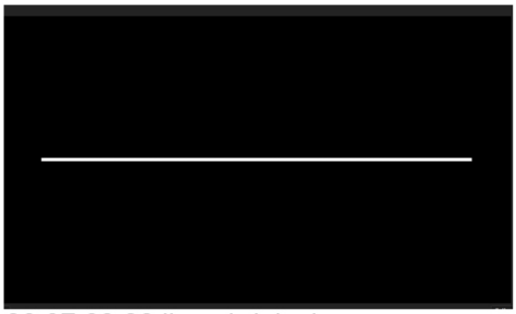
00.33.53.08 lands on ‘g’ of ‘ooog’



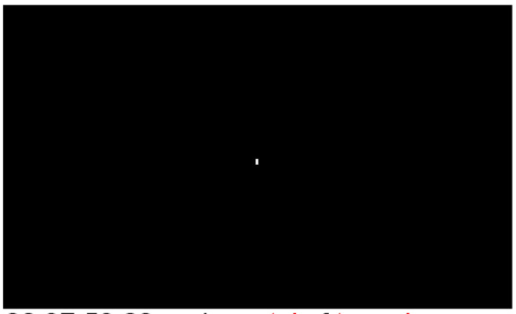
00.33.55.00 shake-out elements, starts silent ‘voo-oov’ gets louder



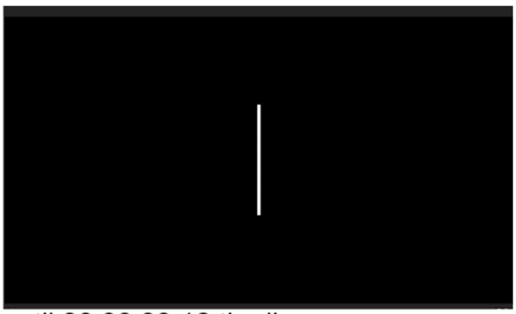
00.36.56.00 shake-back elements, ‘voo-oov’ gets quieter



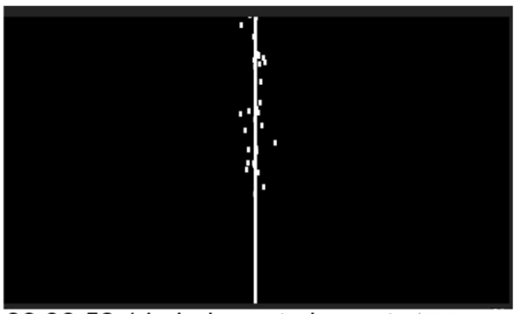
00.37.00.00 line shrinks into centre
*silent*



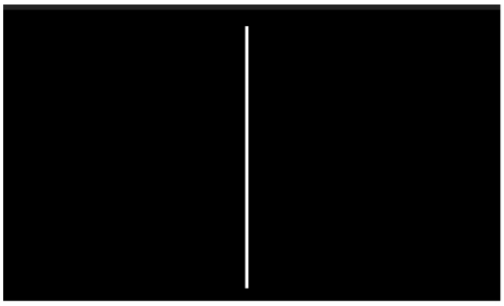
00.37.59.20 ends on ‘g’ of ‘ooog’



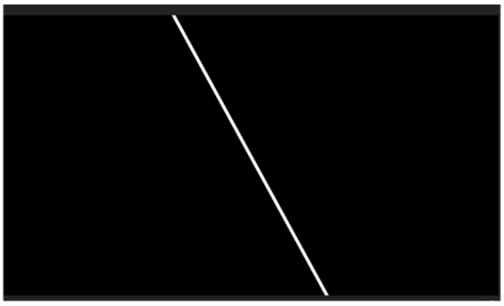
until 00.38.30.12 the line grows vertically

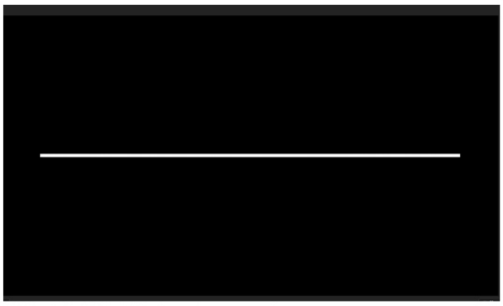


00.38.52.14 shake-out elements ‘voo-oov’ gets louder then quieter

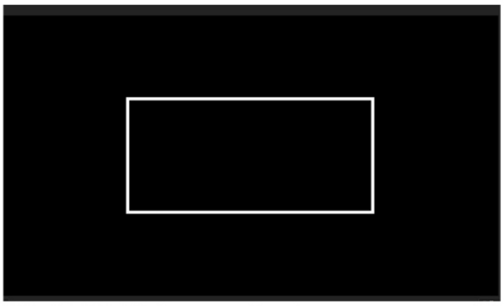


00.40.32.00 rotates





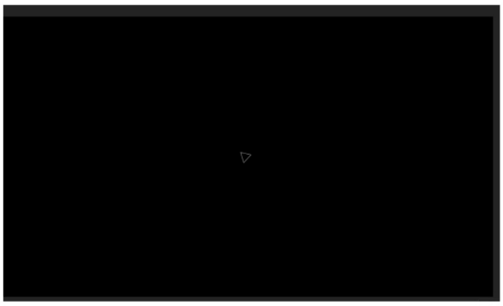
00.40.36.00 horizontal



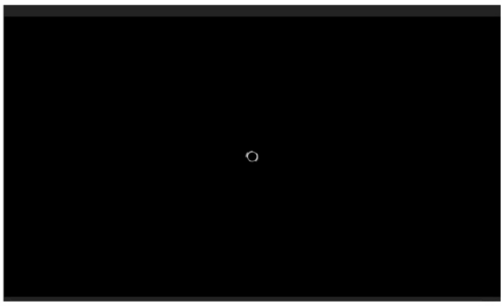
00.40.36.00 line scales into rectangle on ‘ooo’

00.40.38.06 lines come together *silent*

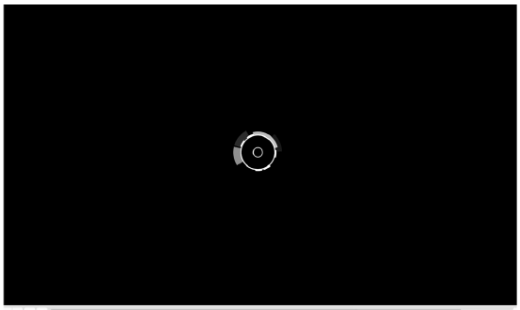
until 00.44.00.00 meet on ‘ooo’ of ‘ooog’



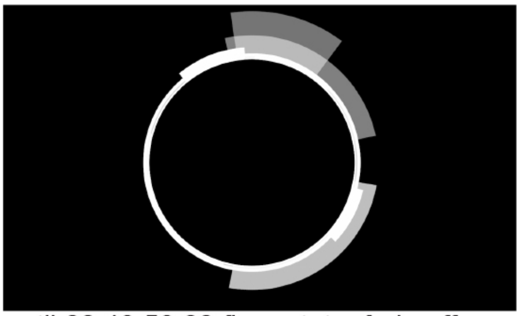
00.44.00.00 goes to black on ‘g’ of ‘ooog’



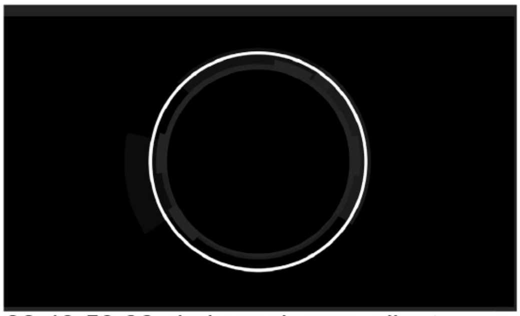
00.44.00.10 circle scales-up ‘ooo’



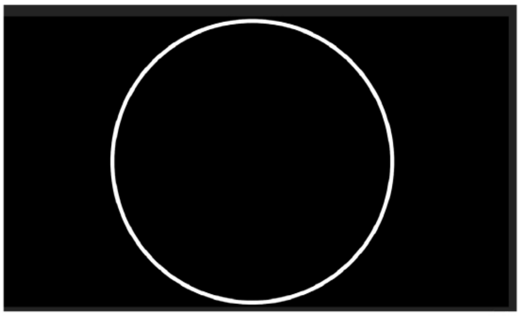
00.44.09.13 2nd circle scales-up ‘ooo’



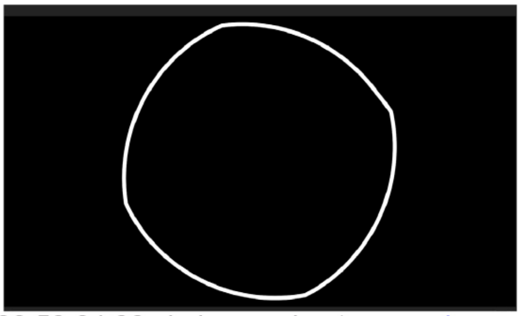
until 00.49.59.00 fins rotate, fade off starts at 00.49.57.00



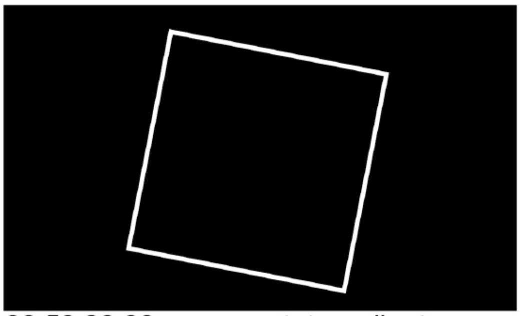
00.49.59.00 circle scales up *silent*



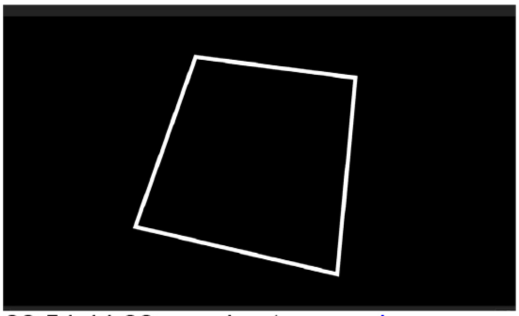
00.50.00.00



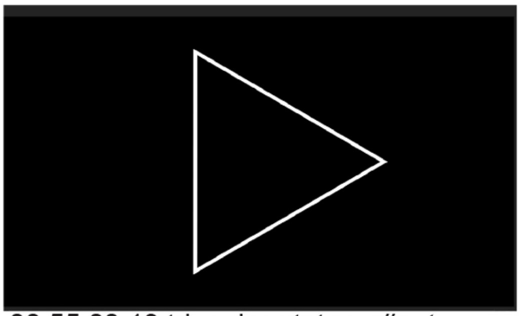
00.50.04.00 circle morphs ‘zoo-ooz’



00.50.20.00 square rotates *silent*



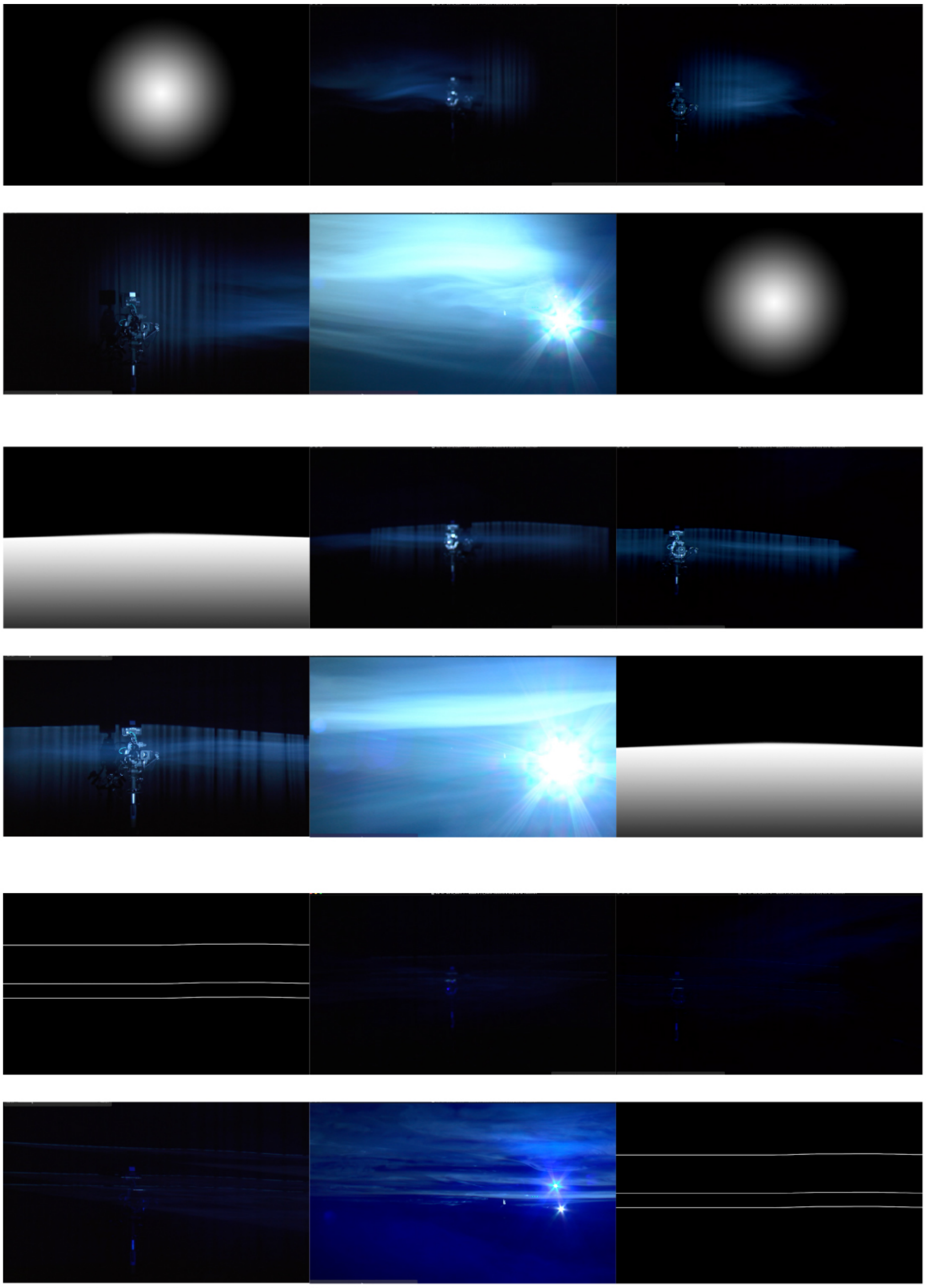
00.54.44.00 morphs ‘zoo-ooz’



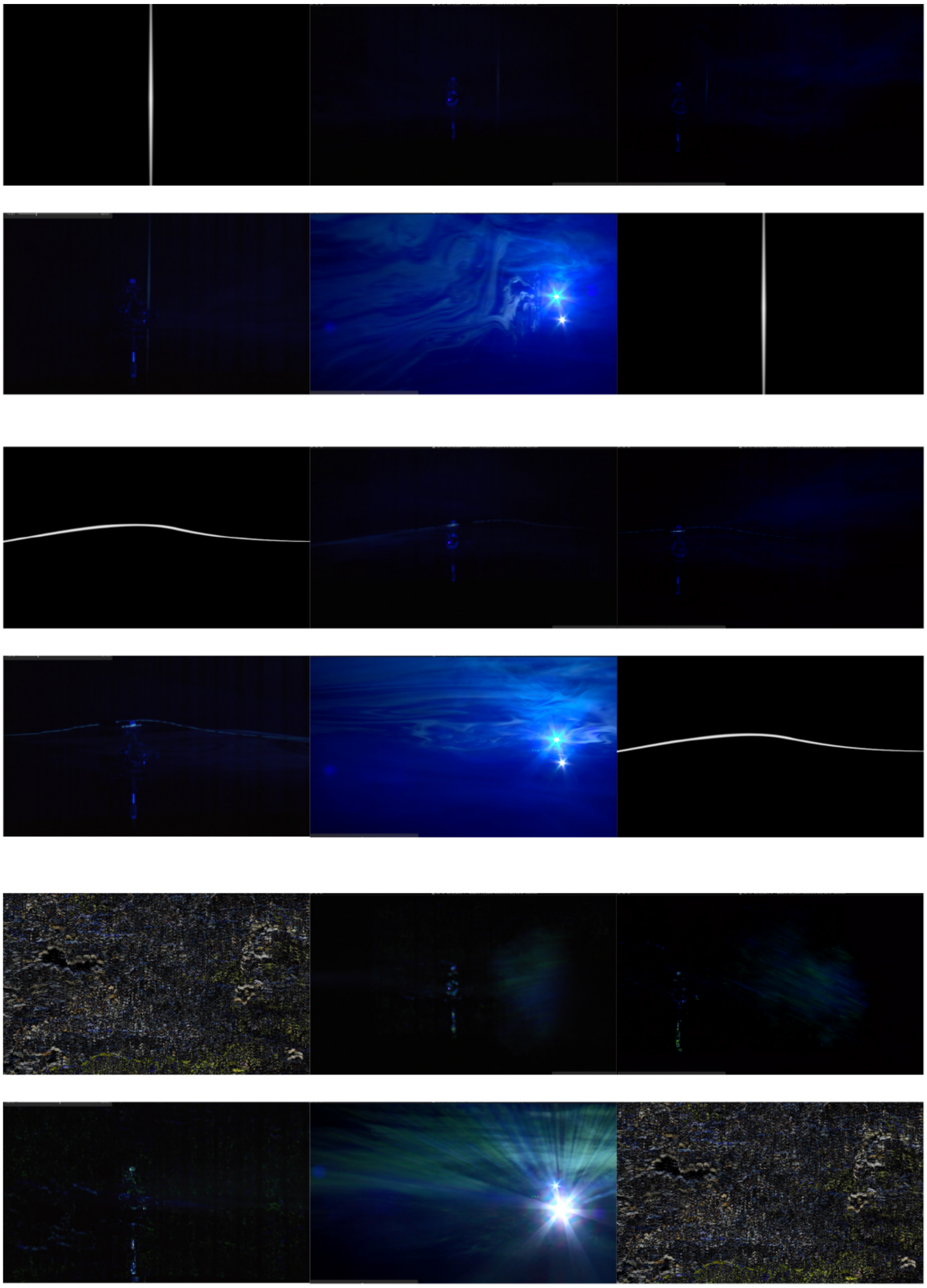
00.55.00.13 triangle rotates *silent*

00.58.30.00 scales-down ‘ooo’ , 01.00.00.00 end

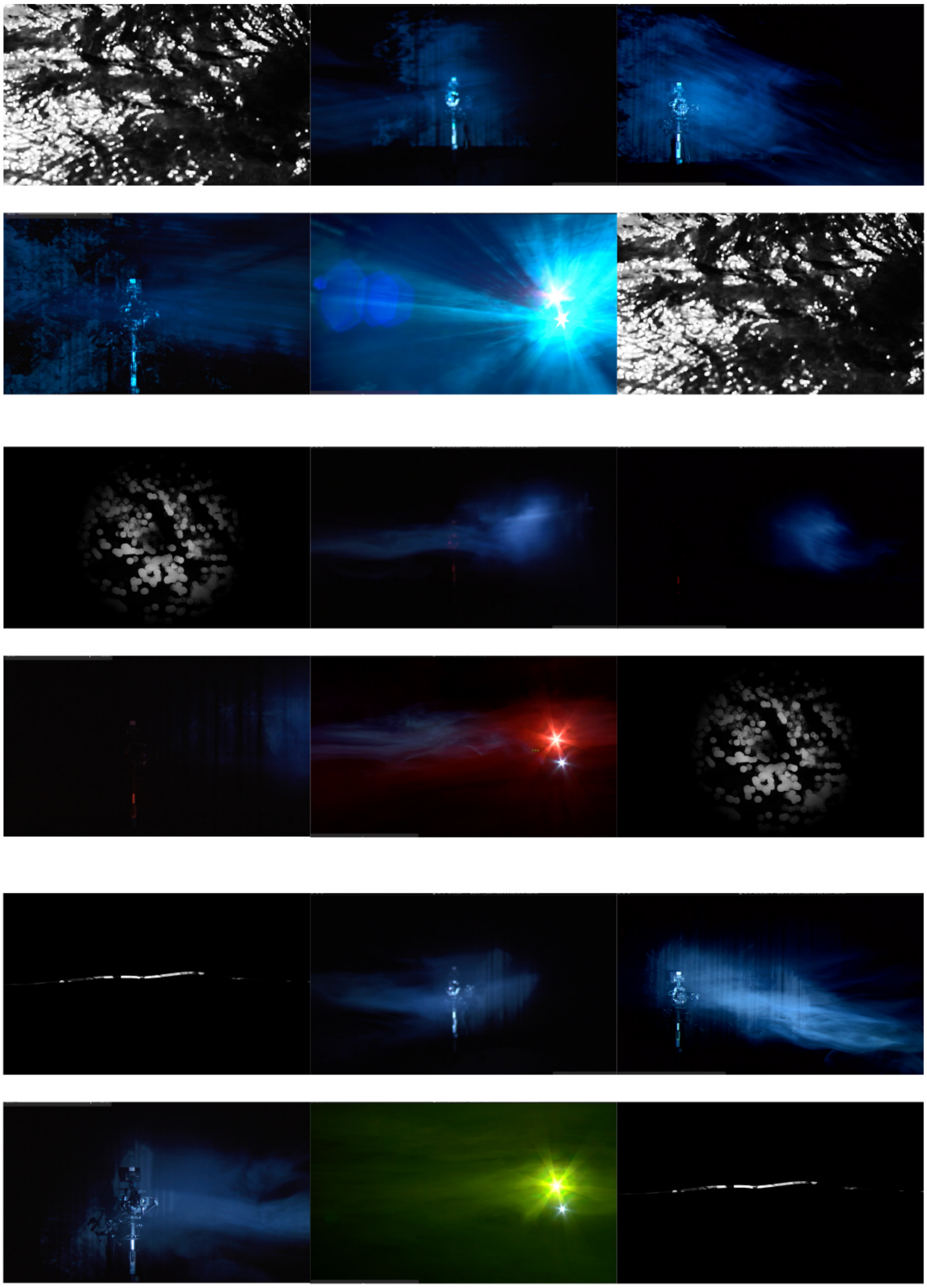
## C.5 Visual log of test sessions in the studio



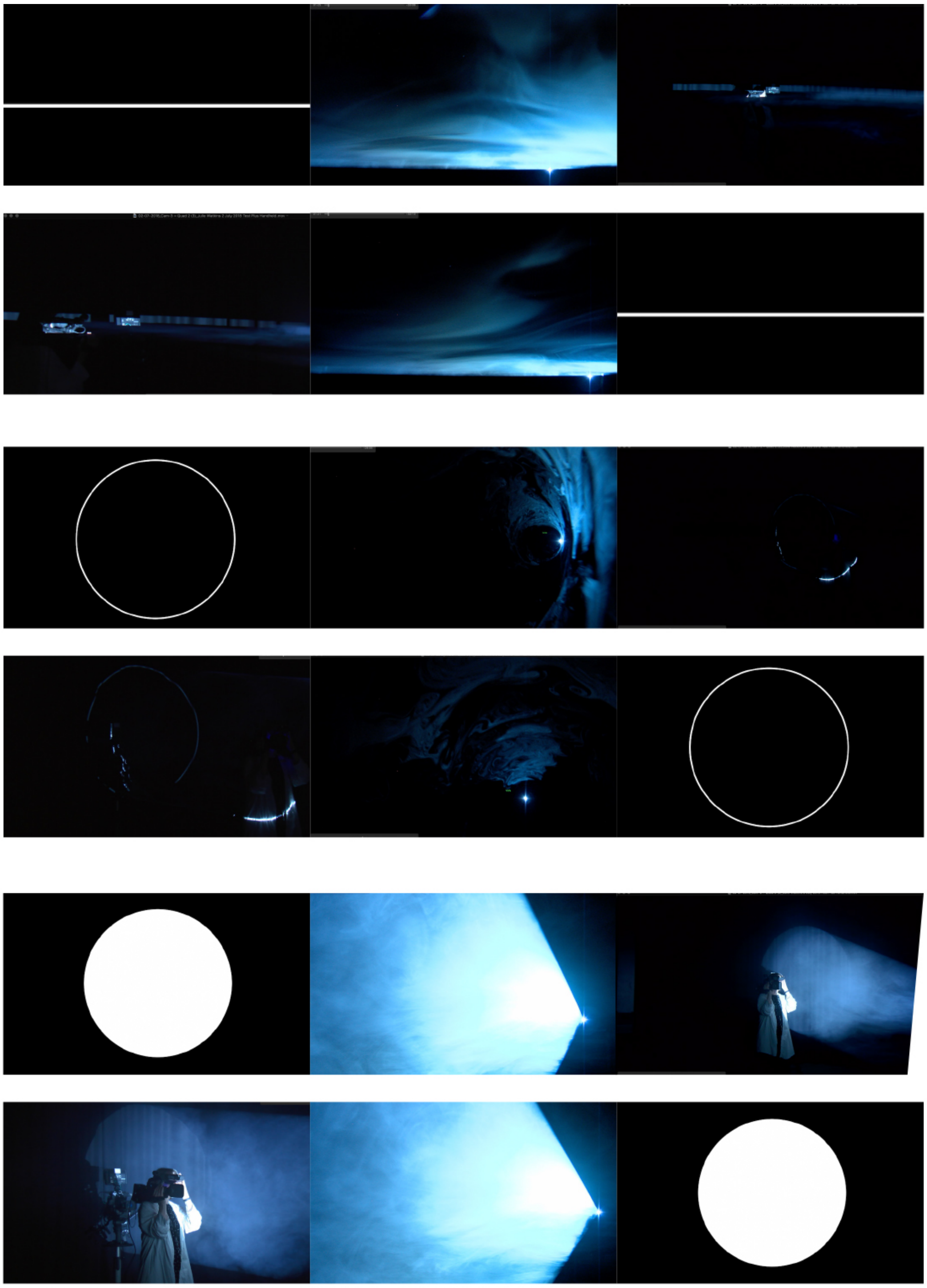
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1



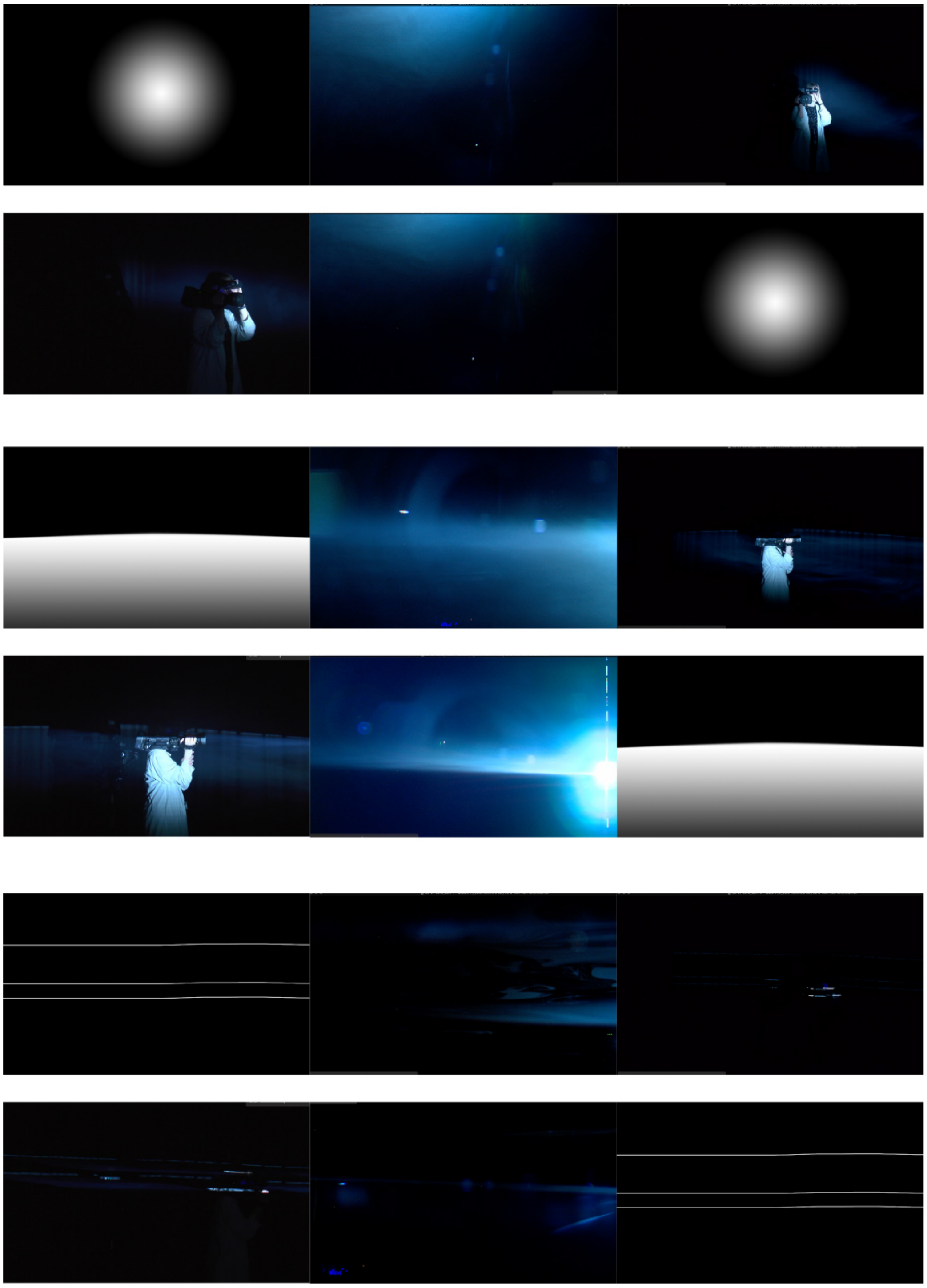
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1



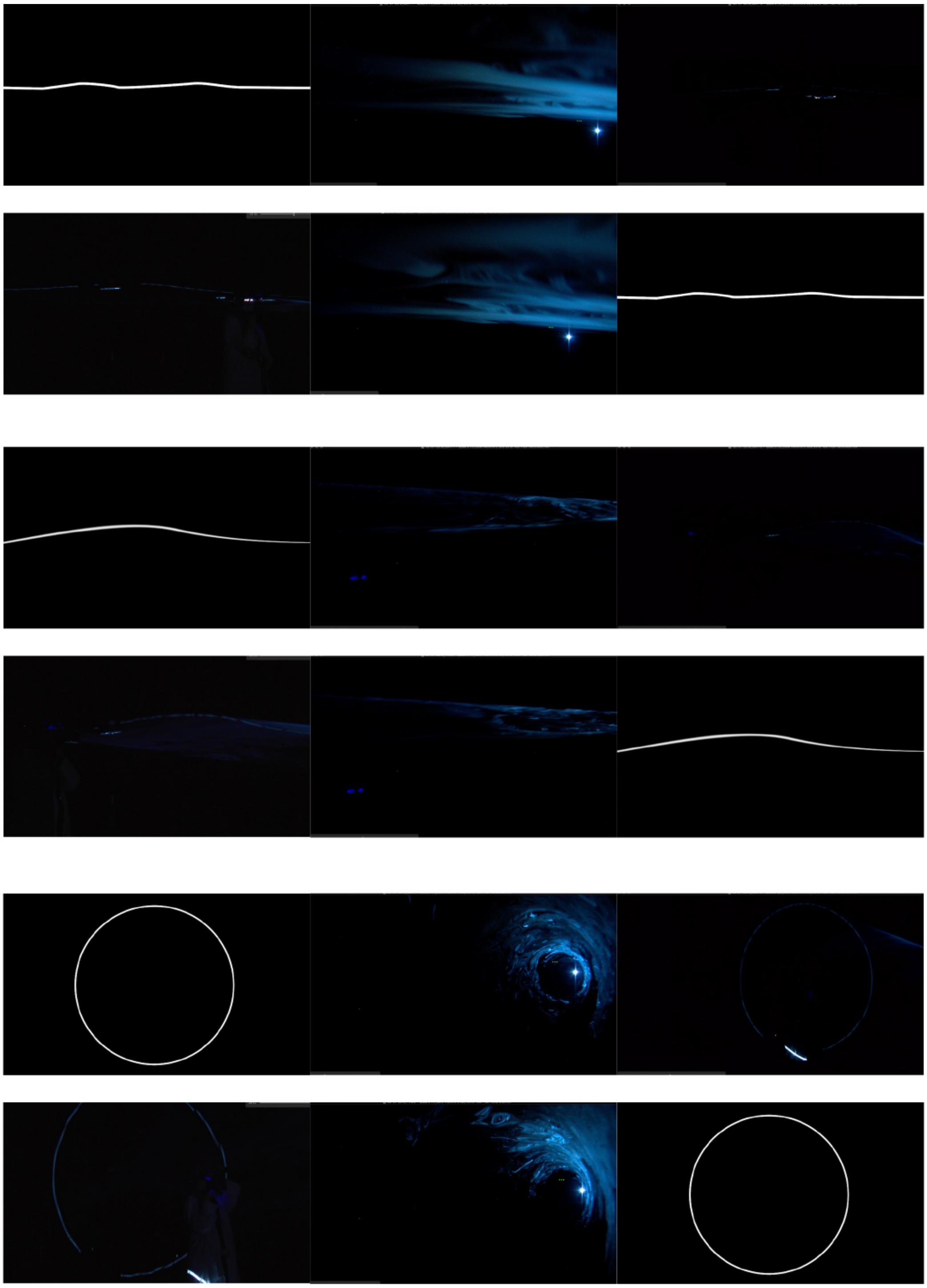
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1, Projector_2 Volumetric Colour



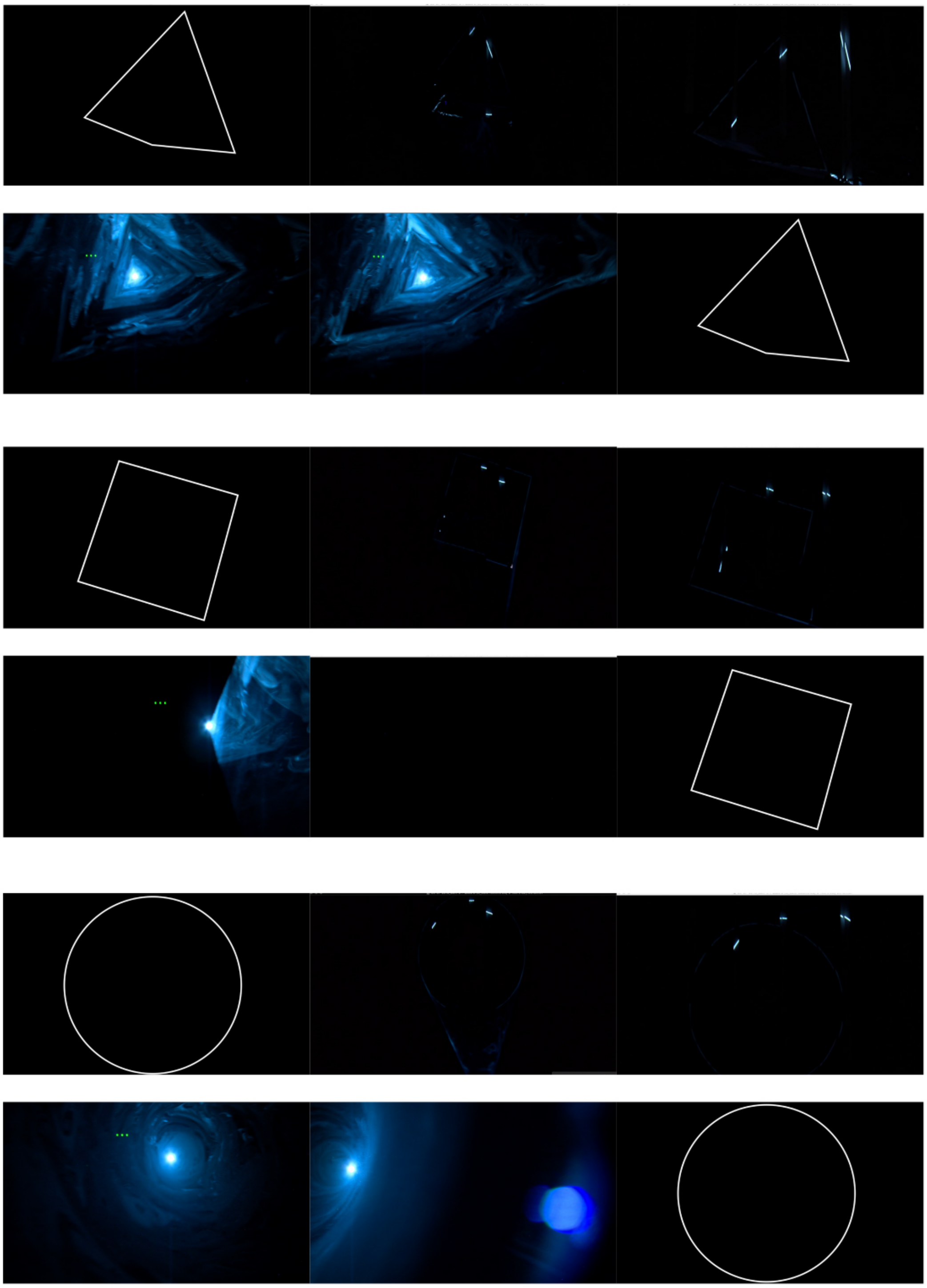
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1, Camera-1 handheld



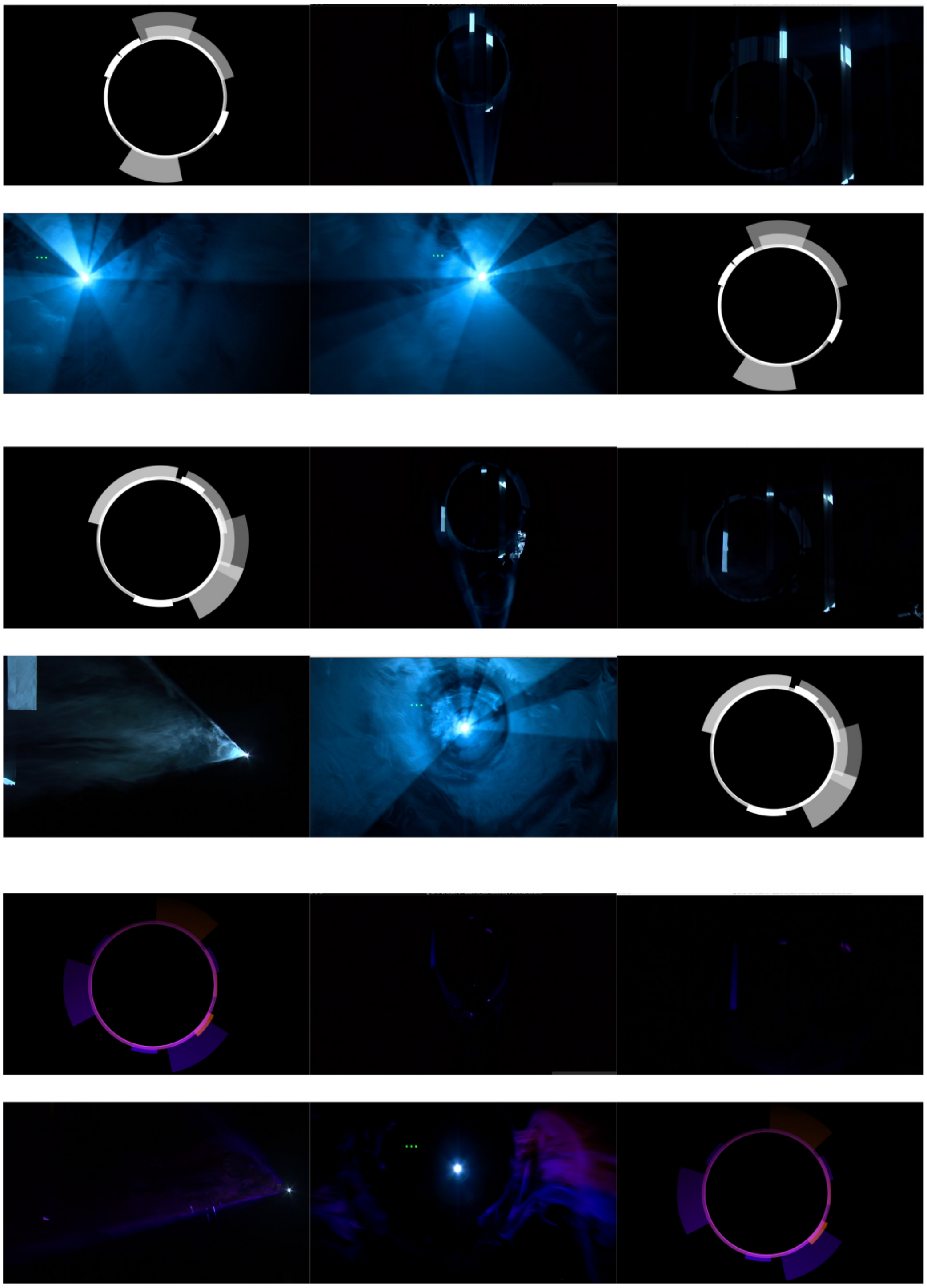
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1, Camera-1 handheld



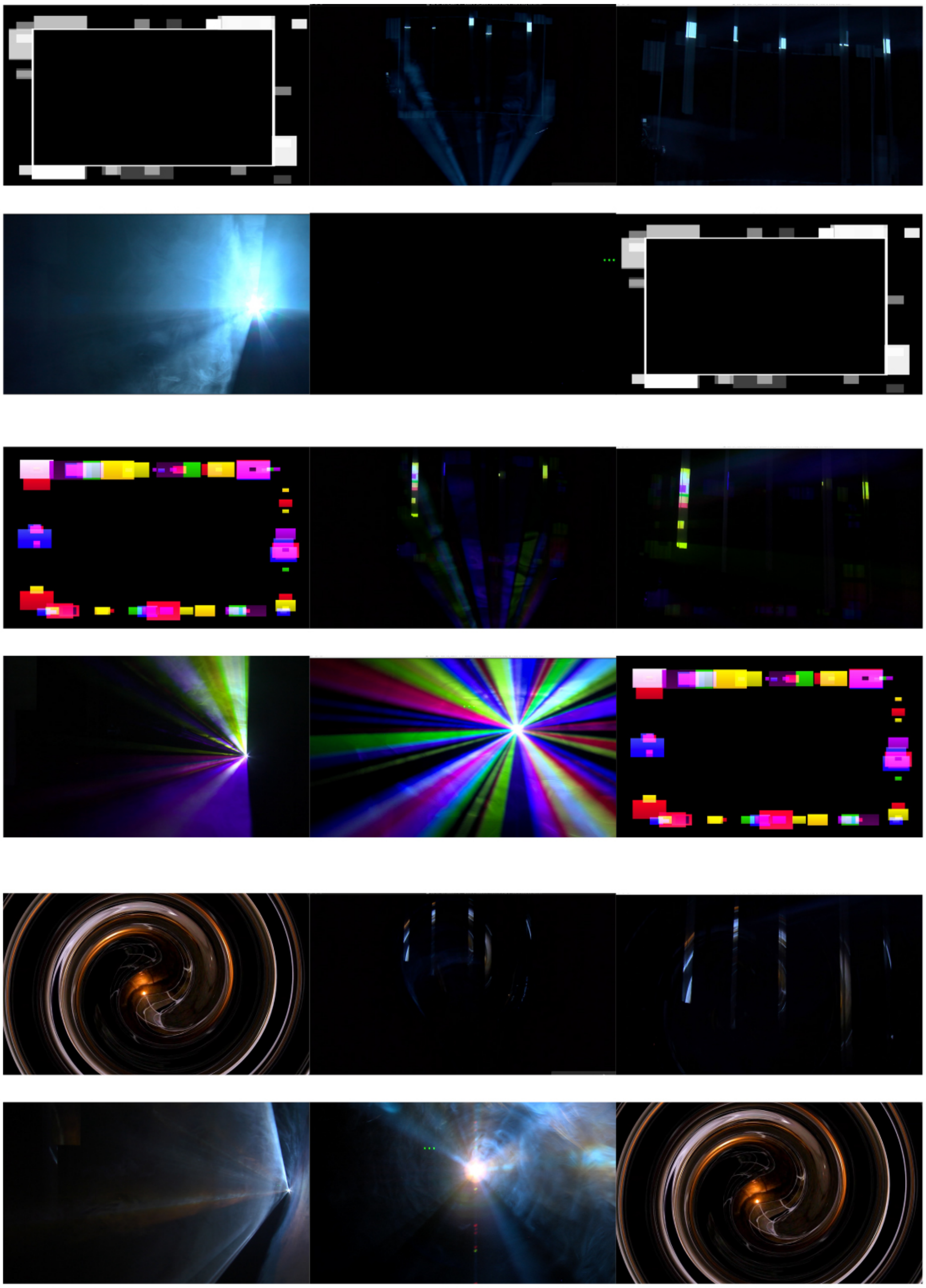
TV Studio Day 1: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation



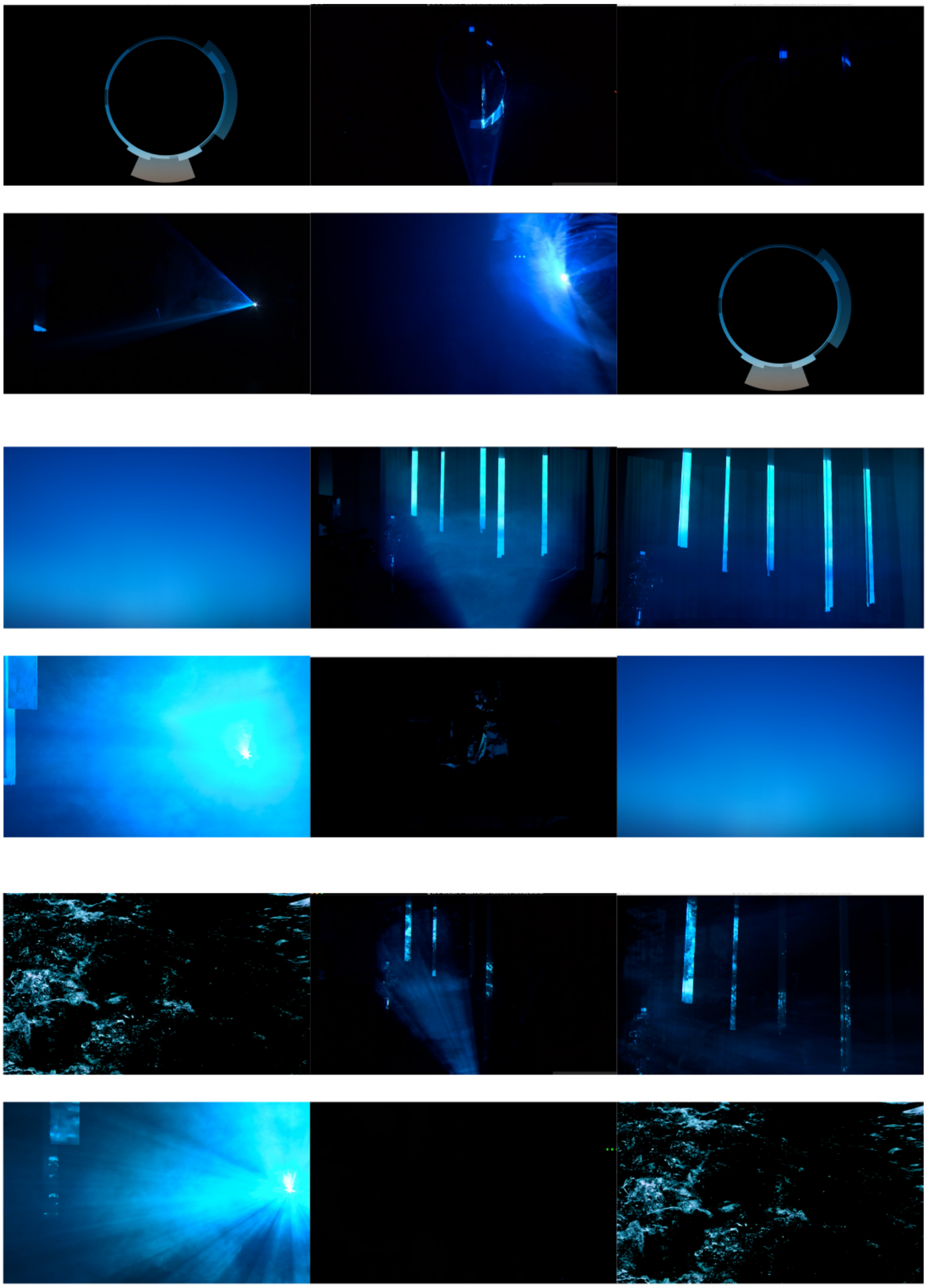
TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation animateShapes, paper strips, Camera-4 on dolly

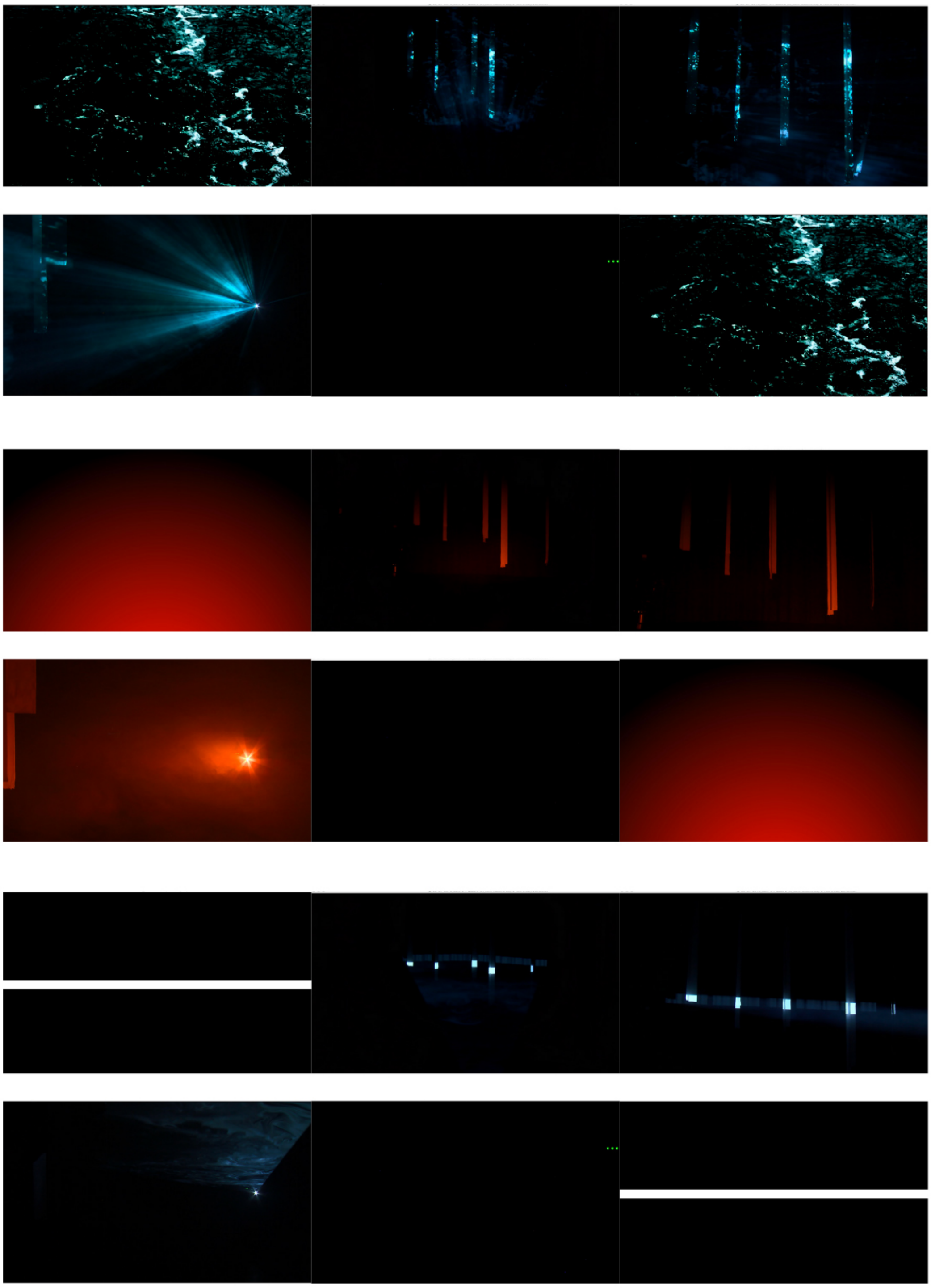


TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation RingSegmentsL2, RingSegmentsColourL3dissolve, paper strips, Camera-4 on dolly

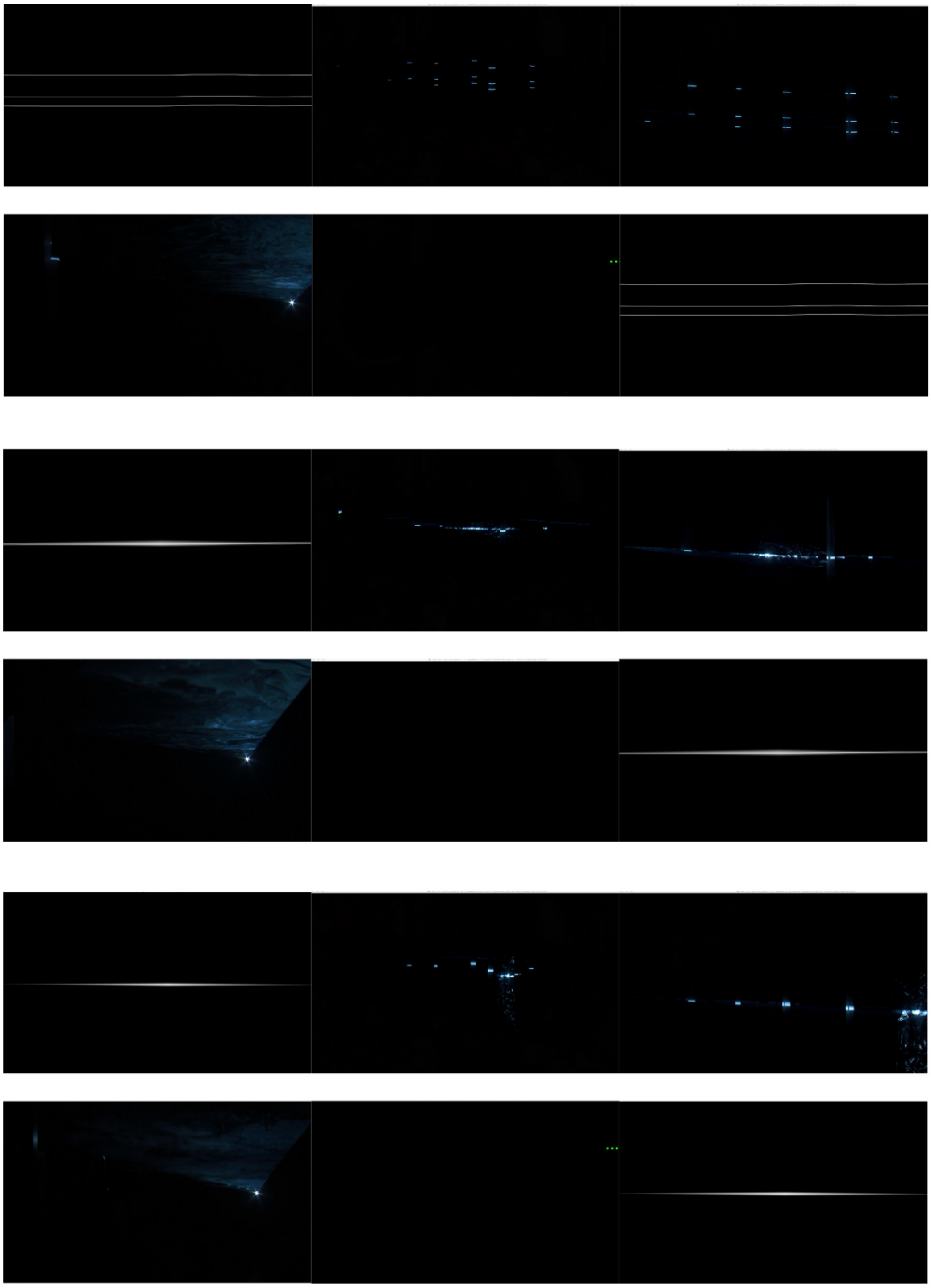


TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
SquaresL2, SqauresOfColourL2-3LoopDissolve, waterTwirl, paper strips, C-4 dolly

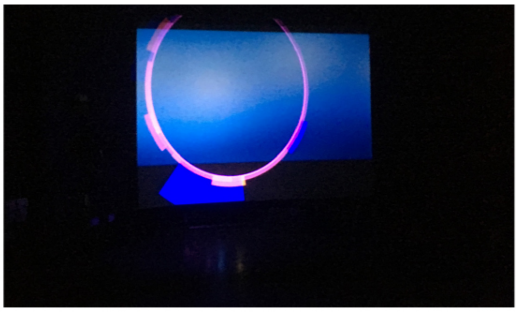

TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation TimelapseSkyRings, Volumetric water_4, paper strips, Camera-4 on dolly



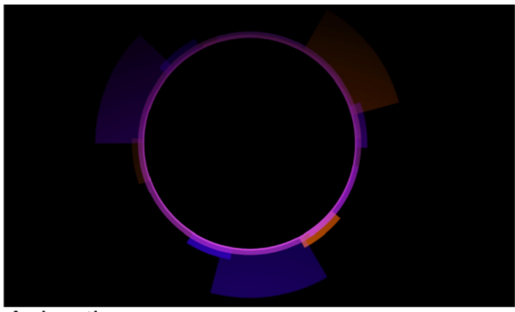
TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric water_4, Volumetric Colour, Volumetric Sequence 01_1, paper strips



TV Studio Day 2: animation, Camera-1, Camera-2, Camera-3, Camera-4, animation
Volumetric Sequence 01_1 with tin foil strip, paper strips, Camera-4 on dolly

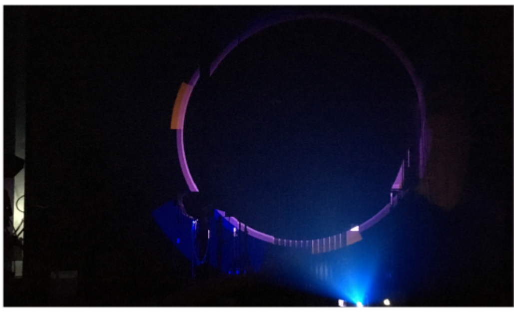
2 projectors, front projector 13,000 lumens, back projector 3,000 lumens




Animations:
front RingSegmentsColourL3dissolve

back Square-Blue_Inner

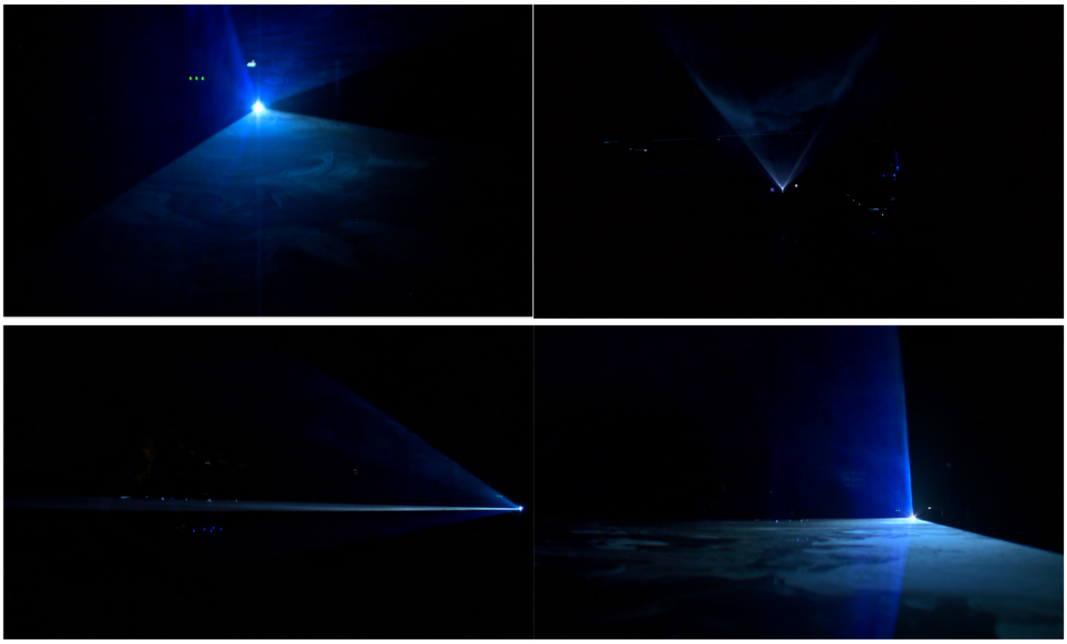
The projected display on to a screen dominates the space. There is a lack of volume. The brightness of the projection flattens the whole effect.



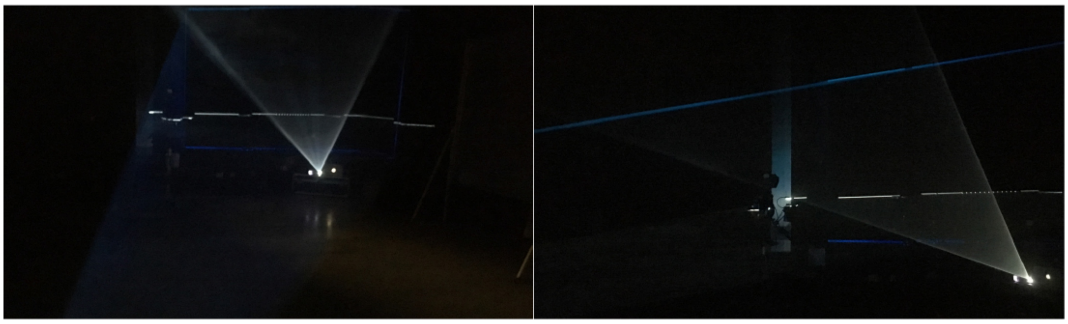
The screen is removed, volume is re-gained. The brightness of the projection on black is lower allowing the colours to show in the haze.

Looking back at the projector

TV Studio Day 3

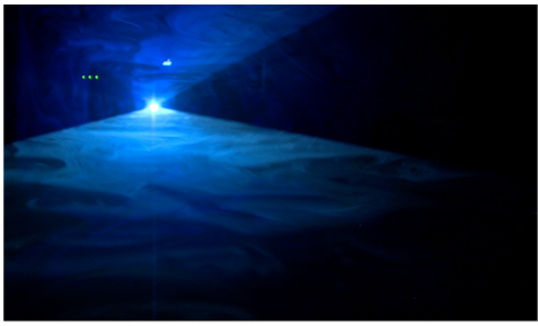
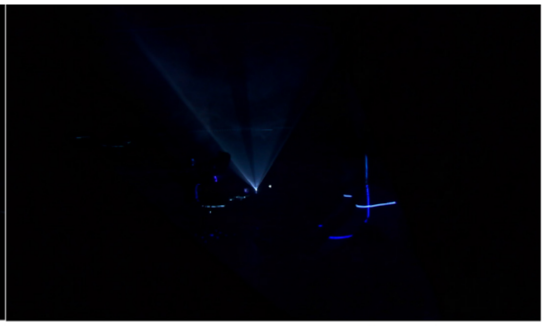


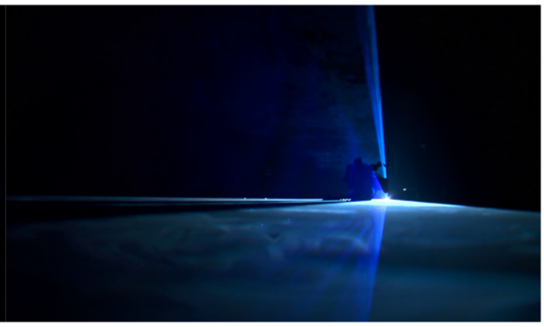
Cameras 1, 2, 3, 4, animation
The white line produces a blade, the blue rectangle is less solid



The 3000 lumens projector did not interact with the 13000 lumens projector. The white blade-ray produced by the horizon-line animation did not add to the blue-frame and horizon-line animation

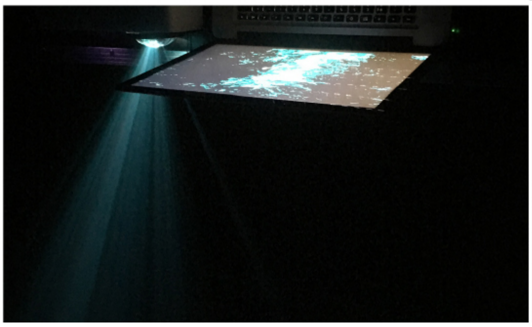
TV Studio Day 3



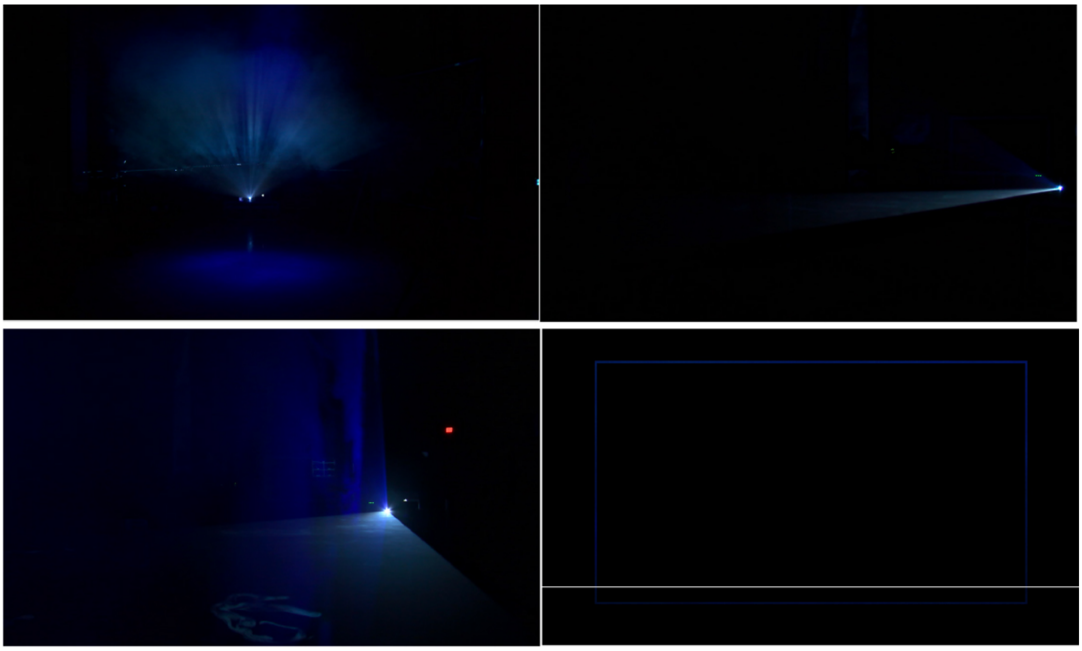

Cameras 1, 2, 3, 4, animation

The 3000 lumens projector did not interact with the 13000 lumens projector. The rays produced by the moss or waves animations did not add to the blueframe and horizon-line animation. But the projected dappled light worked as atmosphere in the gantry

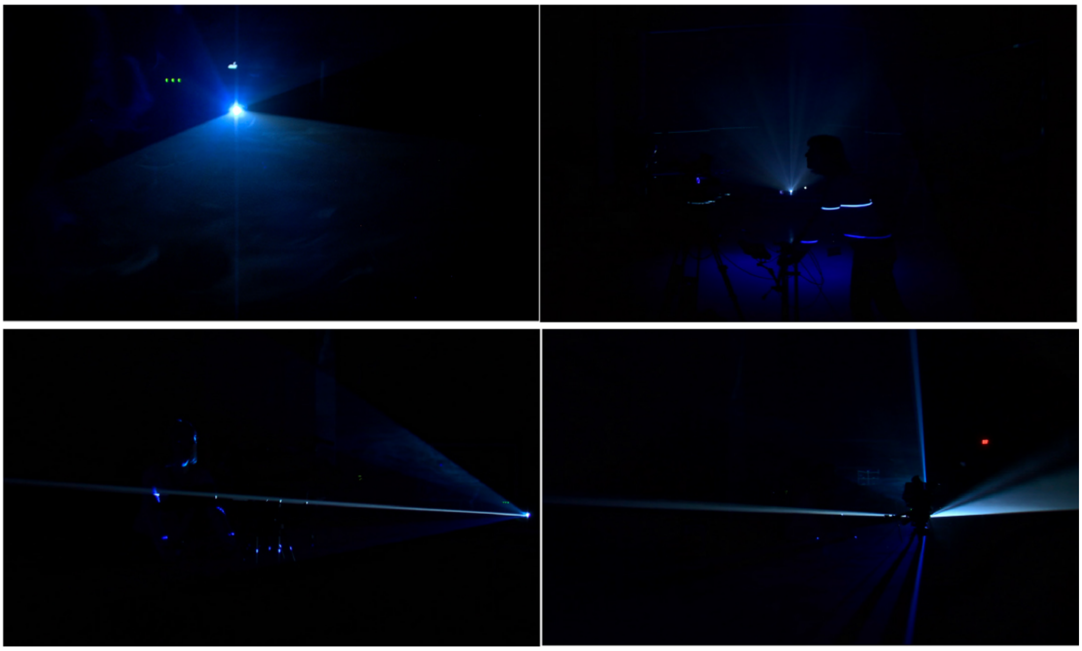




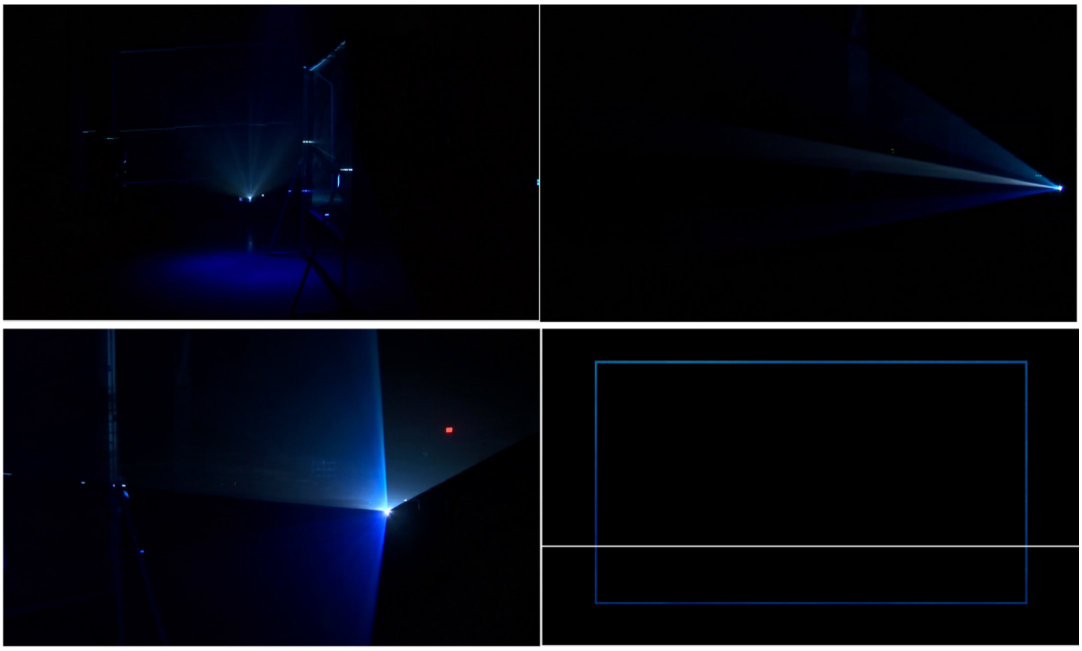
Setting up a blue light, choice of gel or CMYK, and a white light. These lights hang in the hazy air and react to the stronger projector in a way which the weaker projection did not.



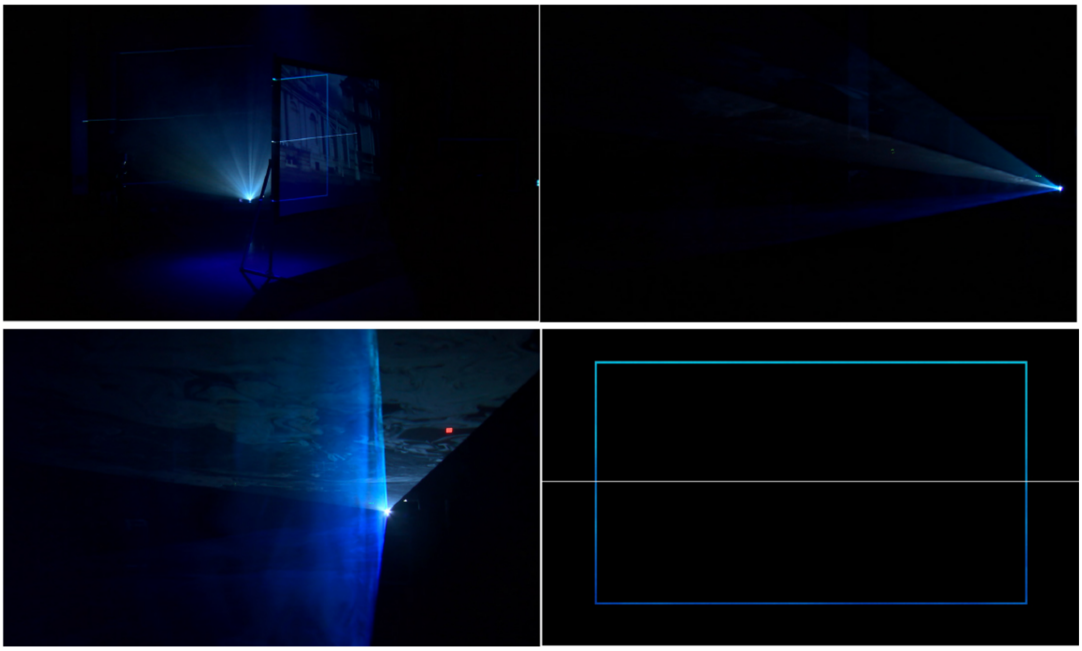
Cameras 2, 3, 4, animation, blue studio light



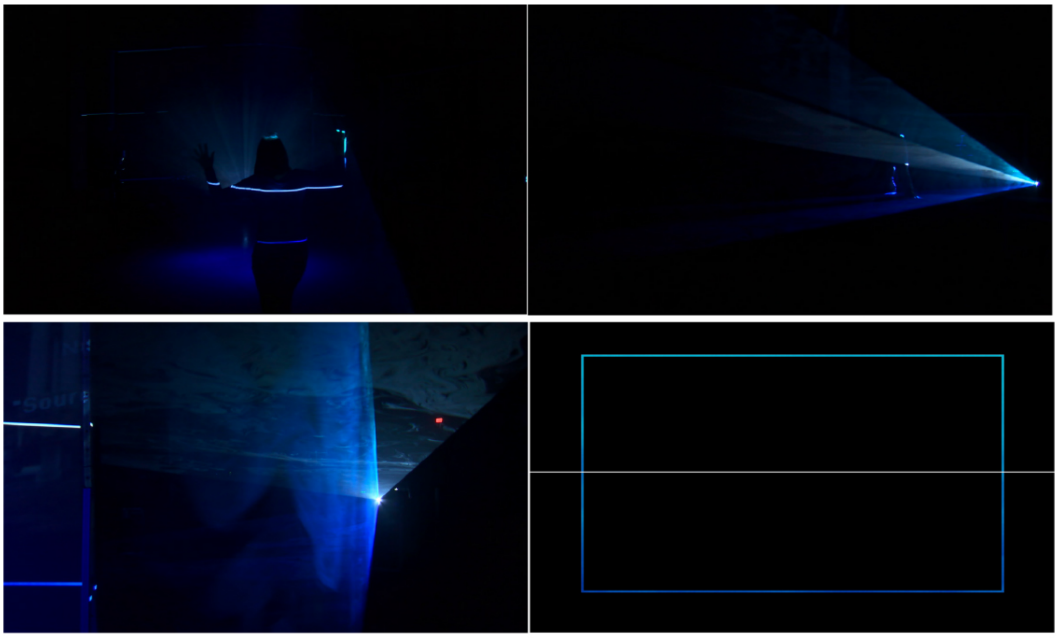
Cameras 1, 2, 3, 4, interacting with the projected rays, blue studio light



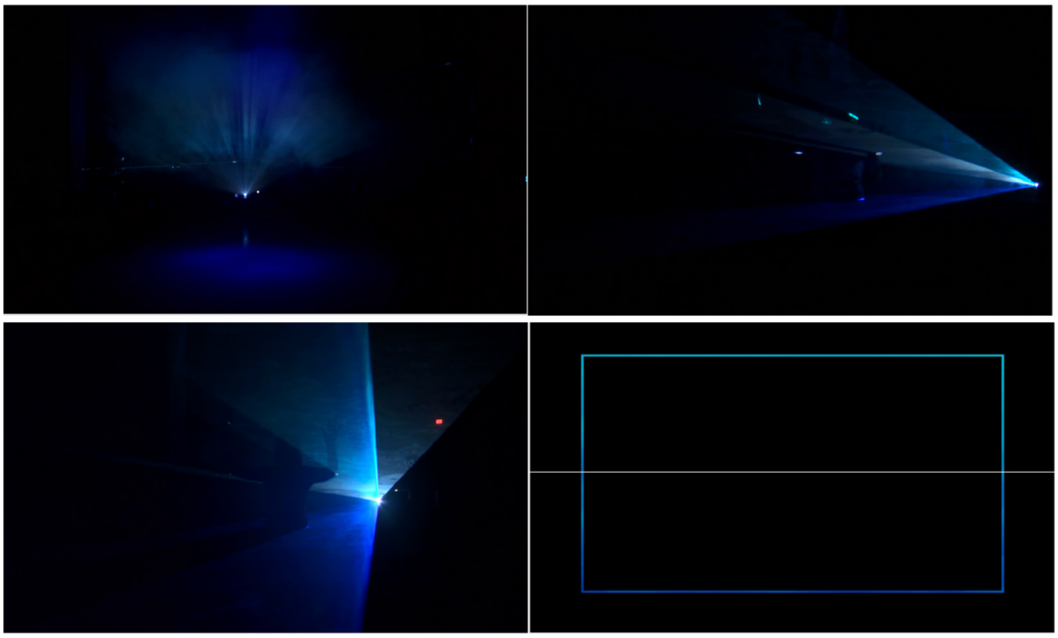
Cameras 2, 3, 4, animation, blue studio light



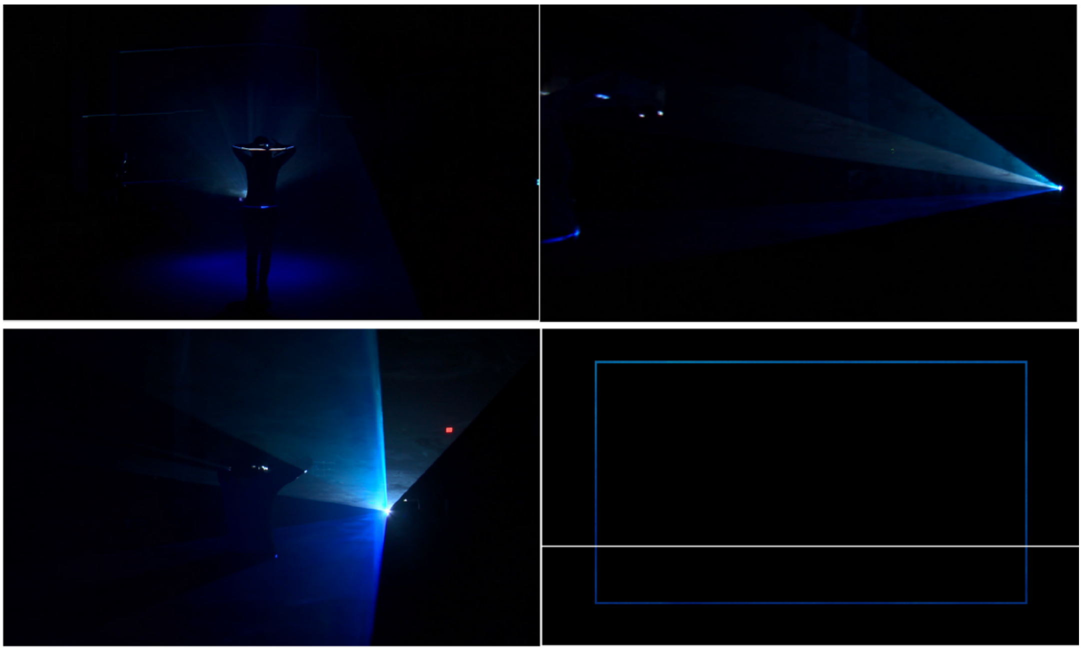
Cameras 2, 3, 4, animation, oblique projection screen, blue studio light



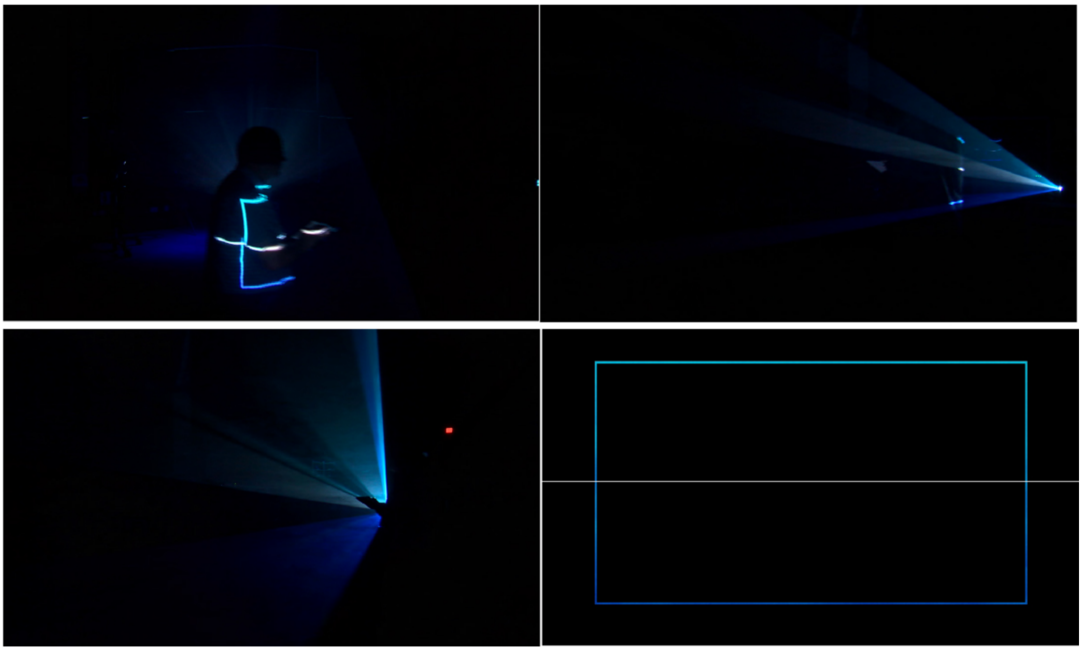
Cameras 2, 3, 4, animation, projected lines define contour of person, blue studio light



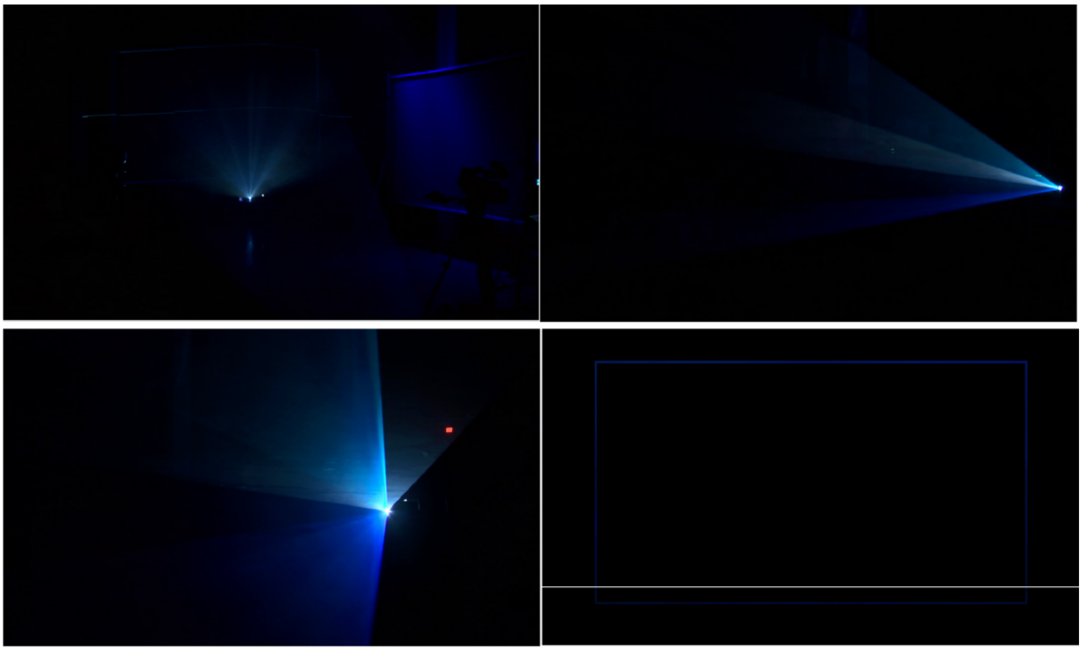
Cameras 2, 3, 4, animation, blue studio light



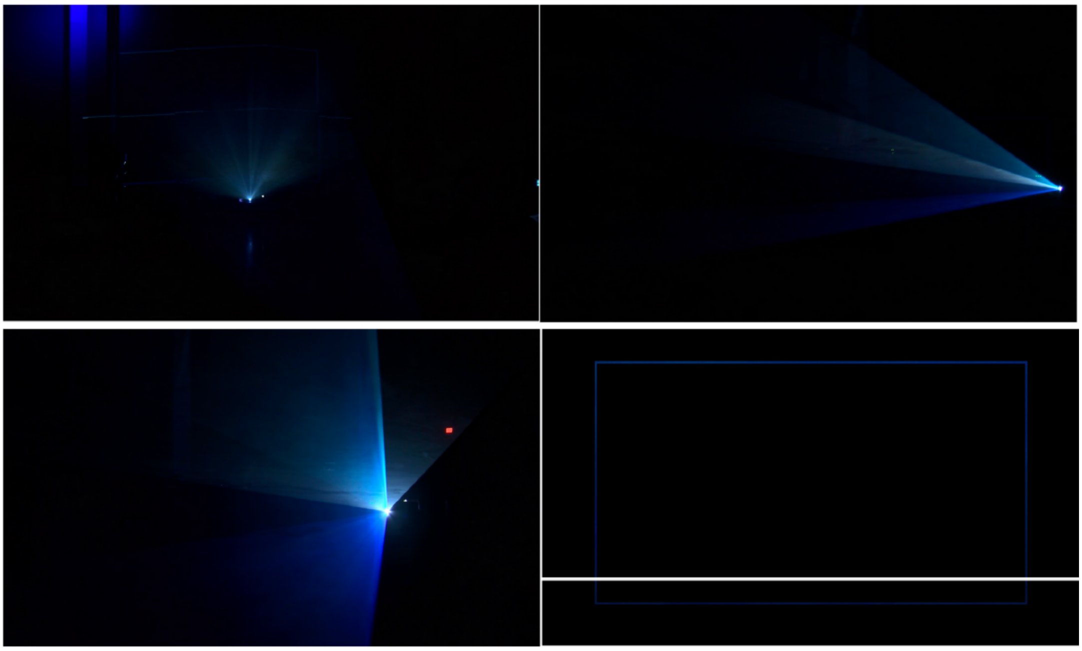
Cameras 2, 3, 4, animation, blue studio light



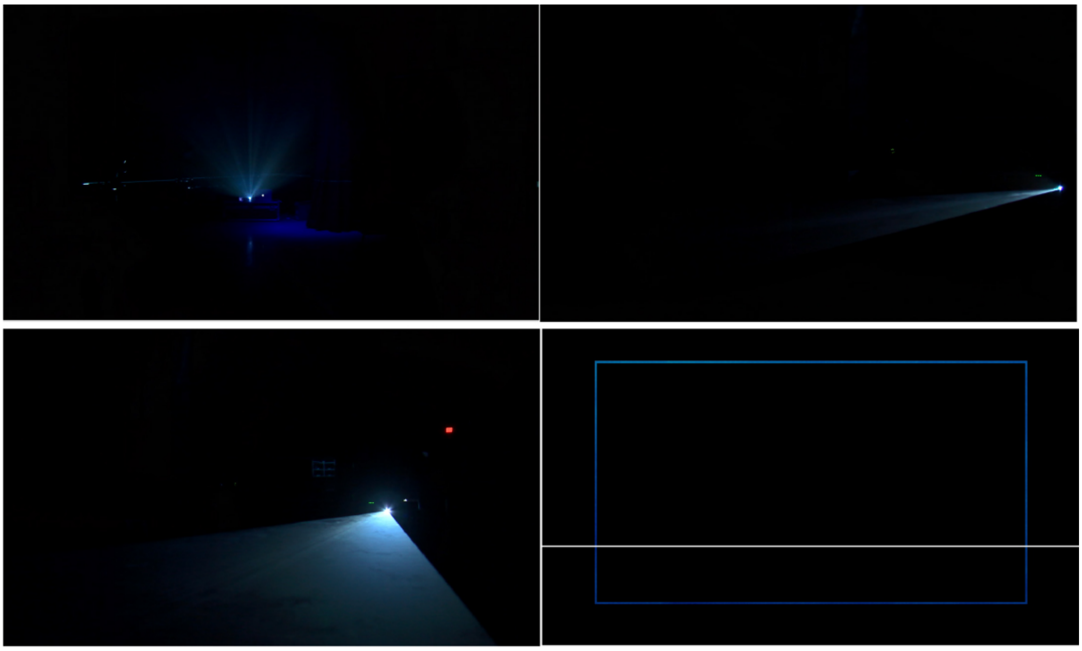
Cameras 2, 3, 4, animation, blue studio light



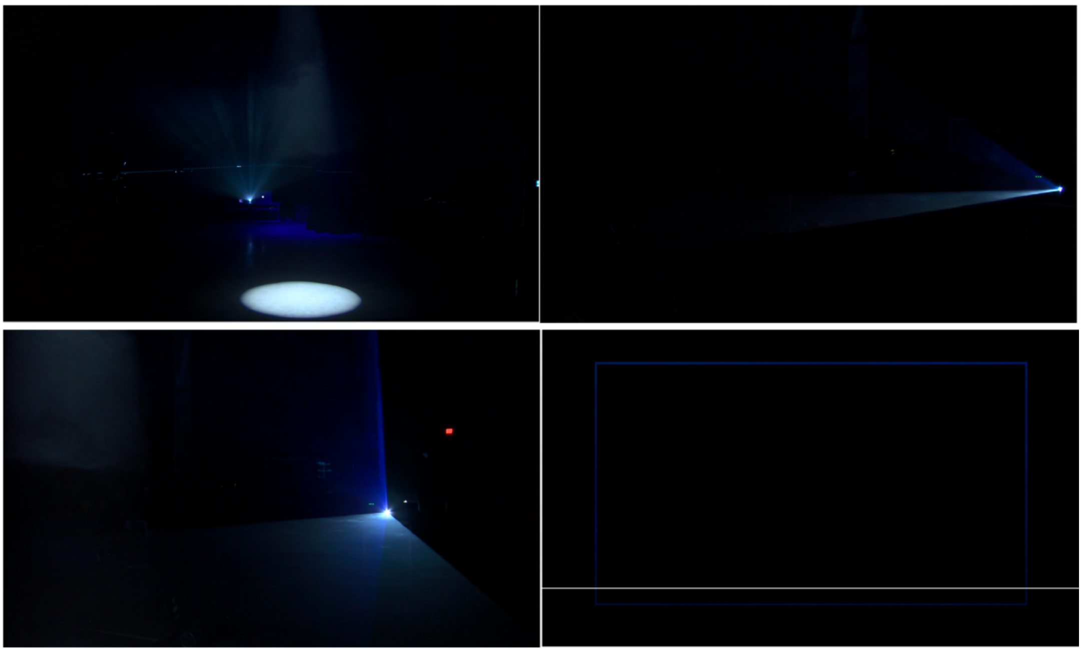
Cameras 2, 3, 4, animation, blue studio light at an oblique angle



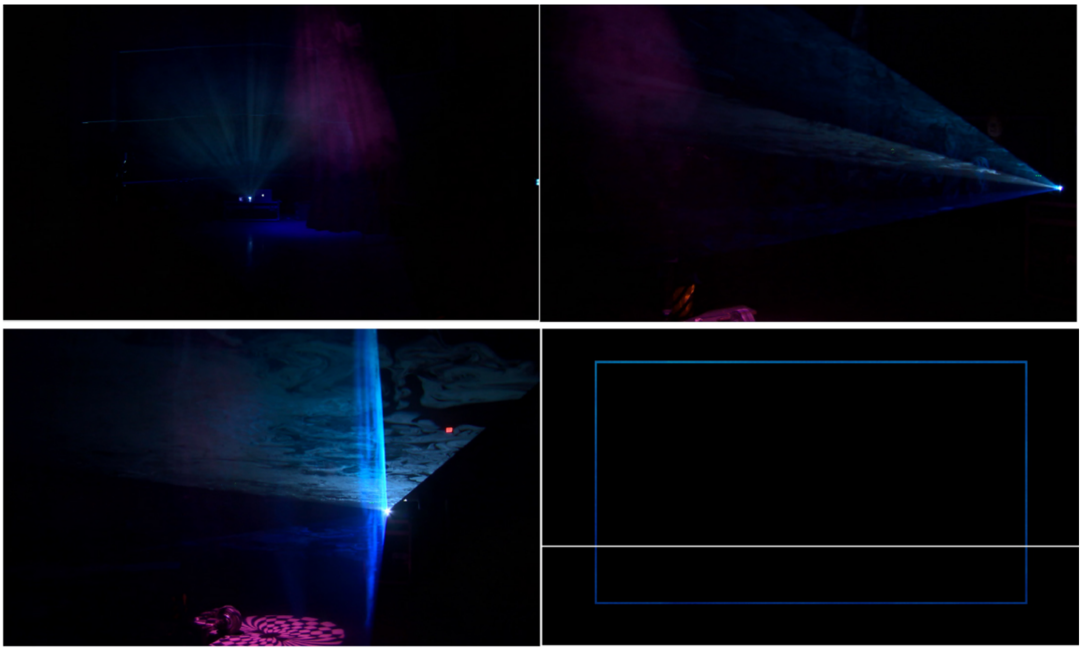
Cameras 2, 3, 4, animation, blue studio light at an oblique angle



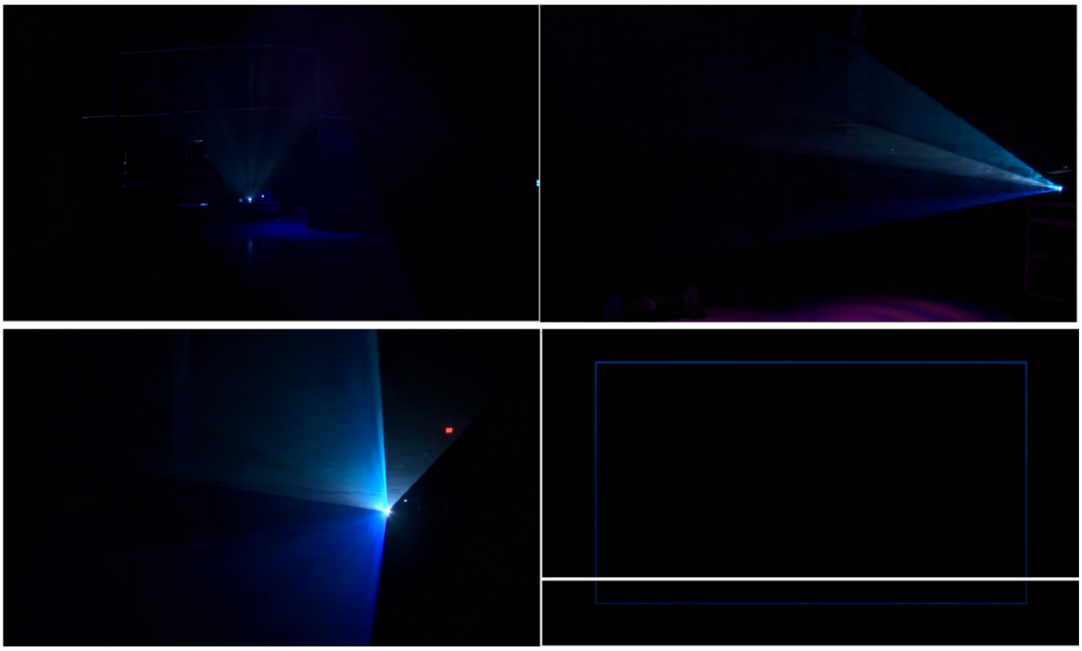
Cameras 2, 3, 4, animation, blue studio light



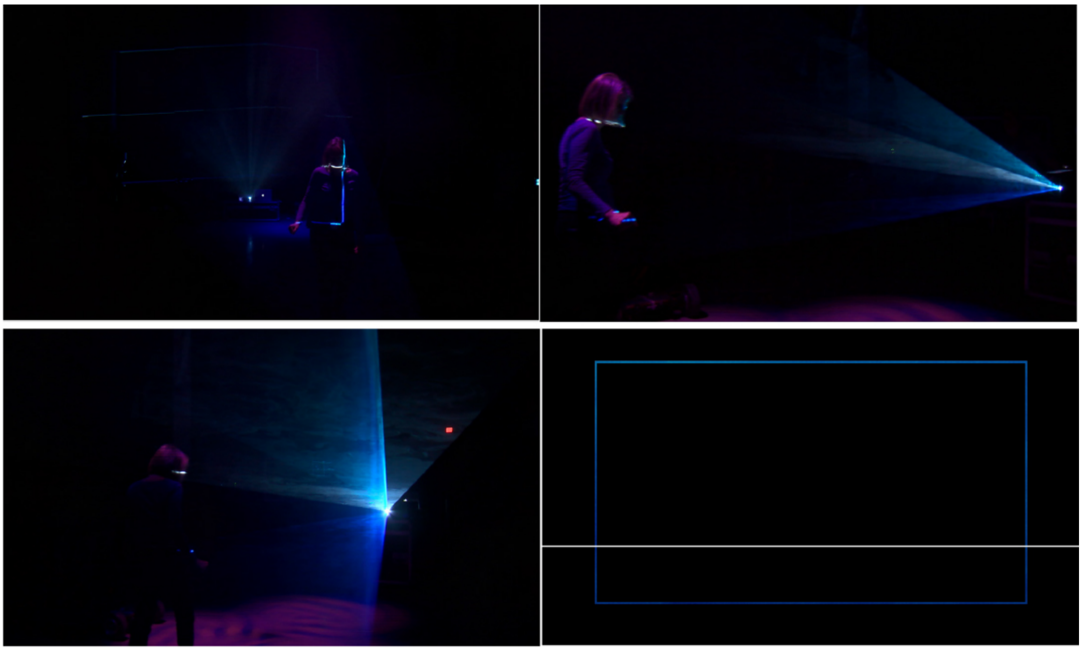
Cameras 2, 3, 4, animation, blue studio light + gobo spotlight



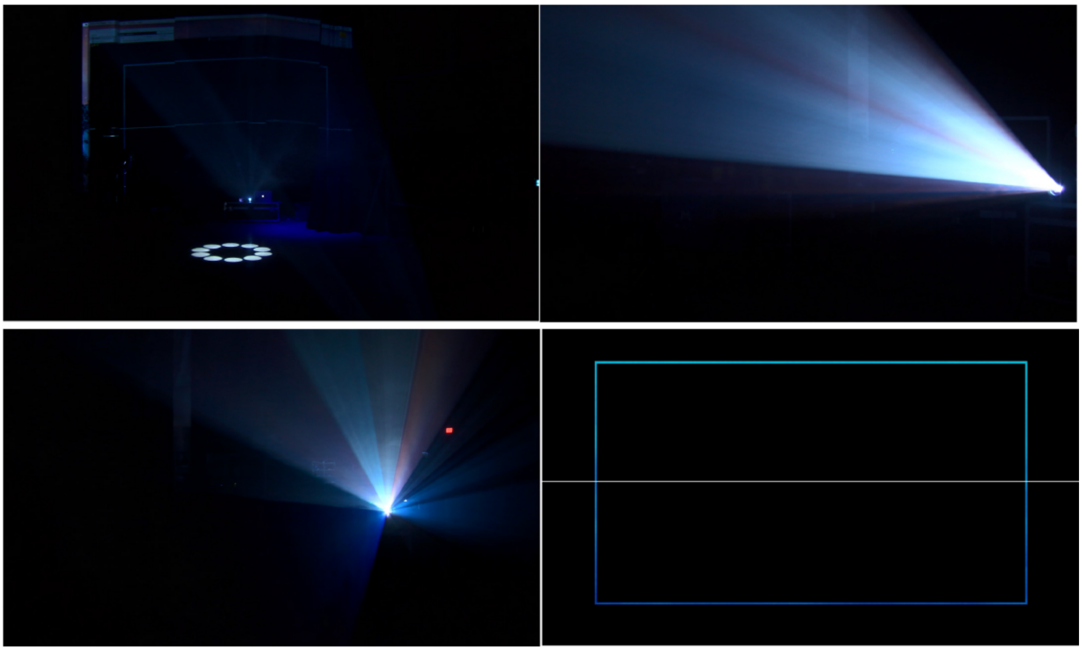
Cameras 2, 3, 4, animation blue studio light + coloured gobo spotlight



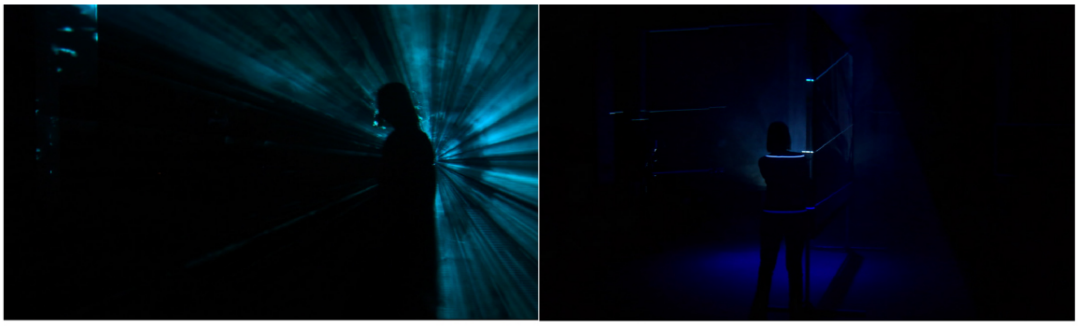
Cameras 2, 3, 4, animation, blue light



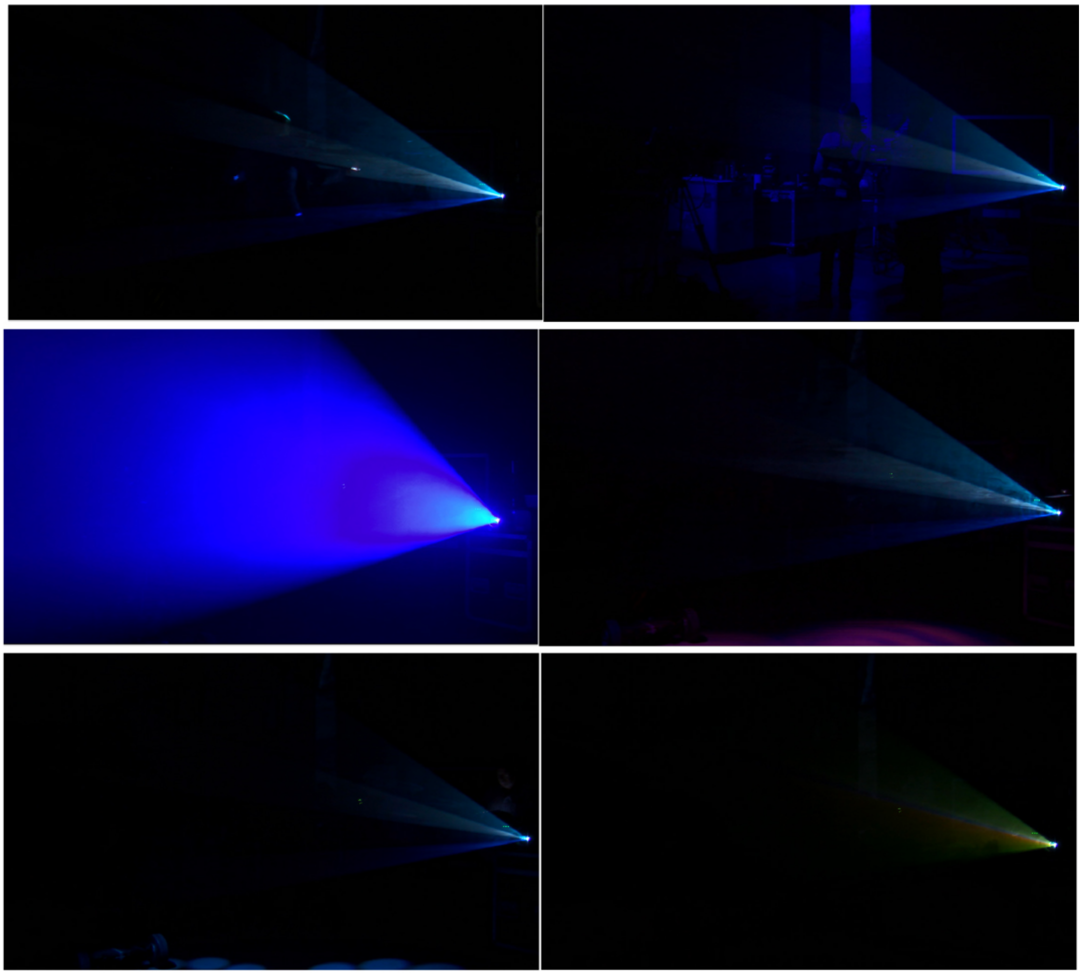
Cameras 2, 3, 4, animation



Cameras 2, 3, 4, animation, blue studio light + gobo spotlight



Camera 2, day 2 and day 3



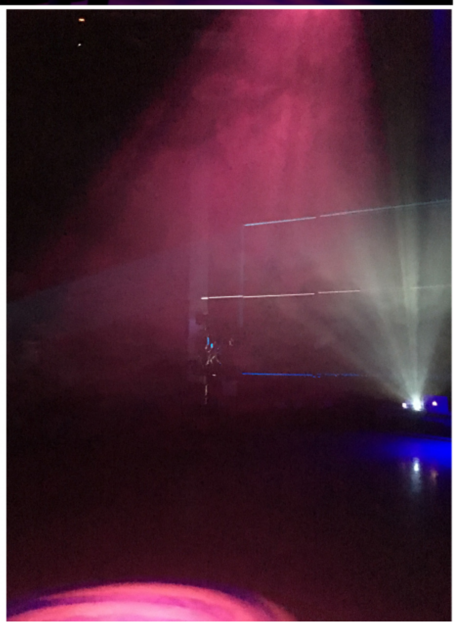
Camera 3, day 3

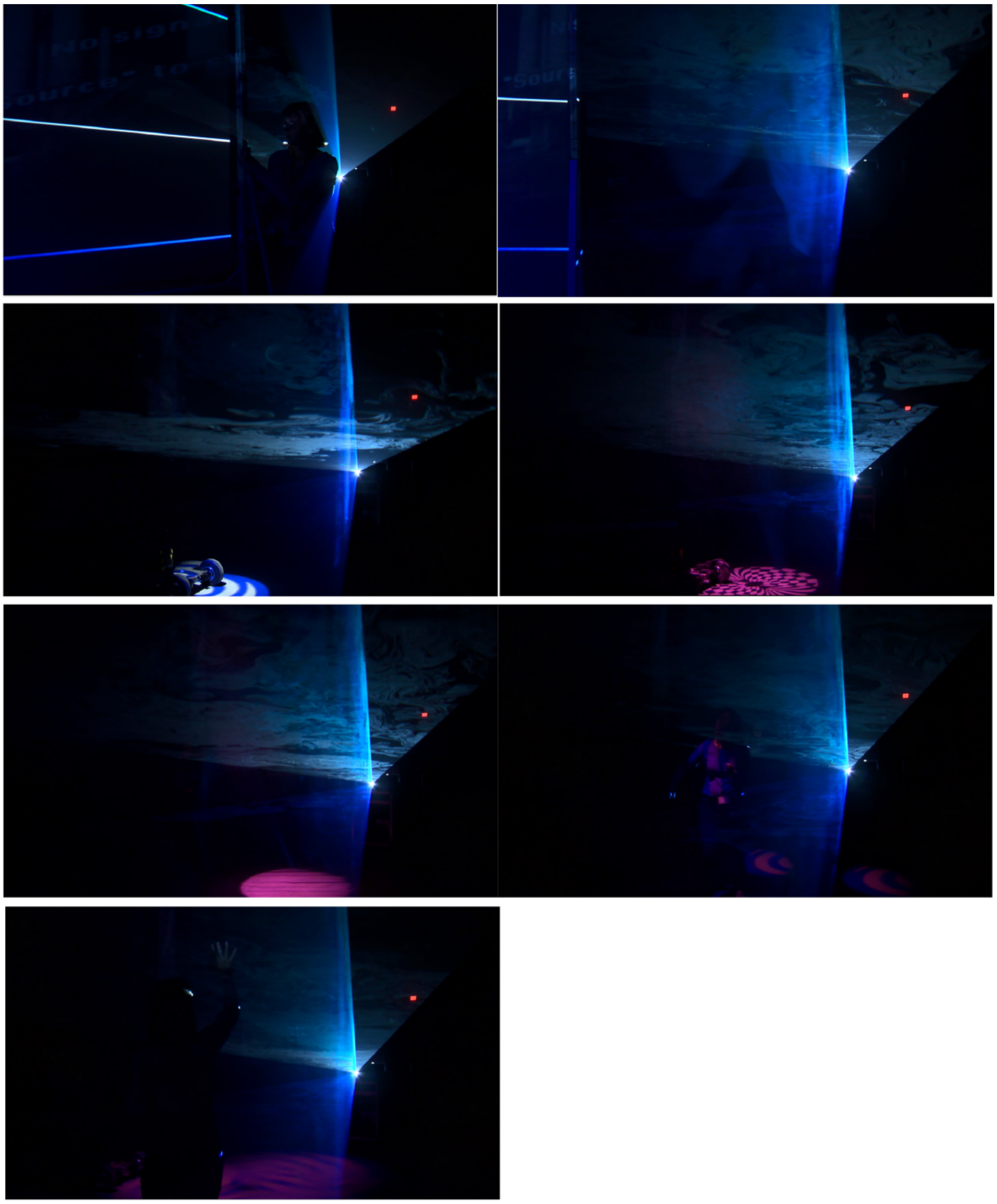





Camera 3, day 3

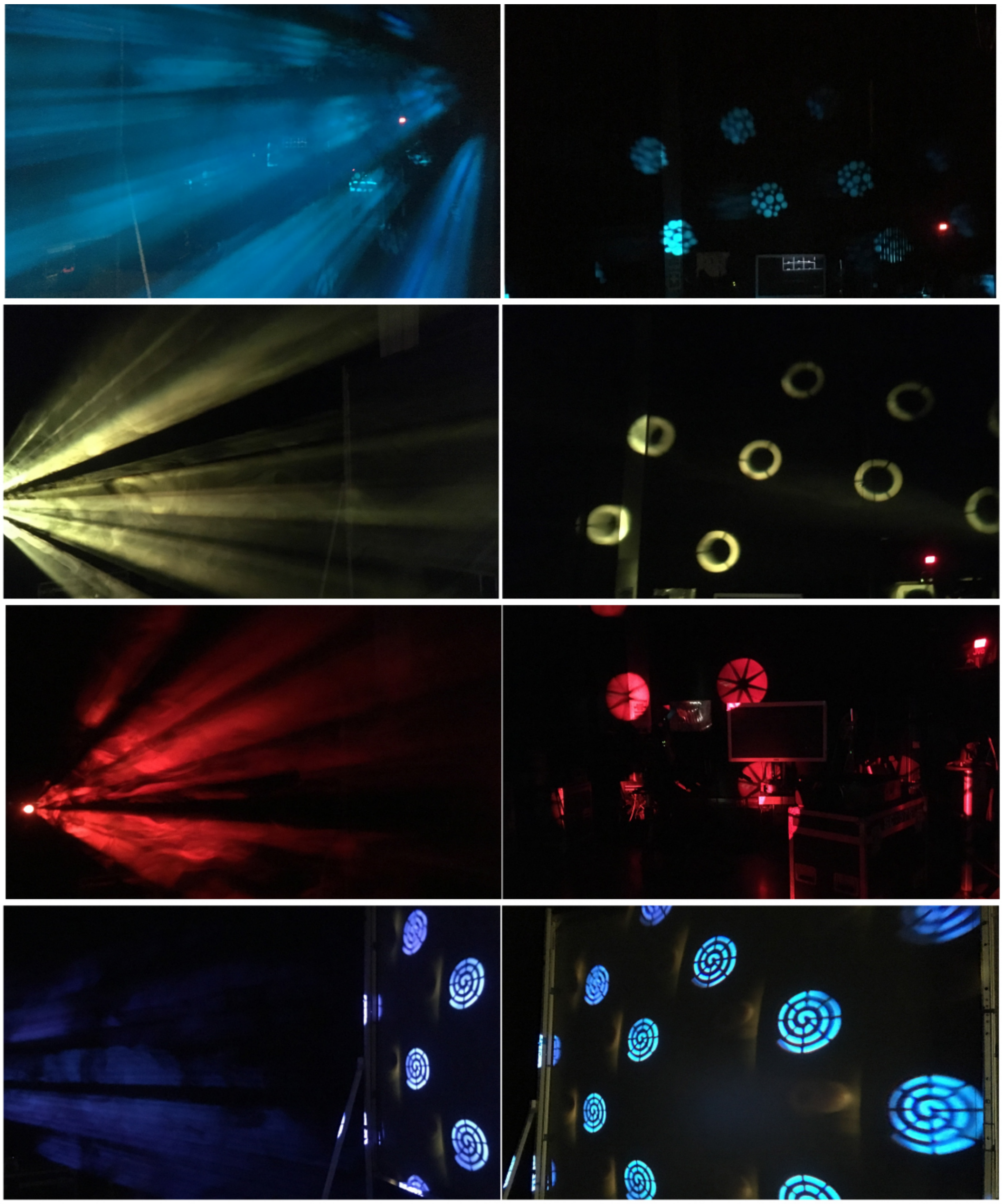
Interatcing with directional coloured light and projection



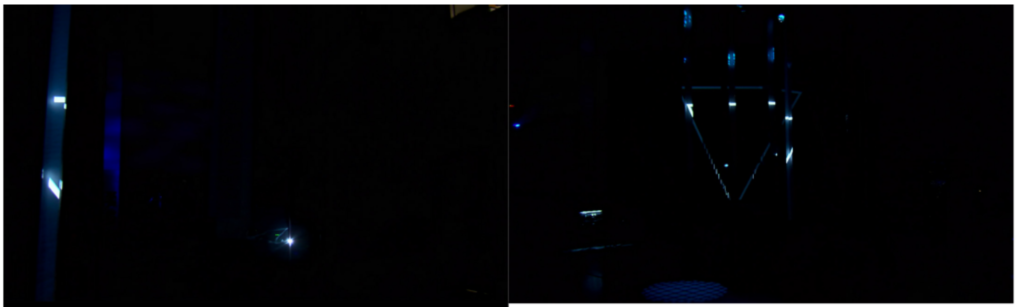


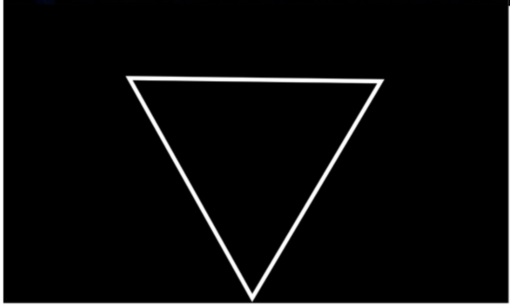
Camera 4, day 3

Changing gobos changing the quality of the beams, pattern won’t be on floor but in gantry. Looking into the intense projector; animation creates a rectangular blue haze.



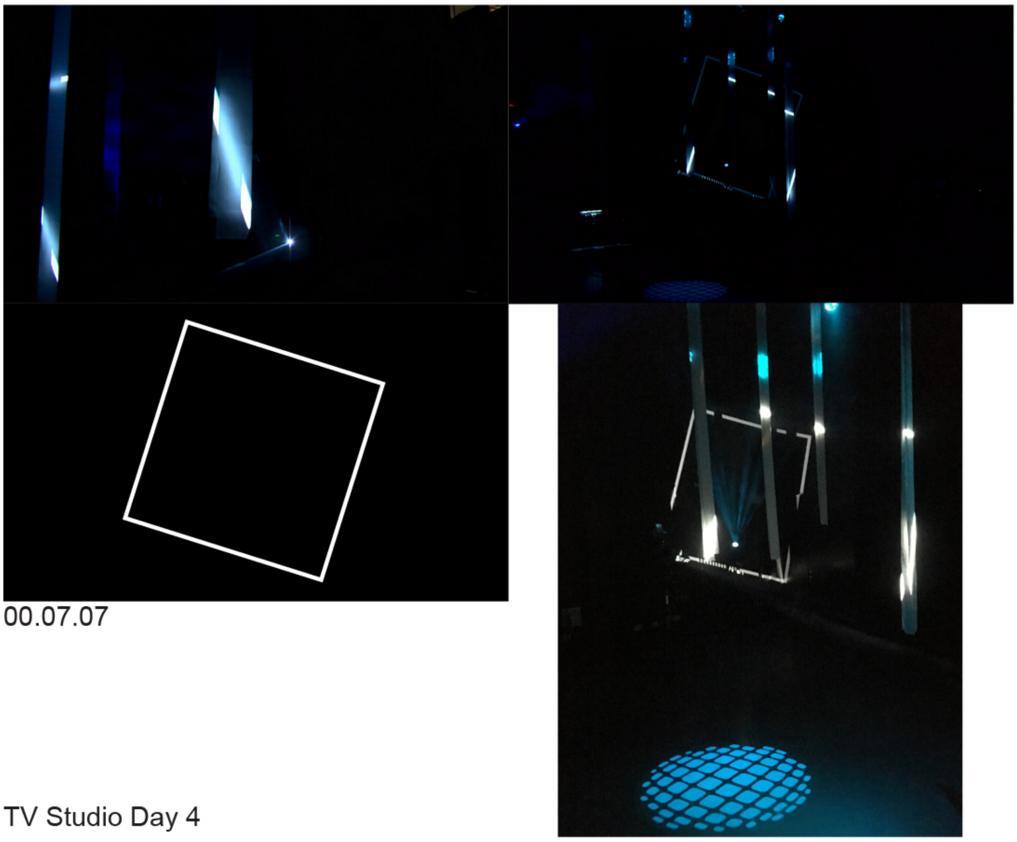
instead of projection all these lights can be used as up-lighters.
I used Datamoon on the floor
I up-lit into metal light-bars suspended from the ceiling.
I would need to hide the pattern: see images on right
And only show the beams as rays of light: see top three images on left





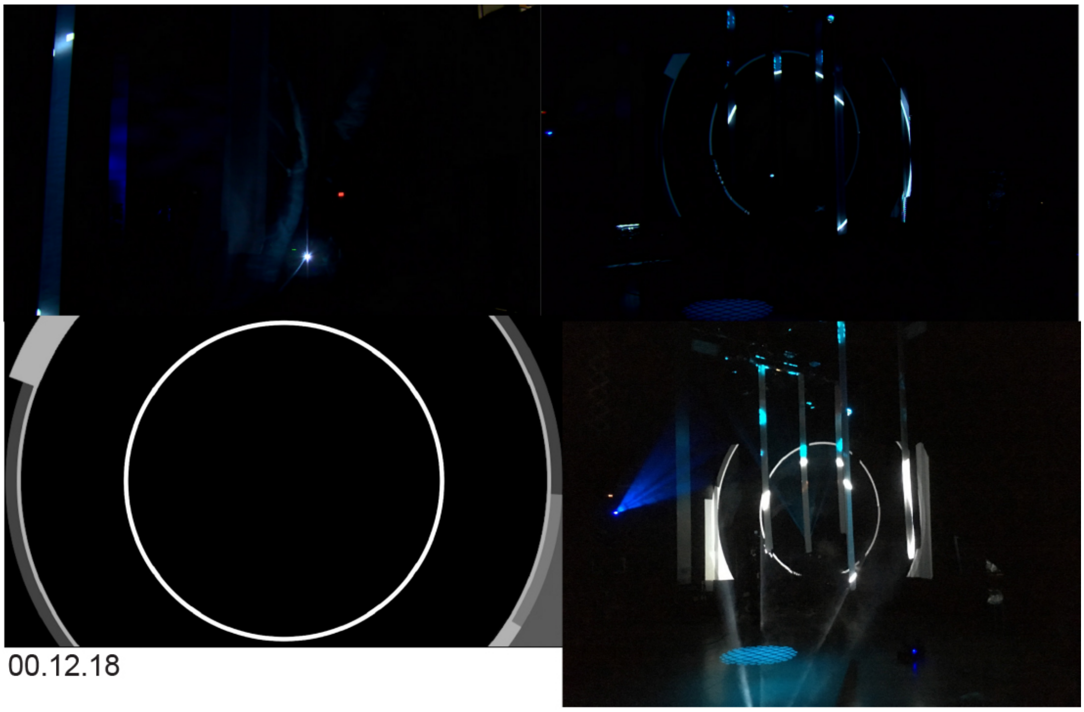
| camera 4 | camera 2 |
| --- | --- |
| animation | photograph |

00.03.19

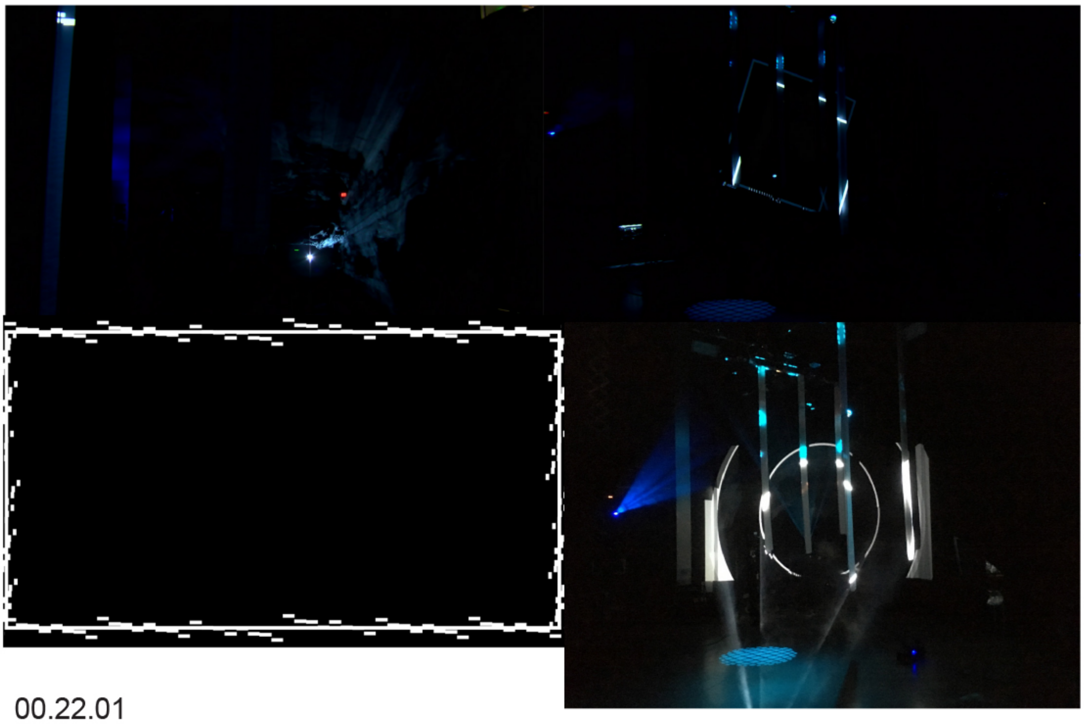


00.07.07

TV Studio Day 4



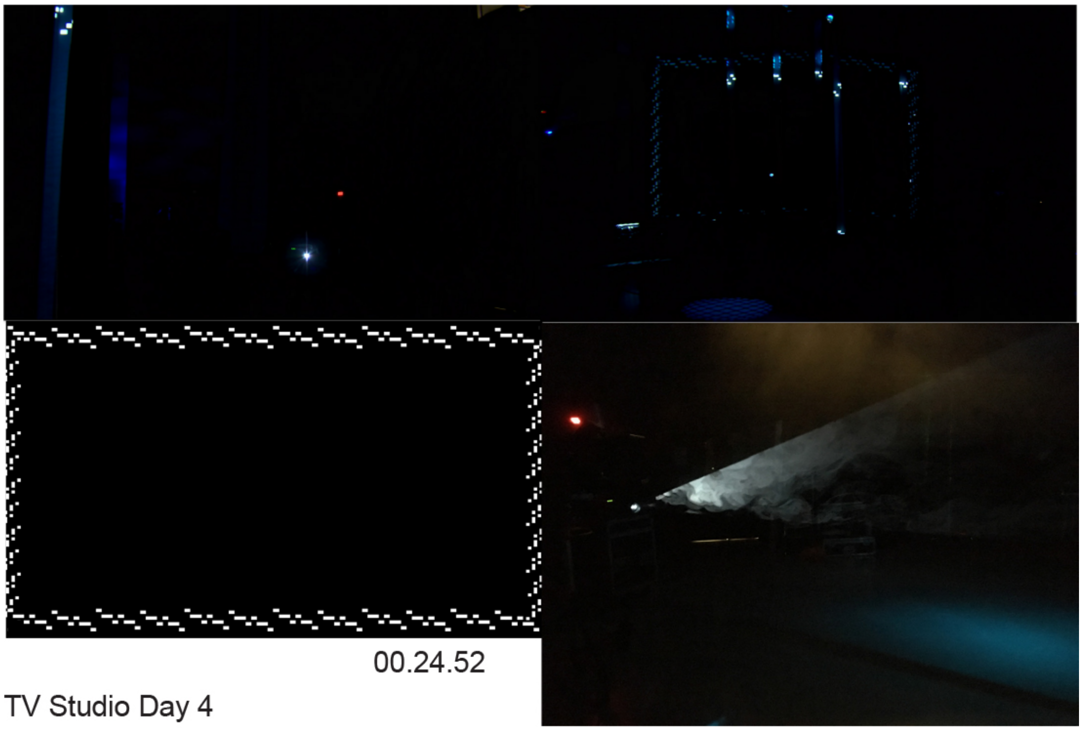
00.12.18



00.22.01

TV Studio Day 4

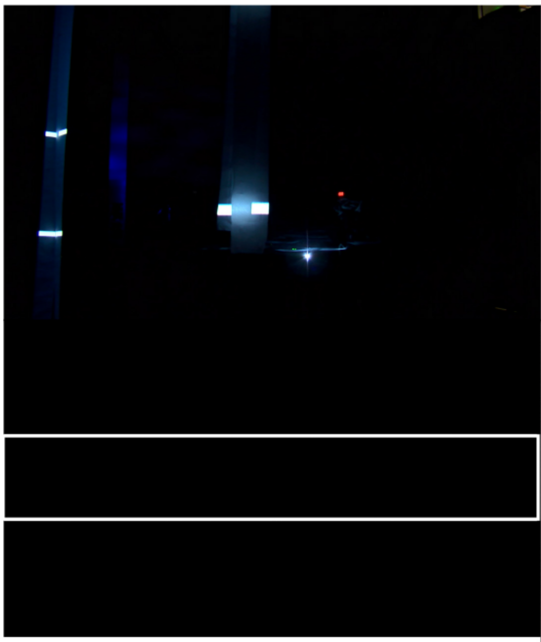
00.23.13



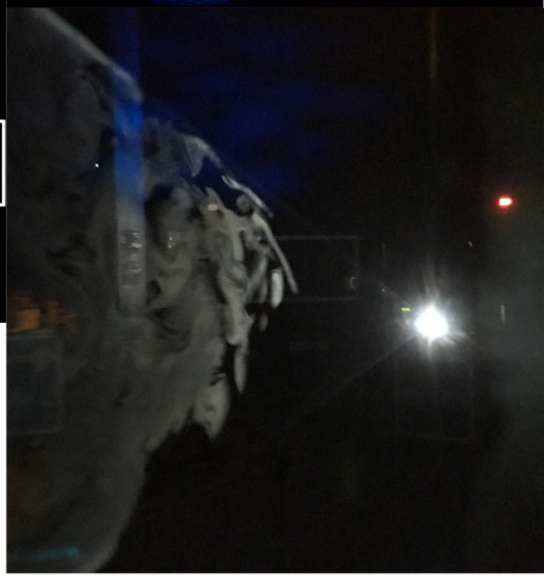
00.24.52

TV Studio Day 4

00.25.46

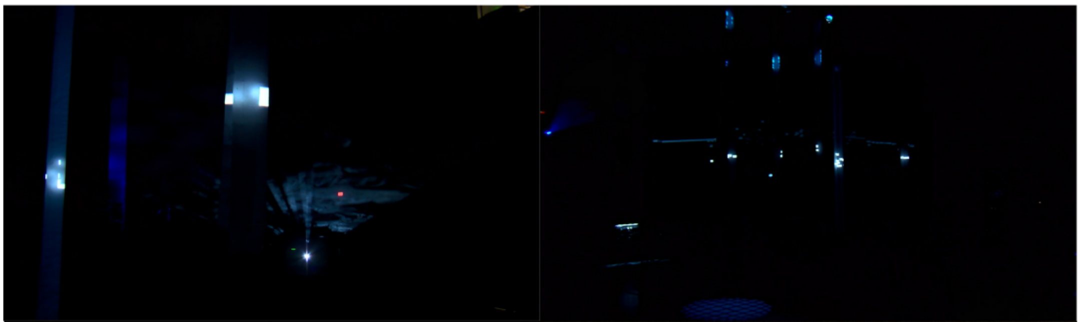


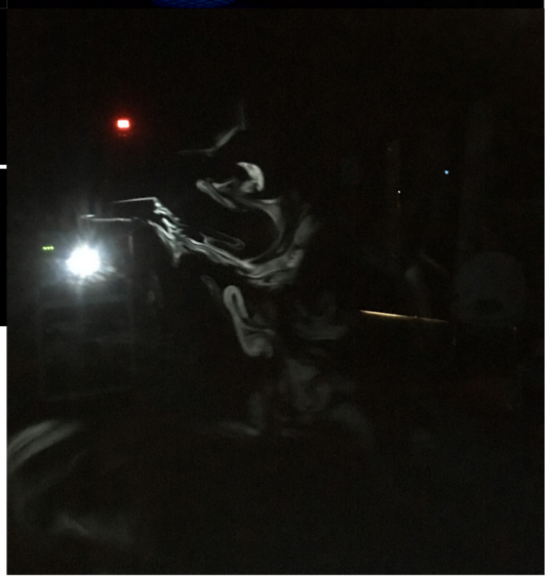
00.27.33



TV Studio Day 4

00.30.35

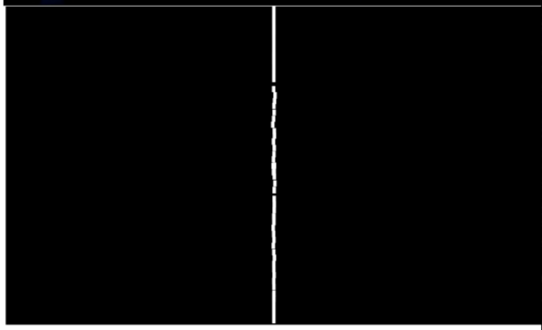




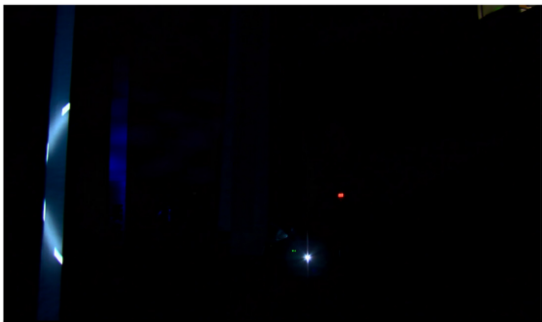
00.35.19

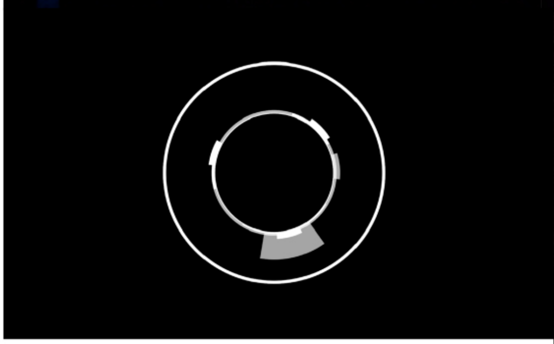
TV Studio Day 4






00.39.08

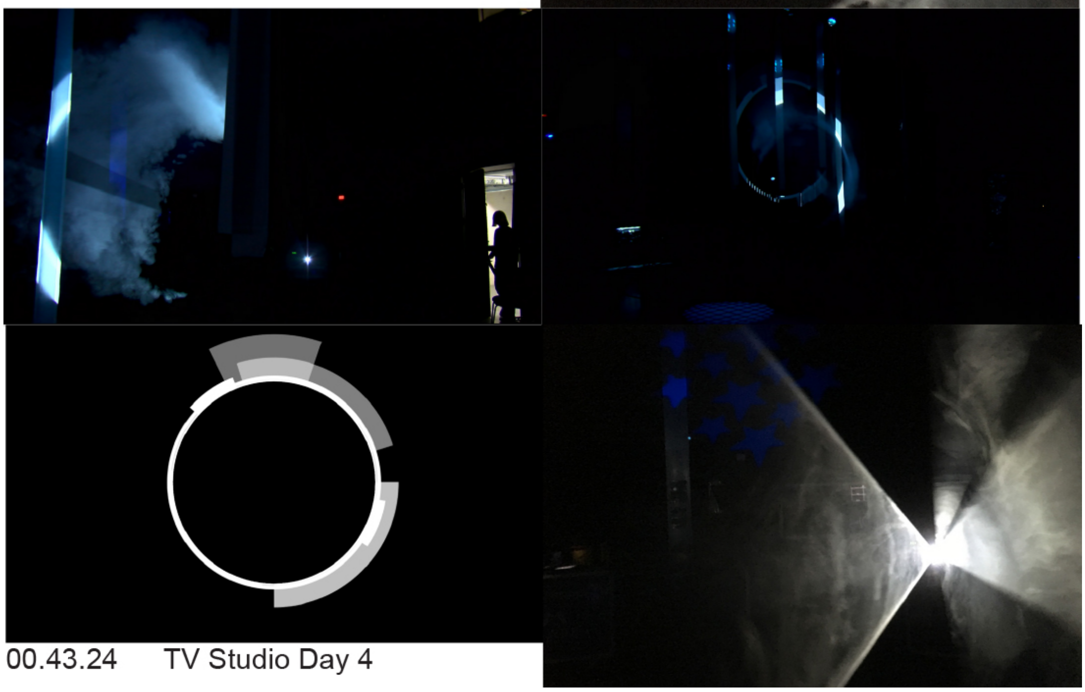




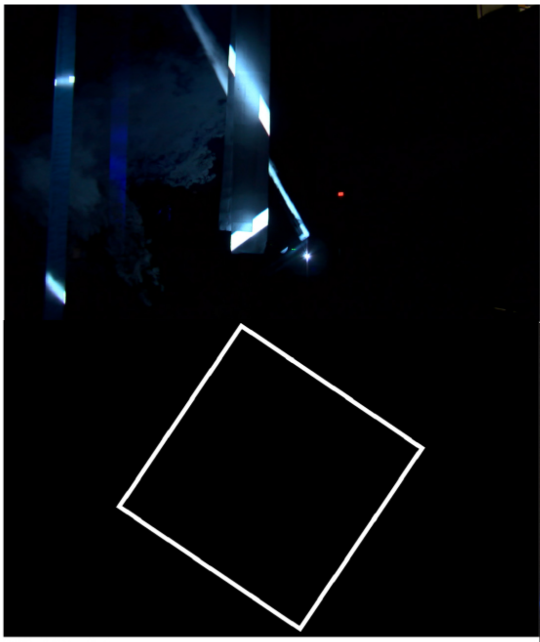

00.43.10

TV Studio Day 4

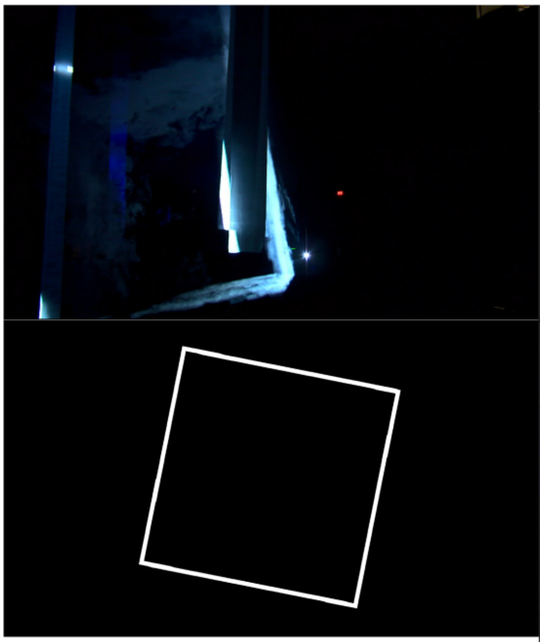
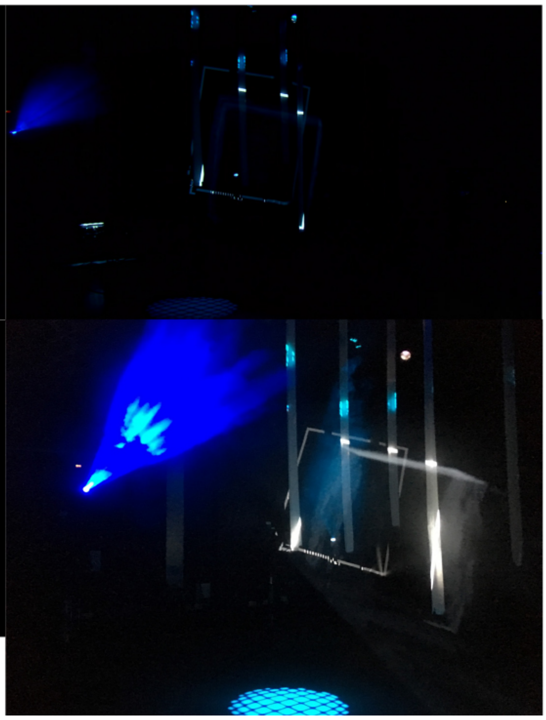
00.43.48



00.43.24 TV Studio Day 4

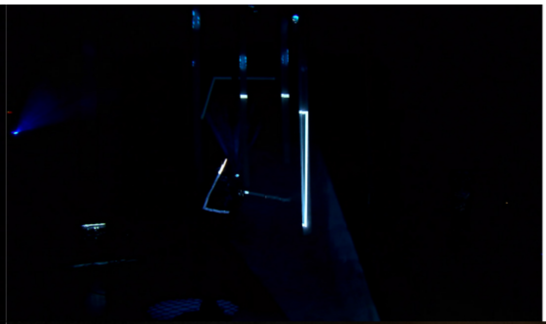
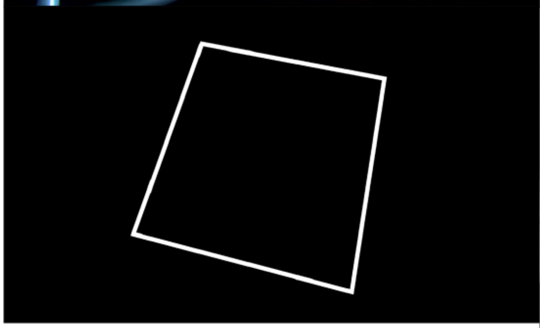


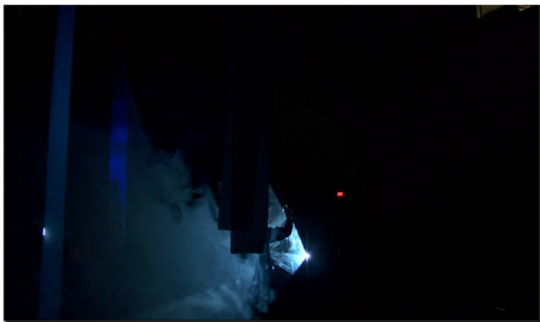

00.50.41

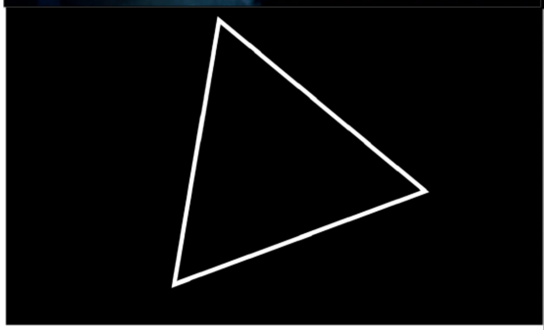
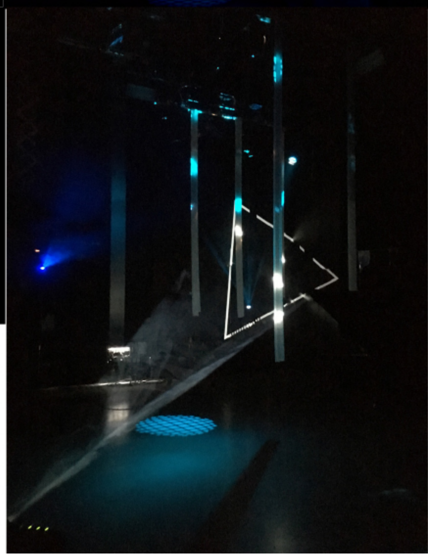



00.51.15

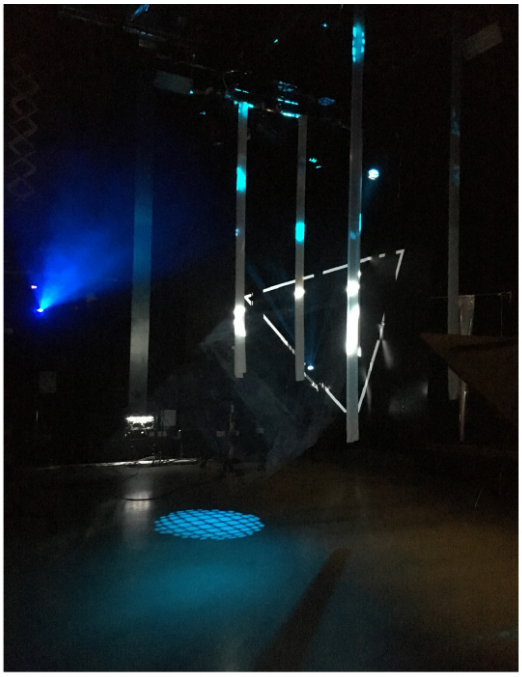
TV Studio Day 4

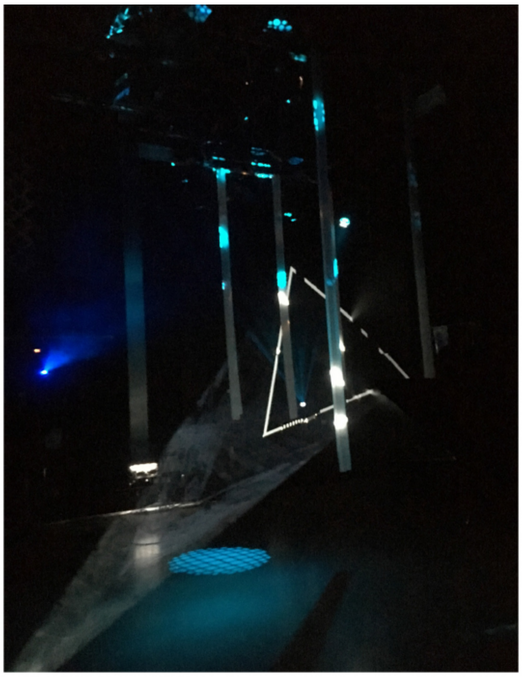



00.53.22



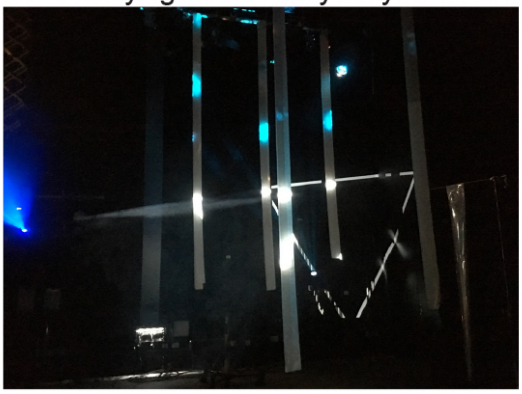

00.53.55


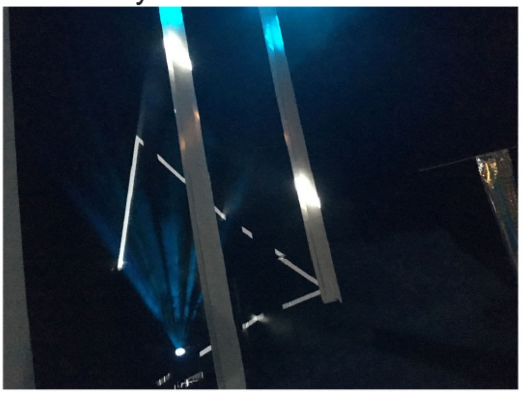
TV Studio Day 4

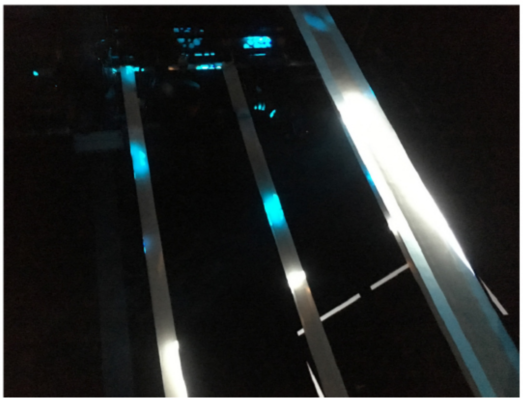


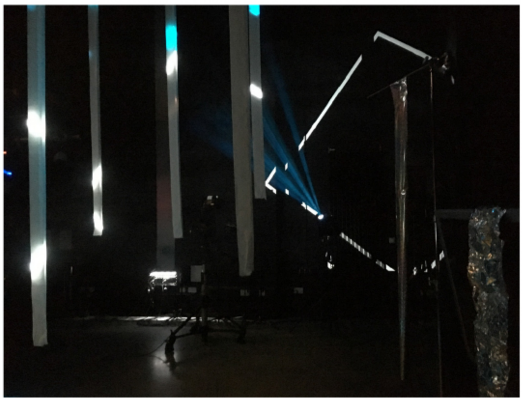


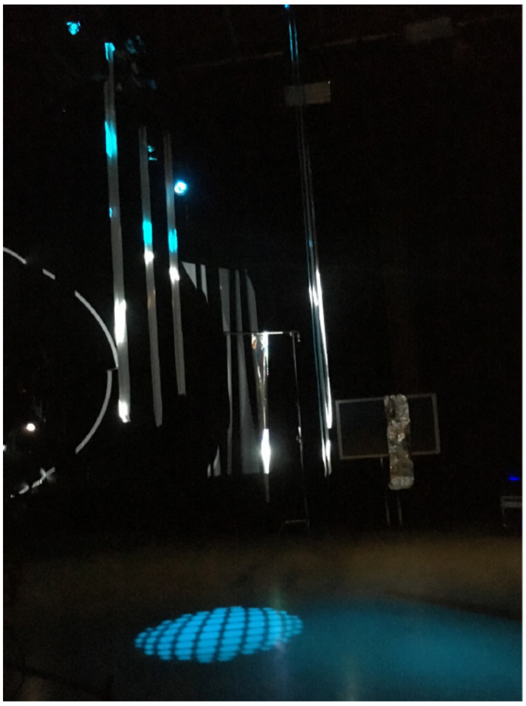
With and without the TV Gallery lights on. The floor is brighter and the beam in the haze is less visible when the lights are on. The rest of the shots are with the TV Gallery lights on. They may need to be on for safety.

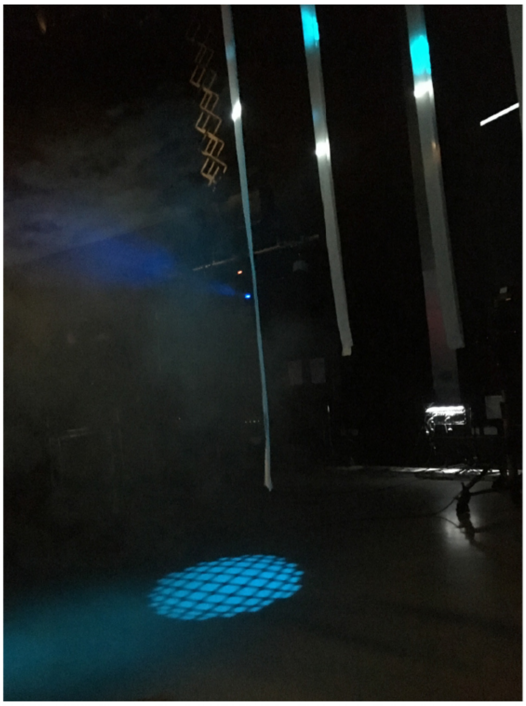




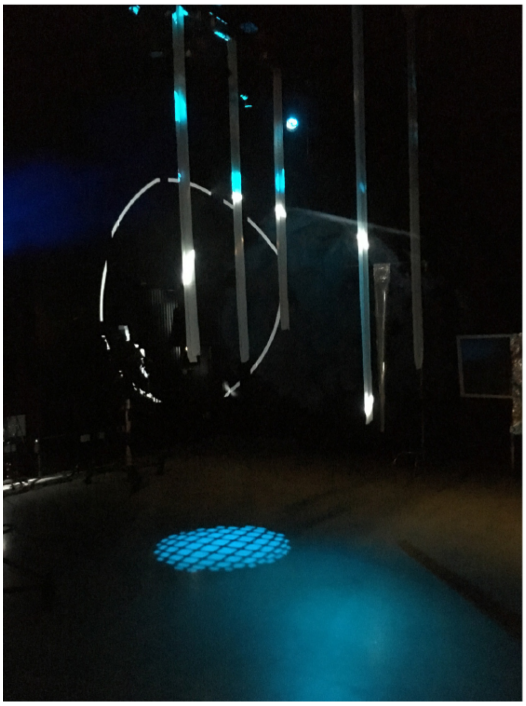


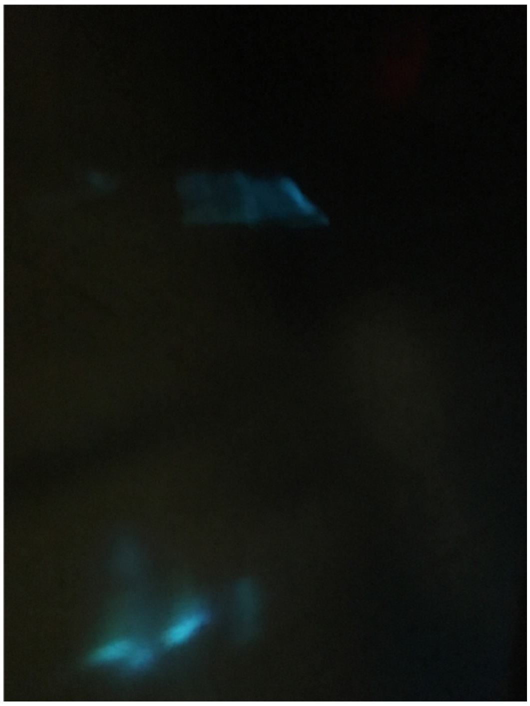


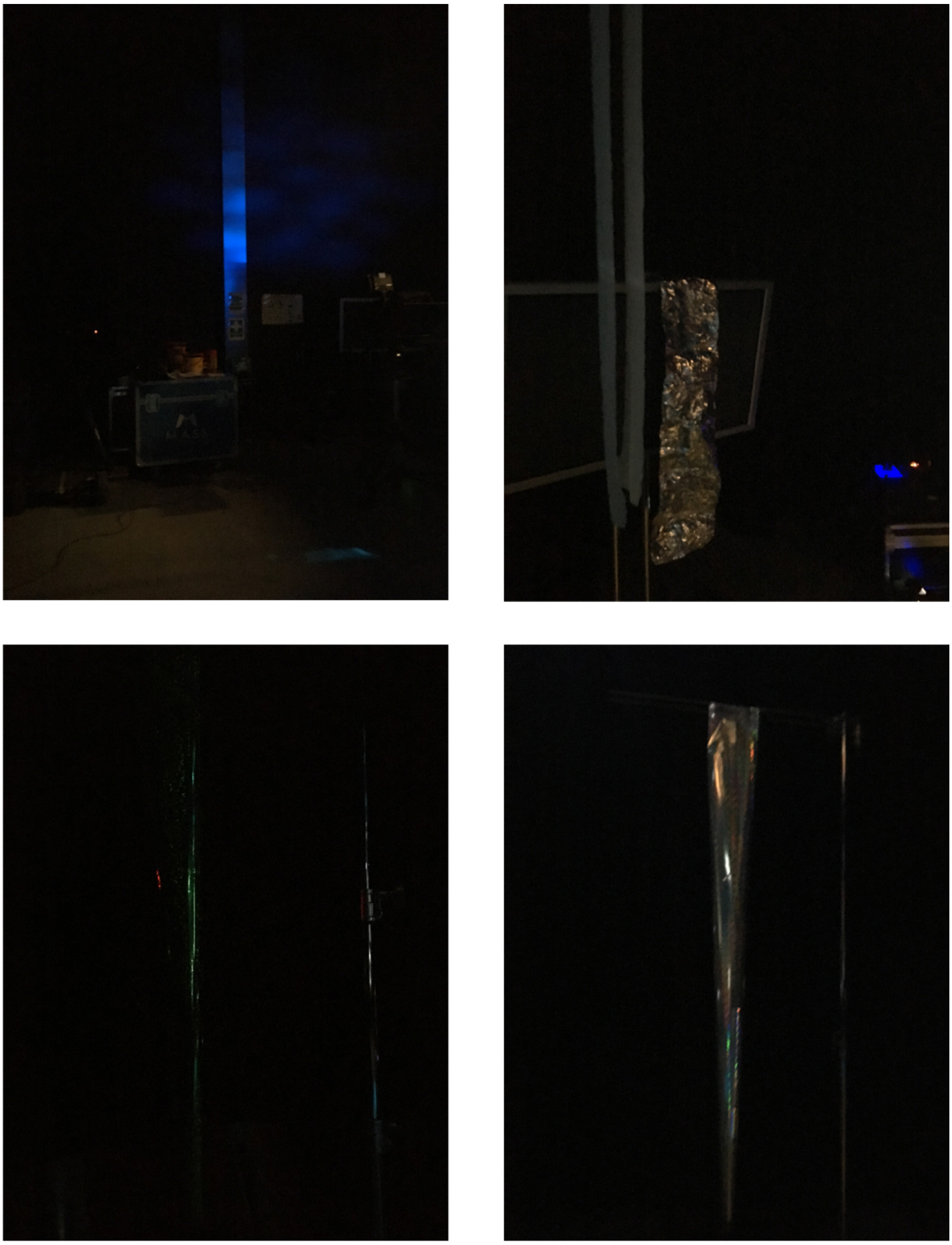




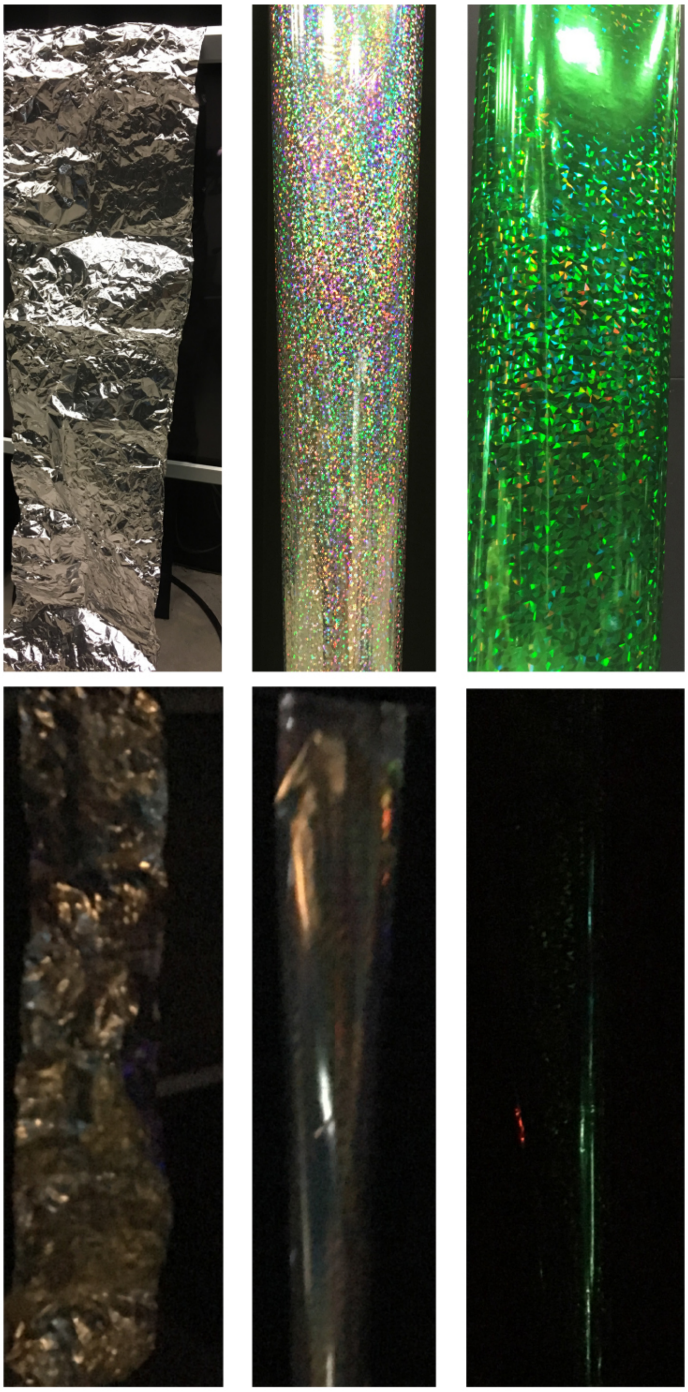
Blending colours of light in the haze



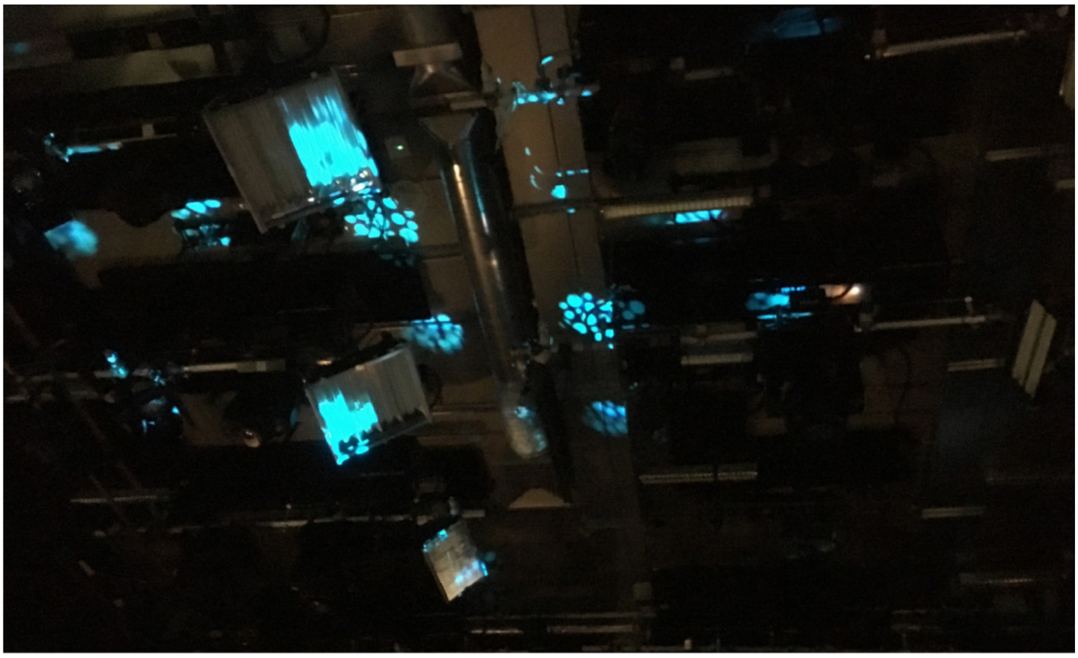




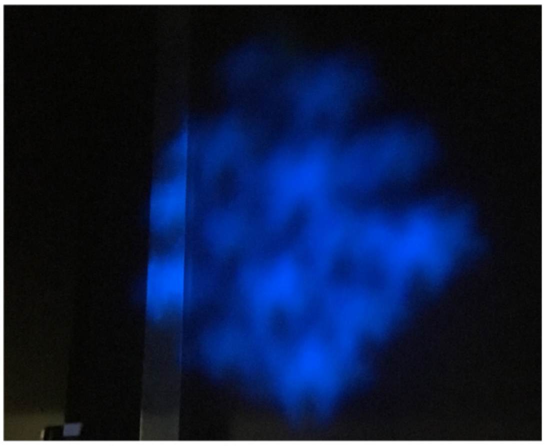
Comparing the shininess of metal on the wall, tin foil, green foil, micro-dot foil in the studio set up



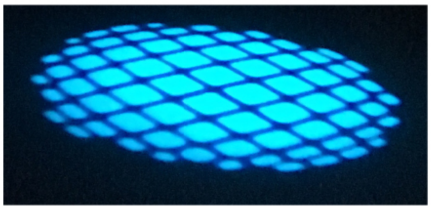
The green foil looks bright but hardly showed in the setup in the studio lights the whereas both types of silver: foil and micro-dot gleamed darkly as well as having bright highlights

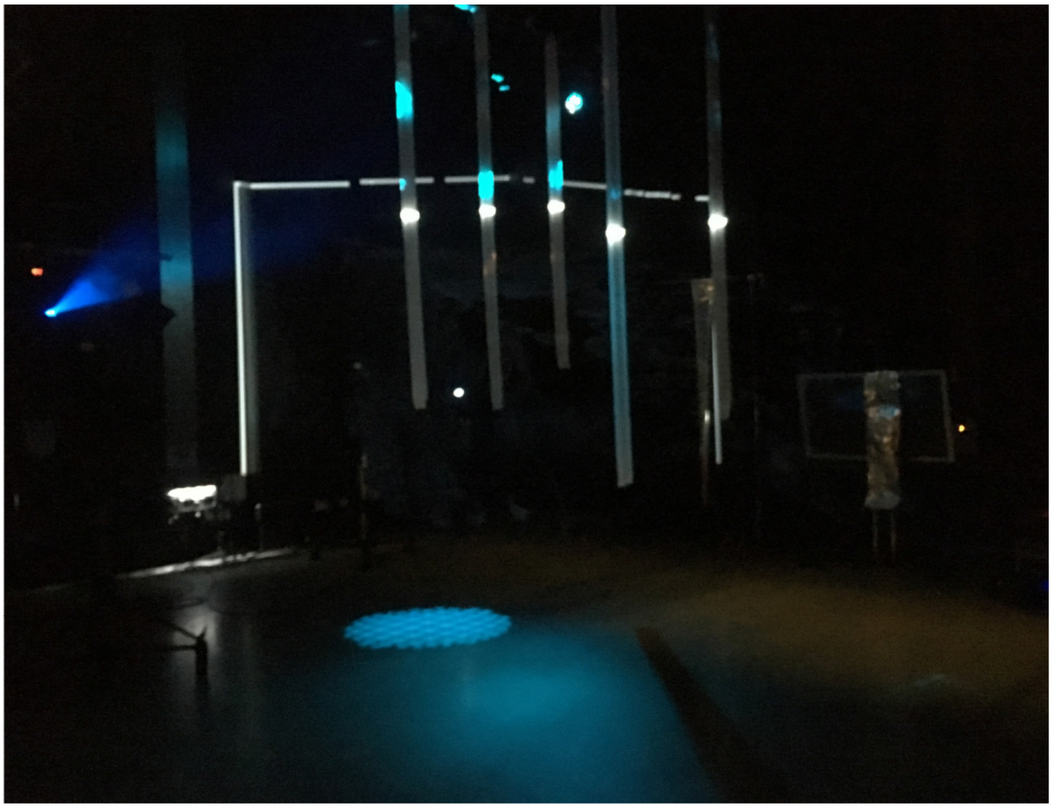


Datamoon light pointing up, pattern broken by
3D shapes
Need tungsten for brightness - LED are less bright
Additionally there are no known gobo makers, so
have to use default patterns

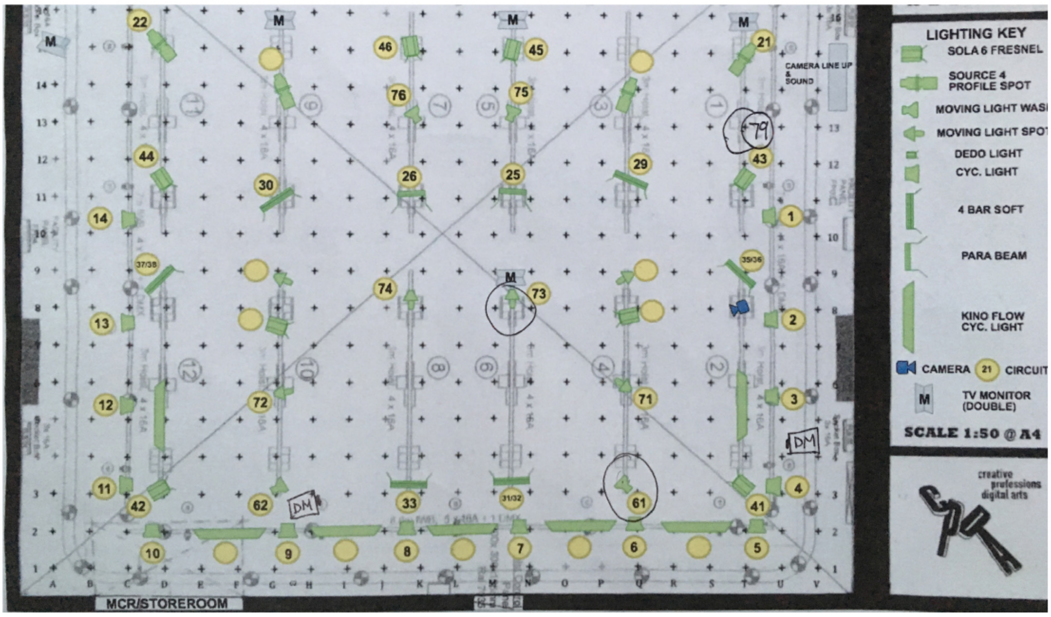


moving head martin mac x 2
with gobos can get shapes cut
Source 4 B size 78 mm
David Hursie Associates
Used: out of focus stars
and lattice gobos

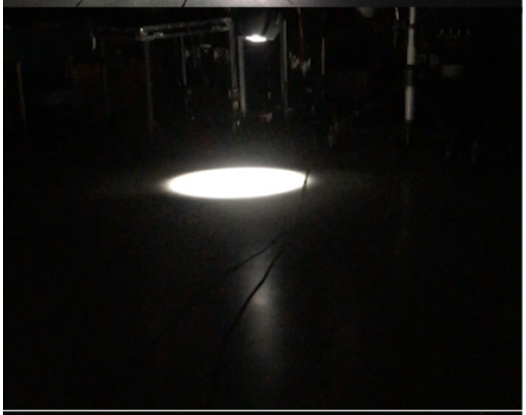


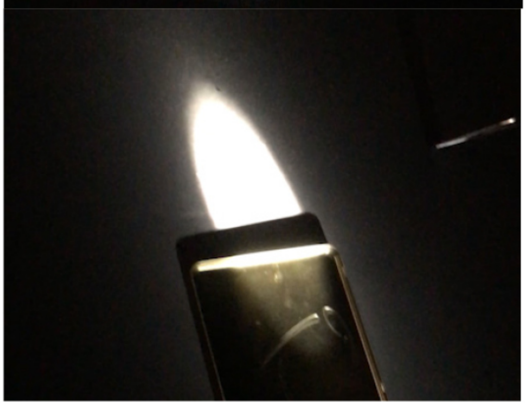


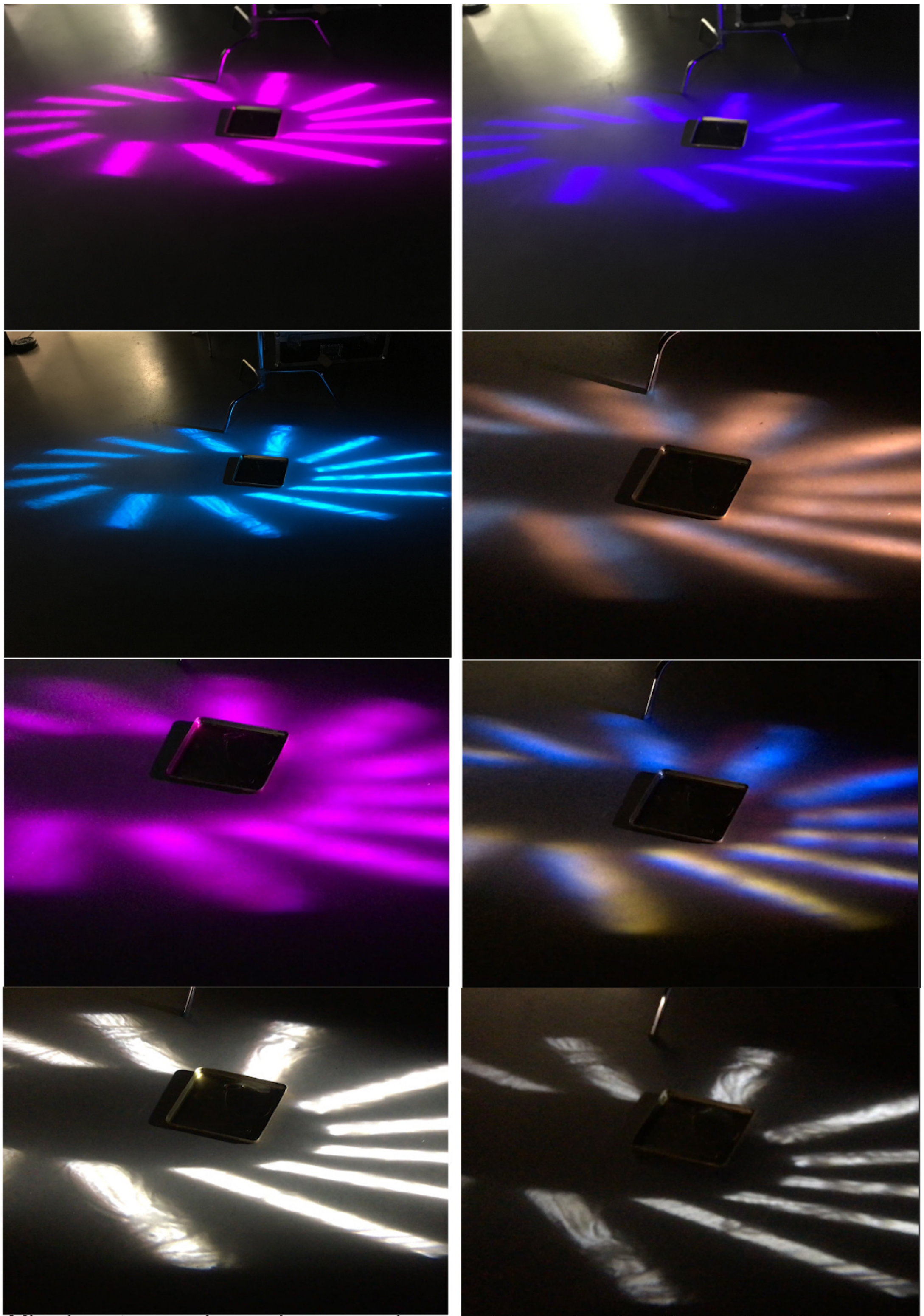
2 Datamoons [DM], 2 moving head Martin Mac with star gobo pointing up at wall 79 and lattice gobo down at floor 73 and Coemer moving head 25% blue wash (a Fresnel) pointing down at floor 61



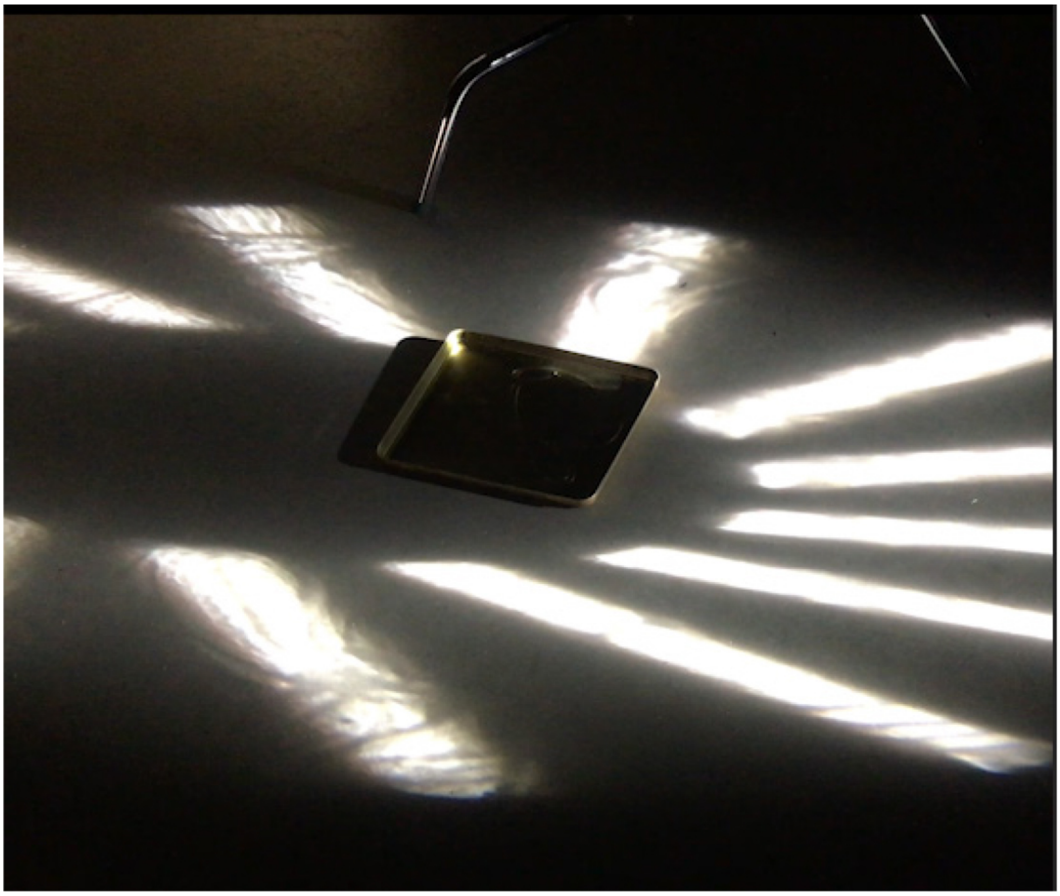

Clay Paky HMIs 1.2 kilowatts, i.e. really bright lights, potentially there are 8
Will be able to put the desk in gallery
Can pre-program to change eg colour
Can assign in gallery and manually change via iPad in studio, i.e. **live** colour etc changing
Can focus & iris down tight and change the shape of the light. It is bright enough to reflect off tin & light the metal strips on the box below



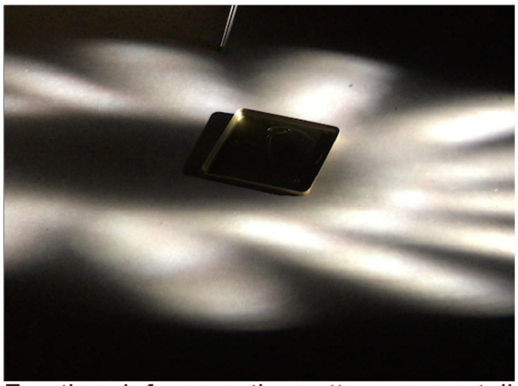




Mix almost any colour using cmy colours and the gels, plus dimmer function



Different gobos, each can spin, and chase (animate across the thrown light). The pattern is created by a flag that comes in fromt of the lamp,



Frosting defocuses the pattern, evenutally it is a smear.

Strong sunlight bouncing off red foil on the floor produces ever changing caustic patterns on the white ceiling

# Appendix D: *Singing Light 1* session log

10 November 2018

Footage: MAH00024

2 spectator-participants taking photographs

Footage: MAH00025

4 seconds test of recording

Footage: MAH00026

Helping spectator-participant to negotiate walking around the line – her eyes were very slow to adjust to the low light

Footage: MAH00027

- 1 spectator-participant walked around twice, then a stream of spectator-participants arrived, queued then stood in the light
- By 18 minutes, 20 spectator-participants had entered, 5 or 6 spectator-participants were left in the room, then 6 spectator-participants came in and stood by them at the back (20 minutes); 2 spectator-participants left and 2 spectator-participants joined at the back
- Spectator-participants were silent or talked very quietly
- 2 spectator-participants joined; 3 or 4 spectator-participants left
- 8 or more spectator-participants left, and 6 spectator-participants joined gradually (26 minutes)
- 2 spectator-participants joined, most spectator-participants had left by now, leaving 2 spectator-participants (28 minutes)

Total of 40 spectator-participants in this 30-minute section

Footage: MAH00028

- By 2 minutes, 7 spectator-participants entered

- By 4 minutes, 5 more spectator-participants; spectator-participants and I circled around to the haze machine, the other spectator-participants were playing in the light
- By 5 minutes, 3 more spectator-participants entered
- At 6 minutes, there were 10+ spectator-participants in the room, playing with the light; 3 spectator-participants left
- By 7 minutes, 2 spectator-participants had entered and 3 left; those in the light were staying for longer
- By 8 minutes, 3 more spectator-participants entered
- By 10 minutes, there were 6 spectator-participants in the light in a huddle and 2 spectator-participants left
- By 12 minutes, I show 2 spectator-participants' hands casting shadows
- By 13 minutes, 3 more spectator-participants entered
- By 15 minutes, 3 spectator-participants left, 1 spectator-participant returned
- By 17 minutes, 2 spectator-participants are playing in the light, then leave;1 more spectator-participant enters
- By 19 minutes, 3 more spectator-participants enter and I show them the path
- By 21 minutes, 3 more spectator-participants enter, more play in the light
- By 22 minutes, spectator-participants play in the light again
- By 25 minutes, 2 spectator-participants leave; there are 4 spectator-participants left visible in the room
- By 27 minutes, 2 spectator-participants are playing in the light (one is recording the other); I add more haze; they step back and then enter the haze again; another spectator-participant enters the light to take photos
- After the last tape near the end, when the beam is single and few spectator-participants are in the room, 1 new spectator-participant steps into the room, has a brief look around and leaves

Total of 31 spectator-participants in this 30-minute section

Total of 73 spectator-participants altogether (Footage: MAH00024, Footage: MAH00027, MAH00028)

Shortest visit 1 minute; longest visit 30 minutes

# Appendix E: A definition of Visual Music by Keefer and Ox (2008)

There are differently formed visual structures that can be called Visual Music.

- A visualization of music which is the translation of a specific musical composition (or sound) into a visual language, with the original syntax being emulated in the new visual rendition. This can be done with or without a computer. This can also be defined as intermedia.

- A time based narrative visual structure that is similar to the structure of a kind or style of music. It is a new composition created visually but as if it were an aural piece. This can have sound, or exist silent. Theorist/inventor Adrian Klein wrote in 1930: "…somehow or other, we have got to treat light, form and movement, as sound has already been treated. A satisfactory unity will never be found between these expressive media until they are reduced to the same terms."
  [Klein, Adrian Bernard. "Colour-Music: The Art of Light." London: The Technical Press Ltd., 1930. Second edition, p. 37.]

- A direct translation of image to sound or music, as images photographed, drawn or scratched onto a film's soundtrack are directly converted to sound when the film is projected. Often these images are simultaneously shown visually. Literally, what you see is also what you hear. (An early example is filmmaker Oskar Fischinger's Ornament Sound experiments c. 1932). There are many examples in Visual Music film of this process, e.g. McLaren, Spinello, Damonte and other contemporary filmmakers, including sections of Pengilly's work in this show. This method has been called a "pure" type of Visual Music.

- A visual composition that is not done in a linear, time-based manner, but rather something more static like a 7' x 8' canvas. However, as in Klee, the movement of the painted elements can and have achieved a kind of Visual Music, serving as an artist's visual interpretation of specific music.

From: *On Curating Recent Digital Abstract Visual Music* by Jack Ox and Cindy Keefer
http://www.centerforvisualmusic.org/Ox_Keefer_VM.htm [accessed 17/06/14]