

Perceiving time through the 'frame gap' in experimental cinema

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Appendices

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Overview:

Appendix A is a chronological record of my practice during the period of study for the practice-led PhD, including a brief introduction of the research context, process, results and reflections.

Appendix B details important feedback gained through conversations with people from diverse backgrounds - scientists, artists and doctoral candidates with varying interests - some of whom directly contributed to the progress of this research. This feedback was mainly obtained through discussions with academic conference attendees and art exhibition visitors at Middlesex University, where I presented my artwork. Given that my research focused on common perceptions of time, no stringent rules were established regarding who was qualified to provide feedback.

Appendix C presents an overview of some of the critical artworks used during this research to demonstrate how my works reflect key theories and practices. These exhibitions involved light installations, light performances, film installations, and film screenings on the topics of light, film and time. Some of them are the descriptions of my personal experiences at several key art exhibitions that I visited during this study.

Appendix A

Date: 2017

Transient Reflection (2017)

Description

Transient Reflection (2017) is a pre-doctoral work I made during my post-graduate study, and it encouraged me to embark on this research on light and film. The animation used light to create caustic images as a pictorial expression of abstract animation. This experimental film used stop-motion animation and frame-by-frame recordings of the movements of caustic light patterns as moving images (see Figure 01). The resulting sequences were edited into four sections based on their distinct visual qualities, which corresponded to the translucent objects used (i.e., glass shards and crystal ashtrays, DVDs with water droplets on their surfaces, squeezed plastic bottles and plastic bags) (see Figure 02). Simultaneously, short black sequences were inserted into the animation as intervals.

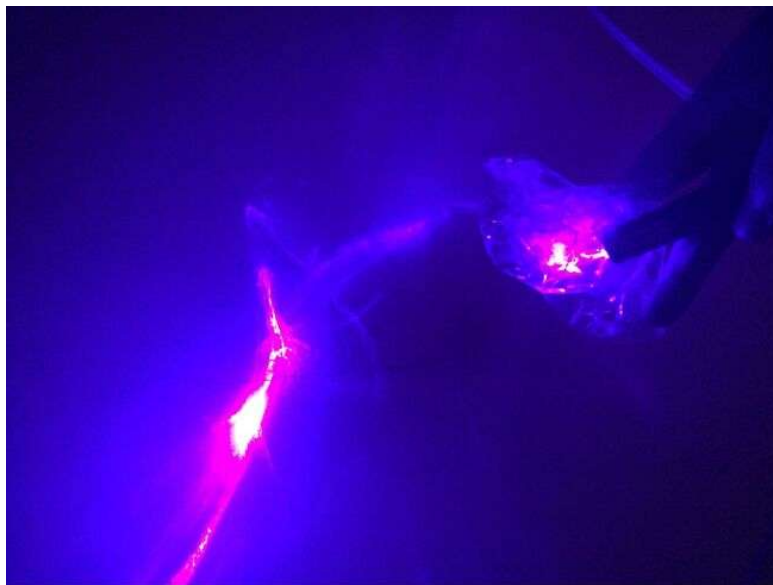


Figure 01. A documentary photo of producing *Transient Reflection (2017)*.

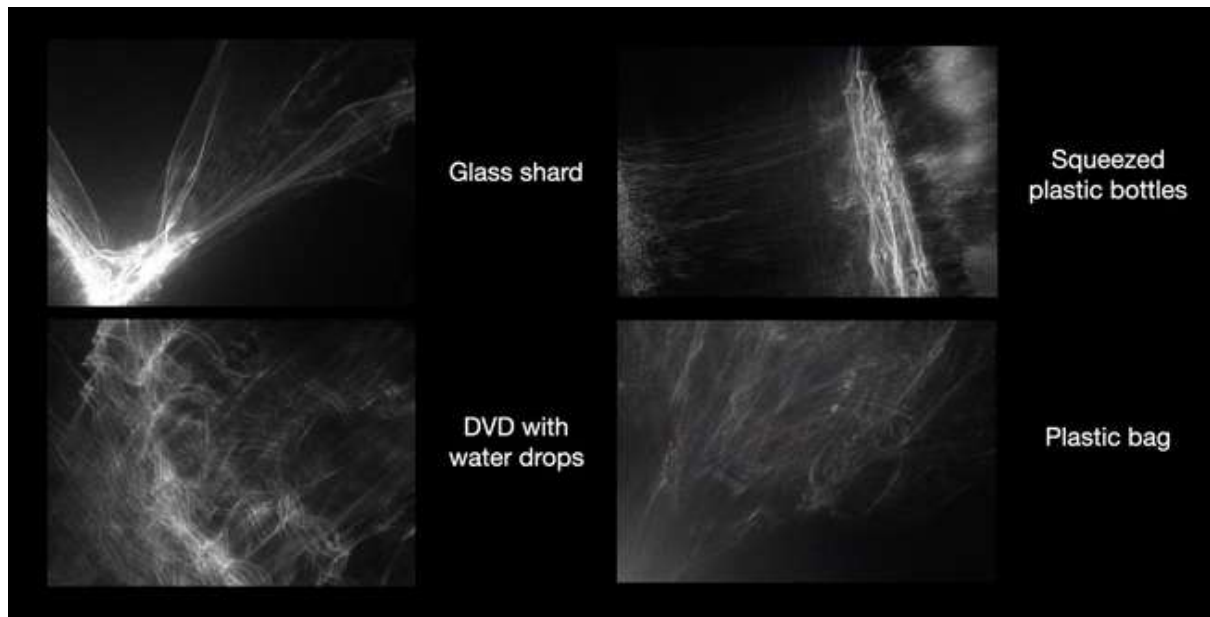


Figure 02. The distinctive patterns from different materials used as refractors in Transient Reflection (2017).

Julien Mier, a contemporary musician, designed sounds synchronised to the image movements that were based on the textural qualities of the refractive images. He applied sound effectors, including GranularMB and MMorph, and reverb techniques to several sonic materials. These effectors rendered the original sounds difficult to identify, creating abstract sounds. The combination of the abstract imagery and audio in this work creates a strange environment in which the mysterious images engage with the unidentifiable sounds, producing an audio-visual experience in which the sound responds to the textural patterns.

Reflection

Using light as a pure medium in this film encouraged me to embark on this wider research into light and film. I focused on experimenting with light aesthetics and engaging with different material qualities. My early experiments can be categorised into three subject areas:

1. The physicality of the refractors
2. Light sources

3. The screen as the receiver of light

In addition, my editing approach, which was based on the similarity of kinetics and the use of blank images at set intervals, shared common features with several existing abstract films. Analysis of these films revealed the anti-narrative characteristics of film. In addition, the frame-by-frame technique generated a jerky motion that prompted me to think about the frame structure of film as a medium specificity. The synaesthetic experience of sound and vision also encouraged me to investigate the auditory qualities of these abstract images and explore the auditory potential of these abstract moving images in the context of visual music.

Date: 24 May 2022–25 August 2022

Durational Reflection (2022)

Place: Animation Studio (G142) at Middlesex University and Common Room at Usher Hall

Description

By reflecting on abstract animations through film history and light artworks that create visual effects similar to those in *Transient Reflection* (2017), my early experiments sought to examine light aesthetics in form and motion through the physicality of the equipment used, focusing on the three aspects described previously. Firstly, I examined sunlight as the light source and relocated my experiments to the Common Room in Usher Hall, which provided sufficient sunlight during the daytime (see Figure 03). During the nighttime, I tested the light performance by using ice as the refractor (see Figure 04). Additionally, I experimented with several materials by applying the scientific rule of using experimental subjects as constants and variables. During these experiments, I was drawn to the rhythmic patterns on the surface of the glassware (see Figure 05). Thus, *Durational Reflection* (2022) aimed to create an audio-

visual experience by using the rhythmic structures of these glasses as an instrument to shape light.



Figure 03. The documentary photo of experimenting light motion with sunlight.

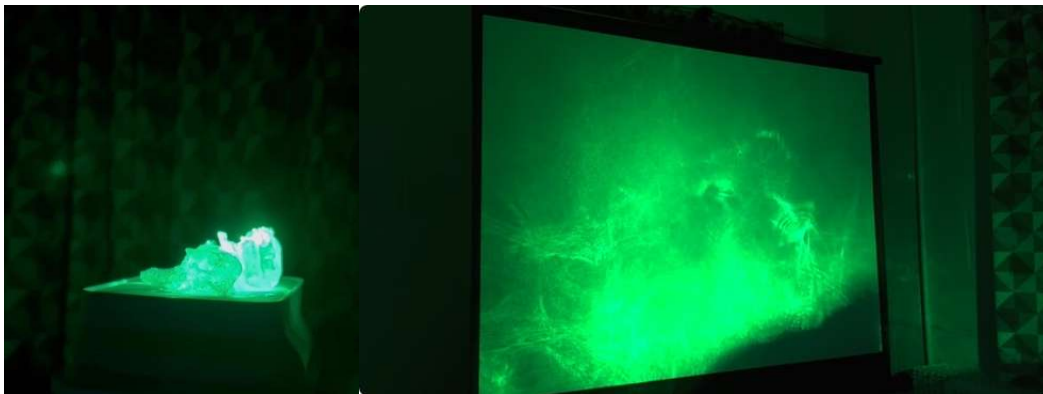


Figure 04. The documentary photo of experimenting light motion with ice



Figure 05. The glassware experimented in Durational Reflection (2022).

Reflection

A series of documentary photographs and short videos was recorded as evidence of the experimental process. The experiments did not produce any significant results that were relevant to the form and motion of the light aesthetics. However, the particular features of sunlight and ice prompted me to consider how the physicality of these materials relates to humans' perception of time. In addition, the exploration of the audio-visual experience encouraged me to further reflect on this through abstract film. Together, these aspects laid the foundation for the development of my frame gap concept.

First, sunlight is not a mechanically driven movement that requires power or human effort. As the caustic images produced are sensitive to movement, the refractor could intensify the motion effects of the light patterns. That is, looking at the movement of a sunlight shadow does not normally evoke a sense of passing time. In contrast, magnifying the sun's movement via a refractor generating caustic movements could create an enhanced sensation of the passage of time, enabling me to perceive the temporality of sunlight.

Ice is a refractor that also has the same characteristic as sunlight, projecting a natural movement without human intervention. This inspired me to consider ice as a unique material with a temporality embedded within natural processes. That is, the melting of ice is a natural process that produces an automatic movement that conveys the sense of time passing.

In *Durational Reflection* (2022), the light performance of each piece of glassware was recorded, showing a square-dot pattern as the beginning and the darkness as the ending in each segment. The distinct sculpting of each piece of glassware produced corresponding imagery on the screen (see Figure 06).

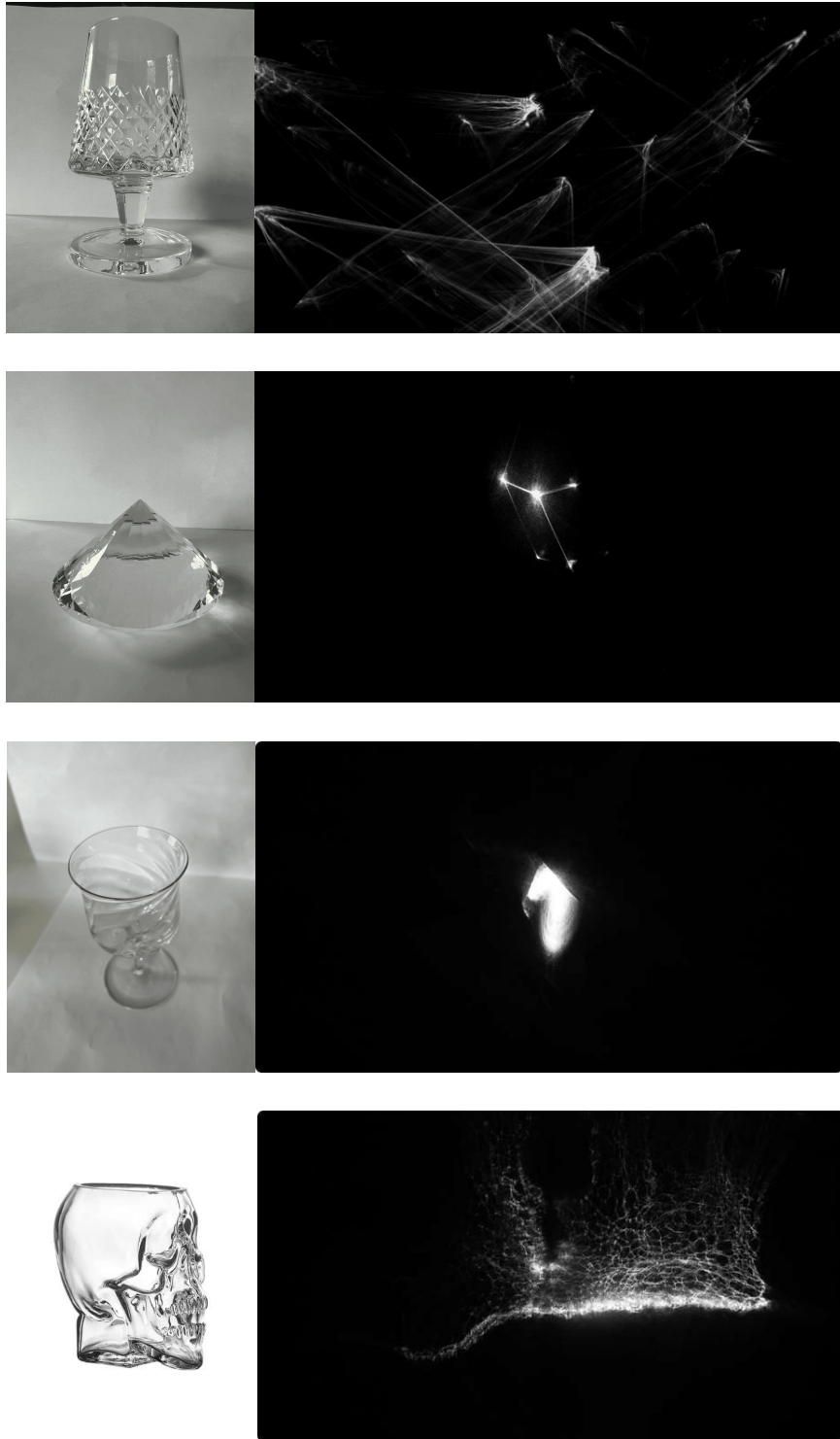


Figure 06. The distinctive patterns from corresponding glasses in *Durational Reflection* (2022).

As a final reflection, the camera's video mode generated an extreme smoothness of light. In contrast, the frame-by-frame technique used in *Transient Reflection* (2017) produced an obvious jerkiness. Comparison of these film techniques prompted me to consider whether

the frame structure (as a natural attribute of film and animation) can shape the perception of motion through the inherent physicality of film.

Date (process): 21 August 2022–25 August 2022

Date (exhibition): 1 June 2022–7 June 2022

Corner Light Projection (2023)

Place (process): Animation Studio (G142) at Middlesex University

Place (exhibition): Room G271 at Middlesex University

Description

Corner Light Projection (2023) represents the final stage in my early experimentation with materials and light. I had experimented with light sources and materials as refractors at the stage of producing *Durational Reflection (2022)*, and this new experiment concentrated on the screen as a perceptual material affecting light aesthetics. Inspired by James Turrell's light installations, this work also explored the active viewing of light by using a video projector as a light source.

The process was divided into two stages. First, I tested my idea in the Animation Studio (G142) at Middlesex University. To create an active viewing experience, I used reflective tape as a screen, with each strip of tape alternatively angled to remove the typical flatness of the screen in traditional film. My original aim was to attract the viewer's active attention to how the materials and form of the screen engage with light, compelling the viewer to move around the space to view the work from different locations as a multi-perspective sculpture (see Figure 07). The work was later exhibited in Room G271, where I investigated two different

screen arrangements that used different materials based on their physical responses to light; the two screens were placed in two corners of the studio (see Figure 08).



Figure 07. A documentary photo of the early experiment in Light Corner Projection (2022).



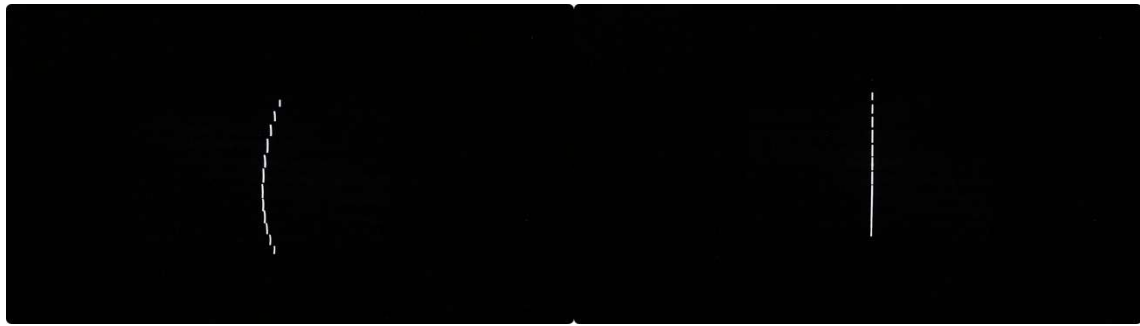


Figure 08. The public show of the Light Corner Projection (2022).

Reflection

This work presented two ways of looking and stimulated my awareness regarding the act of seeing. It abandoned the moving image and narrative, instead using light as a purely physical phenomenon, provoking an awareness of light's presence in film viewing. Considering this active spectatorship of light inspired me to develop the frame gap as a cinematic physicality, which might affect our motion perception as an active experience. This reflection encouraged me to exhibit my further works in a projection environment contextualised by expanded cinema.

Date: 24 February 2023–18 March 2023

***L I G H T* (2023)**

Place: Animation Studio (G142) at Middlesex University

Description

L I G H T (2023) is my key work that investigated the frame gap concept and tested its effect on the motion of light as a cinematic phenomenon. This work returned to using light patterns as imaginary content. Following several experiments with materials, I realised that film itself is an important material that can have an aesthetic impact on the motion of light. Comparing

the distinctive motion shown in *Transient Reflection* (2017) and *Durational Reflection* (2022), the frame-by-frame technique showed that film influences motion through its frame structure. Reflecting on structural film, experimental animation and visual music, I developed the frame gap concept and applied it to this film. Additionally, to explore a deeper level of temporal and spatial perception, it was exhibited as a five-screen installation at Room G271 in Middlesex University, where there is a large gallery space allowing visitors to walk and view freely.

Reflection

Five distinctive motions were created based on the corresponding rhythmic frame gap in their frame structure. These comprised a stable smoothness for the regular gap, an alternating fastness and slowness for the alternative gap, a spasmodic acceleration for the progressive gap, a wave-like movement for the flowing rhythm and a jerkiness of discontinuity for the random gap. Except for the random gap, which evoked an awareness of the missing frames through its jerkiness, the other four rhythmic patterns maintained a coherent movement despite their varying velocity and rhythm of movement. As such, these four frame structures did not deconstruct the perception of the continuity of time, which became dysfunctional in the random gap. This abnormality provoked several questions: Although four sequences applied the frame gap, why were the disappeared intervals only perceived with the random gap? Does this mean that the frame gap breaks the continuity of time through its particular structure and that maximising the distance between frames creates perceptible intervals in time? In addition, do the different speeds and rhythms of movement demonstrate how the frame gap manipulates the perception of motion as the appearance of time, evoking different durations and rhythms as perceptions of time? Based on these questions, I developed my central research question: How does the frame gap evoke an awareness of time?

Additionally, the disjointness of motion exposed by the random gap encourages a reflection on the nature of cinematic time, which is composed of the separated signals. Also, this disjointness creates a disapparatated time between frames, inspiring a depth level of temporal perception in phenomenology. Finally, the form of five-screen projection provokes further thinking on the relationship of temporality and spatiality in cinema, contextualised by expanded cinema.

Date: 15 August 2023

LIGHT vs L I G H T (2023)

Place: Room 183 at Usher Hall

Description

Reflecting on my finding that the frame gap is based on frame manipulation, I developed an additional hypothesis focused on how the frame gap can have different effects on time perception compared to the traditional concept of the frame rate. The jerky motion produced by the random gap not only belongs to the frame gap system but also appears when the frame rate is below a certain threshold. Therefore, this work aimed to compare the frame gap structure with the frame rate, examining the perception of motion and time produced by these two different frame systems.

Reflection

This experiment prompted me to further investigate the temporal experiences of the frame rate and the frame gap by using speeding-up and high-speed cameras. The frame gap created an irregular rhythm of motion, which prompted me to investigate the dialectic relationship between movement and time and rhythm and time in my subsequent research.

Date: 8 January 2024–8 May 2024

Time or Motion (2024)

Description

Based on the findings of my previous experiment regarding how rhythm engages with time, I designed this work to focus on testing the frame gap in two specific rhythms: regular and random. Thus, *Time or Motion* (2024) sought to compare the frame gap with the frame rate; therefore, I abandoned my previous strategy of producing light motion using stop-motion techniques and instead used the narrative imagery I had encountered in London and captured using a high-speed camera. These movements were divided into three themes – nature, human and vehicle – which became three short films that formed a series. This work also examined movement and time in the frame rate and the frame gap following Gilles Deleuze's concepts of 'movement-image' and 'time-image'.



Figure 09. A documentary photo of producing Time or Motion (2024).

Date: 20 June 2024–25 June 2024

One Day in One Minute (2024)

Place: The balcony at my home

Description

Technically, a speeding-up camera produces the opposite effect on the manipulation of time compared to a slow-motion camera. Thus, *One Day in One Minute (2024)* differed from *Time or Motion (2022)* by examining the frame gap using a speeding-up camera. The idea of using the sun's movement was inspired by a tour of Greenwich Observatory, where there was a dolphin sundial that displayed objective time using the movement of a shadow cast by the sun (see Figure 11). This showed that the movement of sunlight can represent the passage of objective time. In addition, my earlier experiments with sunlight also revealed this feature. As such, in this work, the frame gap was applied to the movement of two time-measuring tools – a sundial and a clock – to examine how the frame gap produces a subjective perception of time through the presentation of objective time on the sundial and clock face.



Figure 10. A documentary photo of making One Day in One Minute (2024).



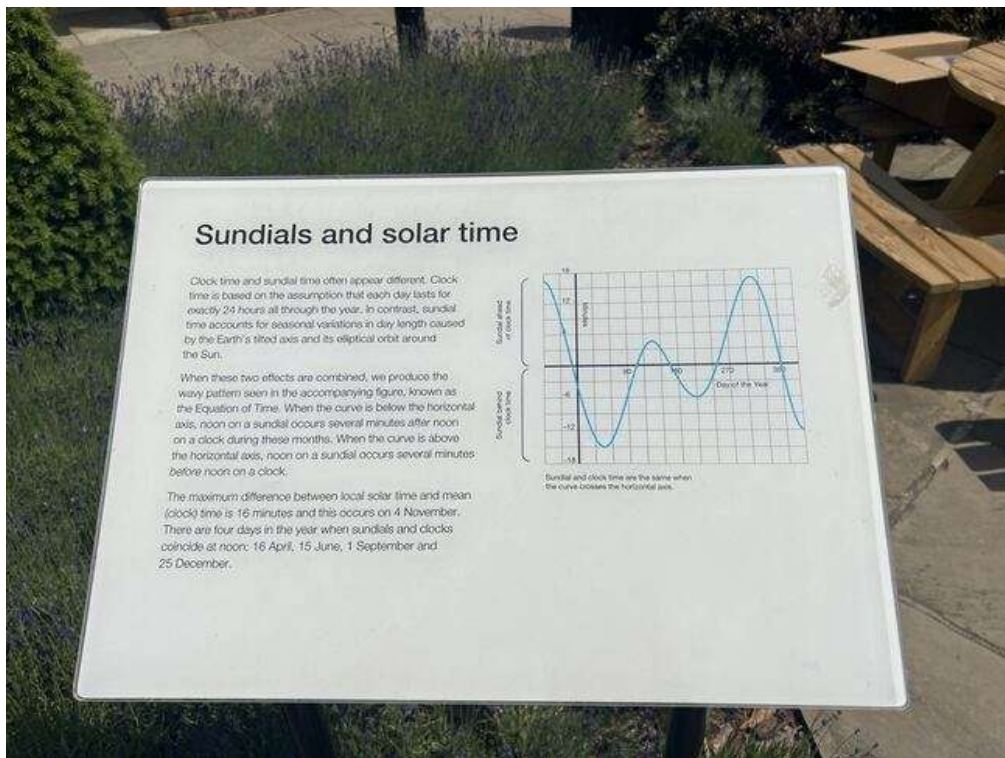


Figure 11. Two photos of the sundial at Greenwich Observatory.

Reflection

The resulting cinemas presented two sets of synchronised movements depicting the frame rate and the frame gap on separate screens. While the contents of both screens contained an equal number of deleted frames, the movements shown on the left screen (frame rate) maintained smoothness. The high-speed camera slowed down the motion while the speeding-up technique compressed the duration of one day into 1 minute. In contrast, the right screen (frame gap) produced sensible ruptures using both techniques, presenting a jerky motion. Comparing the rhythm of the frame structures showed perceptible gaps, and the disappeared time may have been attributable to the arhythmic structure of the frame gap. Another cinematic phenomenon was that the speed-up and slow-motion techniques created a perception of motion that was faster and slower, respectively, than the object's real motion.

This led me to reflect on the relationship between time and movement in these two techniques.

Appendix B

Transcripts of conversations with visitors when my artworks were shown to the public:

Date: 8 December 2022

Place: Animation Studio (G142) at Middlesex University's Winter Conference (2022)

Visitors to this Winter Conference were invited to walk through the Animation Studio (G142), where I showed *Durational Reflection* (2022) and displayed the process and apparatuses used in its production. Two of the visitors provided important feedback, transcribed as follows:

Visitor 221208A: 'Your film brings up my memory towards Stan Brakhage's film.'

Shicong Xie: 'Yes, Brakhage has a similar film, *The Text of Light*, which also produces caustic images by using the crystal ashtray under the sunlight as the imagery content.'

Visitor 221208A: 'Not just the similar process, but also how the film produces abstract images via his camera operation.'

Shicong Xie: 'Yes, but I don't operate the camera in this film; the qualities of these abstract images are more related to my choice of glassware as the optical transformers.'

Visitor 221208B: 'I really enjoy the light, which is similar to a light show.'

Shicong Xie: 'Yes, the process of producing abstract images from light is not my original idea. In history, there was a light performance, *Laserium*, that projected these laser images on the dome of a planetarium. Before this, Thomas Wilfred was a pioneer in this area, building several installations based on caustic images, and his machines are interactive, which means

the visitors can control colour, form and motion by operating the consoles in these installations. Furthermore, after the invention of the laser, it was widely used in concerts.'

Date: 18/05/2023

Place: A Public Show in G271 at Middlesex University

During a public show of *Corner Light projection* (2023), I asked visitors to move freely across the space to perceive the light on the screens. I did this without sharing any information about the purpose of the artwork. Most of the visitors were cautious when walking within this environment because the two projectors were not bright enough to adequately illuminate the gallery space. All of the visitors viewed the screens from different perspectives, and none of them continuously gazed at the screen; thus, they did not perceive the motion as I had when testing the work. I later explained how I had viewed it and asked the visitors to view it in the same way. My conversation with the two visitors highlighted the resemblance of my work to that of James Turrell, encouraging me to further explore his work on active spectatorship.

Visitor Member A: 'What are you expecting us to look at?'

Shicong Xie: 'I am curious about how you would view it, whether you would view it like me, moving your body and gazing at the screen for the motion perception.'

Visitor Member B: 'When I entered the room, the left one was brighter enough to know it was your work, but I couldn't find the right one. At the start, I thought the window was your work.' [Member B then pointed to the wall and roof windows that let in light at their edges].

Shicong Xie: 'I didn't expect that.'

Visitor Member B: 'Your works look like James Turrell's, which you said inspired you. After you told me how I could view it.'

Shicong Xie: 'Yes, like his light corner one, I am also exploring the viewer's active viewing, engaging with the different shapes of artwork from different positions. Looking from far away, it looks like a cube on the wall, whereas when you approach, the cube disappears, and you finally find it's just an intense light projection on the wall.'

For me, looking at the two forms of light, there is a continual transformation if you keep your horizon on the objects, which I think is a perception of time, changing from a cube to a hexagon.

It is not the definitive version of this artwork. I am considering hiding this structure inside a box and inserting it into a wall, and the viewer should be moved on a moving walkway in the airport. Then, you would not perceive the pressure from the floor while walking. Now, it is distracting because the pressure makes you realise that it is your mobility that provokes a movement. On the moving walkway, you may have a more immersive experience of perceiving a perfect smoothness of the light movement, composing and decomposing.'

Visitor Member B: 'James Turrell has more work on looking and viewing. I don't remember the name.'

Date: 3 July 2023

Place: Room C107 at Middlesex University's Summer Conference

During Middlesex University's Summer Conference in 2023, I presented the results of this experiment together with a poster containing my research question and a detailed description of my process (see Figure 12). Before my presentation, Angela Woodhouse, a dance lecturer at the university, asked a key question regarding the process. She asked: 'This is an artwork, right? Or are you just exposing the process?' In addition, regarding time, Johan Siebers, a professor of philosophy at the university, commented, 'The frame is really frozen time, and time is spiritual more than physical.'

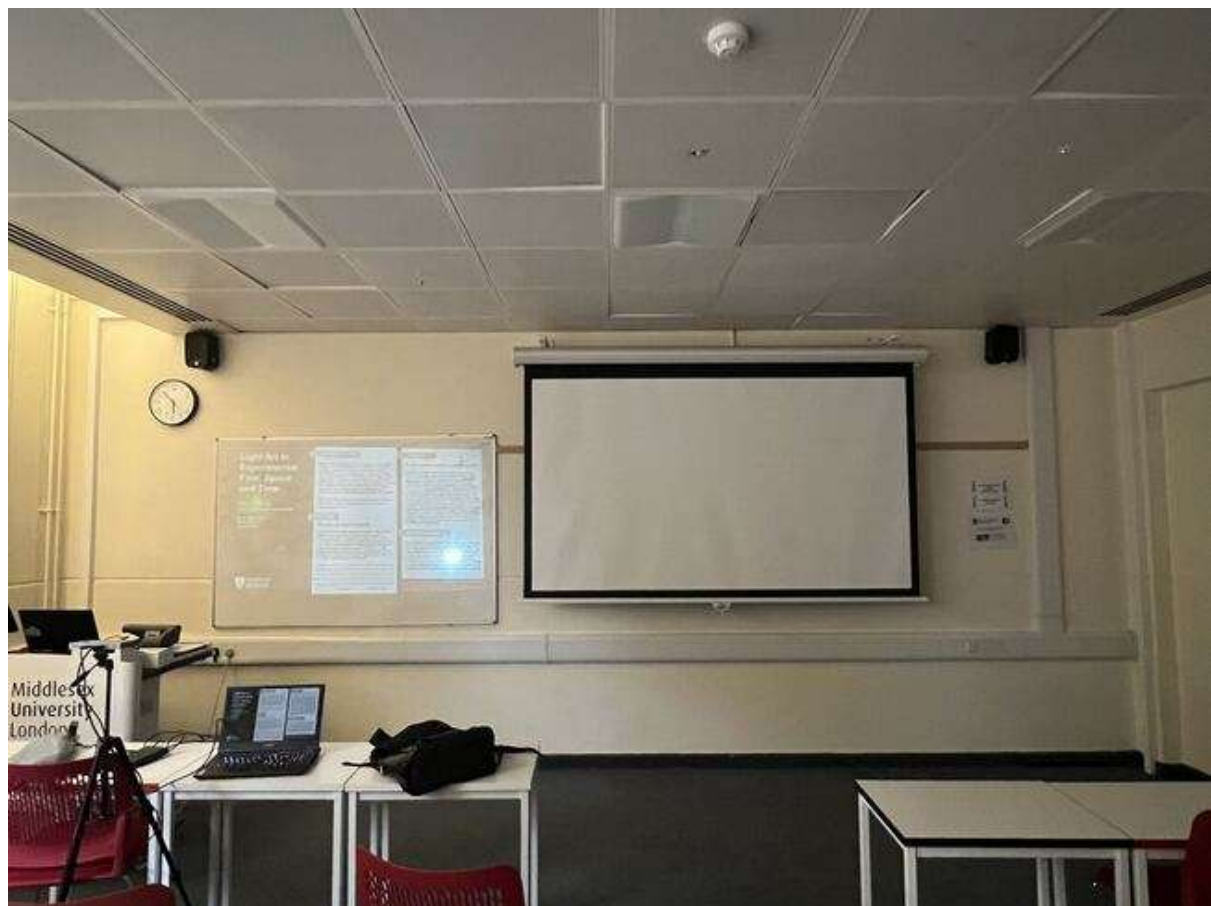


Figure 12. A documentary photo of presenting L I G H T (2023) in an oral presentation at the 2023 Middlesex Summer Conference.

I had no immediate response to these comments. Nonetheless, this feedback encouraged me to think about two important aspects of the frame gap. Angela Woodhouse's comment

revealed that the process in my artwork is a direct viewing experience – that is, the different movements in the same images may reveal the process as the film’s content. This indicated a connection with structural films – that is, viewing the film’s process as content through research on the materiality of film.

Professor Siebers’ feedback regarding spiritual time implied a relationship between the frame and subjective time. This encouraged me to investigate how the frame gap engages with temporality in the context of phenomenology. Combining these considerations and my previous thoughts on perceiving the frame gap as the disappearance of time, I developed my central research question: How does the frame gap evoke an awareness of time?

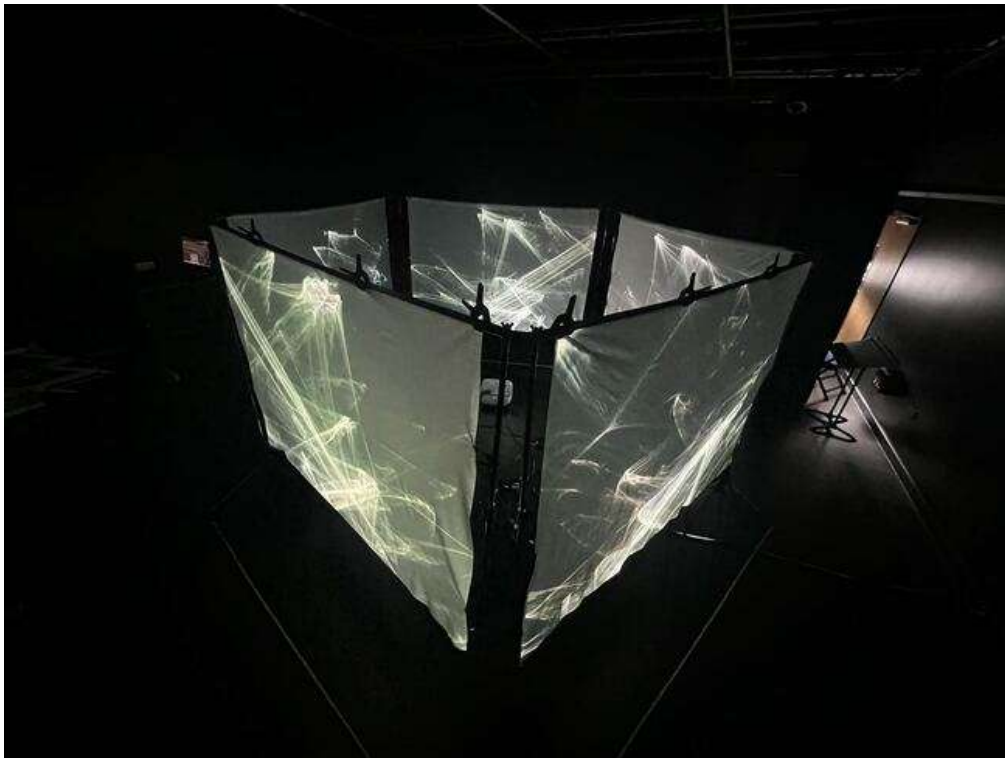
Date: 3 July 2024–4 July 2024

Place: Room G271 at Middlesex University’s Summer Conference

L I G H T (2023) was shown in Room G271 as a five-screen installation during Middlesex University’s Summer Conference in 2024, with the five screens positioned as an enclosed pentagon (see Figure 21). This shape allowed the visitors to move freely through the installation without a beginning or end, with visitors being invited to view and compare the movements in an immersive environment. Unlike the conference in 2023, when the experimental results were viewed simultaneously on a flat screen, this five-screen set-up prevented the viewer from observing the five movements at once. Thus, the viewer had to walk around the space to perceive the frame gap, comparing the nuanced differences between the five screens. Therefore, I asked the visitors two key questions after their viewing: Did you notice that the same sequence depicts five rhythmic movements on five screens? Did you become aware of the missing frames through the jerky motion on one of the screens? I

received positive answers from all of the visitors. Based on this cinematic phenomenon, I explained how the frame gap evokes a temporal experience.

In addition to the film installation, I presented the original process of producing these non-identifiable images using light refraction as a small light installation (see Figure 22). The laser and the diamond-shaped crystal used as the refractor were mounted on a tripod and projected smooth movement onto a wall. However, this adversely affected my explanation of the work because the performance content could not be synchronised with the imagery on the screen.



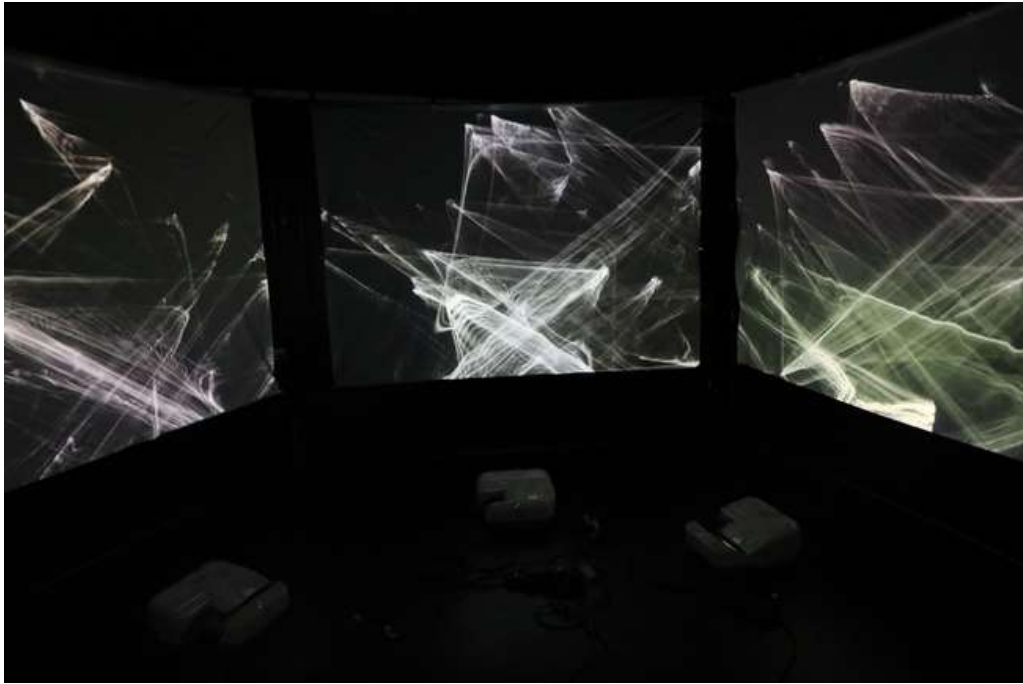


Figure 13. Two documentary photos of L I G H T (2023) shown in a five-screen installation.

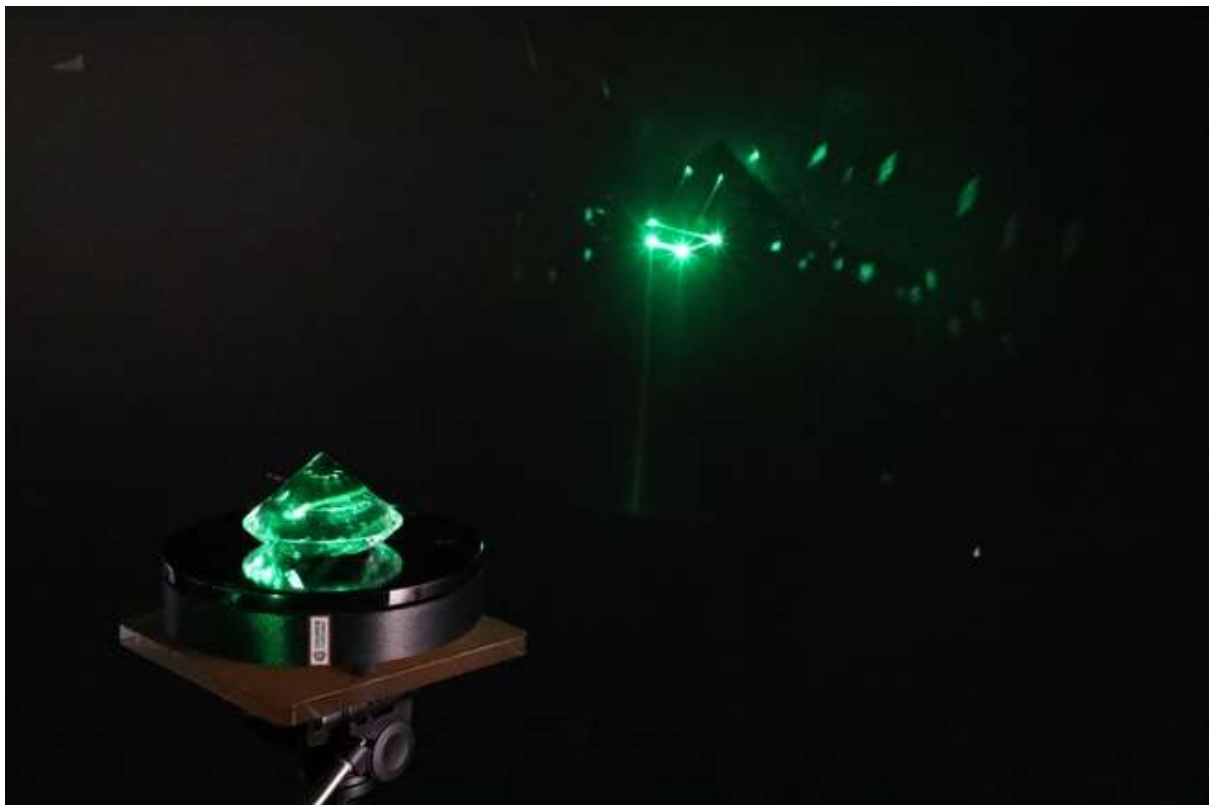


Figure 14. A documentary photo of a small light setup beside the installation of L I G H T (2023).

Several interesting conversations took place during the exhibition, which I have transcribed below:

Elliott [a lecturer with a sports science background]: ‘How far could our brain not perceive these frame gaps before they come to exist in our brain?’

Shicong Xie: ‘Your question concerns neuroscience, in which our brain could process these separate images in the film to become a perceptible continual movement, known as “apparent motion”. Science has proved that there is a minimum frame rate above 16 frames per second, which is a threshold for perceiving this apparent motion. However, my frame gap is a qualitative change, interrupting the metric or regular rhythm of the frame structure to be a random rhythm.’

Elliot: ‘Yes, but I am curious about the quantitative change in this randomness, how far our brain cannot perceive disappeared patterns. I will leave this question for you to consider.’

Shicong Xie: ‘Can you perceive the intervals between frames?’

Dominique: ‘I just perceive the jerkiness; sometimes fast, sometimes slow.’

Shicong Xie: ‘I think the jerkiness is the direct result of the frame gap as its function, but perceiving the missing frames requires your active perception, seeing the moving trajectory as a whole. Then, put the disappeared back in your consciousness.’

Visitor A was from a mental health background; she told me that one of the screens made her feel uncomfortable.

Shicong Xie: ‘Which one?’

Visitor A: [pointing to the screen showing the progressive gap] ‘That one.’

Shicong Xie: 'Haha, that one is progressive rhythm, following an increasing frame gap mode, like 1, 2, 3, 4, 5. As a result, you perceive a crazy acceleration, faster and faster, until it becomes spasmodic. Are you feeling good with the jerkiness in front of the random gap screen?'

Visitor A: 'Not at all. I am from ... [Visitor A introduced her background in mental health].'

Shicong Xie: 'The discomfort of perceiving fast movement is a physical reaction. In history, when you perceive fast flicker lights, it would cause a seizure. Your discomfort might be similar to the flicker light. Interestingly, I developed the concept of the frame gap via the inspiration of this flicker film, which manipulates the film's frame structure via the white and black images.'

Visitor A: 'I am from ... [Visitor A again began to introduce her background].'

Shicong Xie: 'You mentioned mental health and your discomfort; I am thinking about whether the people who have obsessive-compulsive disorder could not accept these intervals. They could not accept that the folders or files are not orderly placed on their laptop's screen, whether there is an obsessive-compulsive disorder for time. They cannot perceive time as a discontinuity or presented as a jerky movement on the timeline because, from my individual perspective, the obsession with orderly placement is a kind of obsession of spatial perception in which they cannot accept that objects are placed randomly in space. So, as a randomness in time, perhaps they could not receive my random gap as the incompleteness of time.'

Visitor A: 'That's an interesting idea.'

Shicong Xie: 'My research is about time.'

Visitor B: 'Time does not exist.'

Shicong Xie: 'Maybe. But it is still significant to our consciousness because it allows us to identify yesterday was yesterday, today is today and tomorrow would be tomorrow. You said it does not exist because time is like air, invisible and intangible to us; you know it exists, but it never reveals itself to you. Objectively, time perhaps does not exist, and the invented units of time on the clock and calendar are just for the convenience of life. Go to work at nine o'clock, get off work at five o'clock. However, subjectively, there is always an existence of time in our mind. When we look in the mirror, we can perceive time passing by realising we get more white hairs than ten years ago.'

Date: 4 July 2024

Place: Room C205 at Middlesex University's Summer Conference

At this conference, I showed several sections of *Time or Motion* (2024) and *One Day in One Minute* (2024) on a projection screen. This was followed by a presentation on how my films are related to previous experimental films throughout history in the way that they expose film as a perception of materiality and in the way that the frame gap evokes an awareness of time. I also emphasized how my approach aligns with several theories, including Maurice Merleau-Ponty's concept of 'temporality' in phenomenology, Henri Bergson's 'time philosophy', Gilles Deleuze's 'movement-image' and 'time-image' and Henri Lefebvre's 'rhythmanalysis'. A range of feedback was provided by the visitors, which I have transcribed as follows:

Visitor A: 'For me, there's something really interesting about these two images side by side that are the same, yet different. I don't know if I really understand the frame gap thing. What I am thinking is, how do I trust? My feeling is that the train is slightly ahead of another train ...

and the clock makes it very clear. What I am thinking is just my imagination. If I have to make a question, it is: How can I trust my sensation and how film is an illusion?’

Shicong Xie: ‘The vehicle and natural movement are not obvious because my research question is about time, which makes the clock obvious.’

Anne Robinson: ‘Thank you, Shicong. It’s a very interesting presentation. I think my question is, the idea of frame gap is the concept in stop-motion animation, which very well presents the difference between analogue and digital. In the analogue film, you could actually see the light flickers between the frames compared to digital. But here, you presented this frame gap, which is very unsettling when you see it side by side by taking frames out randomly. Could you explain the difference between your frame gap and analogue film? My understanding is that the frame gap is the missing time.’

Shicong Xie: ‘The first film was shot frame-by-frame, moving the static objects every frame a little bit like stop-motion animation. When it comes to these films, I just want to compare how the slow motion can just slow down the movement, whereas the frame gap creates a missing time. To create the frame gap, I have to use the camera to record these events automatically, but I output the sequence as the image sequence, like the stop-motion animation. Then, I did the jump editing on the frame structure with two different rhythmic patterns. They both have the frame gap. Interestingly, we can perceive the frame gap on the left screen, but we can perceive it on the right.’

Dominique: ‘For me, you removed time, but you removed the space as well.’

Shicong Xie: ‘Yes, we talked about this; the frame gap can only be perceived in moving objects. For example, in my film, the building and the roof are static. We can only perceive the gaps in

the light-shadow movement. That's why all my films are concerned with movement: humans, nature and vehicles.'

Tansy Spinks: 'It's also a sense that I thought about before. It's a sense of loss, which is perhaps to be a gradual sensory loss, gradual memory loss, a disconnection.'

Shicong Xie: 'I think what you mentioned, it is like neuroscience. You perceive it from the outside in, and your consciousness processes these signals to be memories. But the methodology that I used is phenomenology, highlighting the active perceiving, building a bridge between consciousness and the perceived objects, a relation between audience and film.'

Elliot: 'I am thinking about neuroscience, how neuroscience about perceiving time. I am thinking about how far you could take this because by taking this chance, the brain is automatically putting something back in there, but how far our brain cannot perceive this disintegration? Your brain has a compulsion to see those sequential patterns, wants to make it sense.'

Shicong Xie: 'I think your concept is about frame rate, where there is a threshold. When the frames per second are below 16 or 24, you might perceive the jerkiness as well as the frame gap. However, this pattern still follows a quantitative pattern, but my frame gap is a qualitative one, which interrupts the quantity of this metric rhythm.'

Elliot: 'My question is, when you explained it, you are taking out the frames randomly – three, one, eight – that random extraction jumps. If you did that, it looks sensible. If, suddenly, you have a huge jump, your brain will get what?'

Visitor A: 'You will get that a bit by playing DVDs forward or backward at different speeds. You know you see the jumps, but you can tell a story that it is about the randomness of doing with this stuff.'

Shicong Xie: 'Yes, it's just like the video viewing experience can have this visual pleasure, which changed the act of viewing in analogue film, as mentioned by Laura Mulvey in her book *The Death of 24 Frames*. For example, when you use YouTube to watch a video, you can jump 10 seconds forward, skipping 10-second content; a different action of looking.'

Visitor A: 'What is the significance of this? What is the meaning to you? Why is it important?'

Shicong Xie: 'Well, since the frame gap is a new concept, the knowledge I mentioned before about time, active viewing and materiality related to this new concept is significant. Firstly, the frame gap exposes the film's frame structure as conscious of its physicality. Also, the frame gap creates a new film phenomenon of perceiving intervals of time, so the film itself is doing phenomenology.'

Visitor B: 'I even take a picture of your film on the phone; I am fascinated with the film. For me, I want to say something aesthetically. It's just how it makes me feel. I like your talking about past, present and future. For moment to moment, just looking at the two frames. The same but doing different things. Emotionally, I just love the feeling of watching it.'

Stefanie: 'Initially, I was not sure whether they were the same or duplicated until I found the clock and the roof; they were not the same. I really appreciate the way you said the process of looking over or through time. I just wonder [about] the philosophy you cited; they become central in your thinking. In terms of the process of philosophy, I really appreciate [that] you are Chinese; you brought the sundial, which came from China. Western philosophy is very

located and rooted in being, and Chinese philosophy has a complete setup in terms of language. I just want to send you a direction to think.'

Shicong Xie: 'In terms of my research, I used Taoism to understand phenomenology. I think there is a bridge between these two philosophies. What Merleau-Ponty mentioned about perceptual knowledge before scientific knowledge is similar to the saying in Taoism, which is, "The Way can be expressed, but the Way that can be expressed is not the eternal Way." My comprehension about this is the "eternal way", which cannot be describable, is what Merleau-Ponty's perceptual knowledge is: a changeless structure of perceiving the world. Another saying in Taoism is, "Tao develops One, One develops Two, Two develops Three, finally Three develops Everything." This description of Tao is similar to our perception of time, in which science divides time into infinitely smaller units: year, month, day, hour, minute, second ... which is endless. However, there is an eternal way of time in our psychic state; in Bergson's word, *durée*, or intensity in our mind

Appendix C

Key artworks that have informed this research

Lumia (1920s–1960s)

Format: Light installation

Artist: Thomas Wilfred

Thomas Wilfred's *Lumia* (1920s–1960s) is an innovative work that combines light and colour to create a mesmerising moving light experience. Developed in the early 20th century, *Lumia* (1920s–1960s) projects coloured light through lenses and filters, creating dynamic, ever-changing patterns. Wilfred's work is often compared to music because it evokes emotional responses and unfolds over time. This pioneering work laid the groundwork for exploring light art and multimedia installations, influencing artists, expanding the boundaries of visual art and providing context for light as a medium for artistic expression (see Figure 15).

Reflection

Wilfred's *Lumia* (1920s–1960s) highlights the kinetics of light as an artistic expression, using lenses and filters to create light aesthetics and focusing on 'colour, form and motion'.¹ *Transient Reflection* (2017) shares a similarity with this work by using translucent materials as filters, bending light to create abstract patterns in film. Influenced by Wilfred, I explored light aesthetics during the initial stage of this research, investigating the potential of light aesthetics to examine the physical properties of materials. The use of glassware as an experimental subject enabled further exploration of the audio-visual experience in light, reflecting on the concept of 'visual music'.² Furthermore, the 'durational experience' through

¹ Wilfred, T. (1947) 'Light and the artist', *The Journal of Aesthetics and Art Criticism*, 5(4), pp. 247–255.

² Keefer, C. (2015) 'Visual music's influence on contemporary abstraction', in Jennings, G. (ed.) *Abstract video: the moving image in contemporary art*. Oakland: University of California Press, pp. 81–97.

the medium of static light prompted insightful contemplation of the perception of time in my later work.³

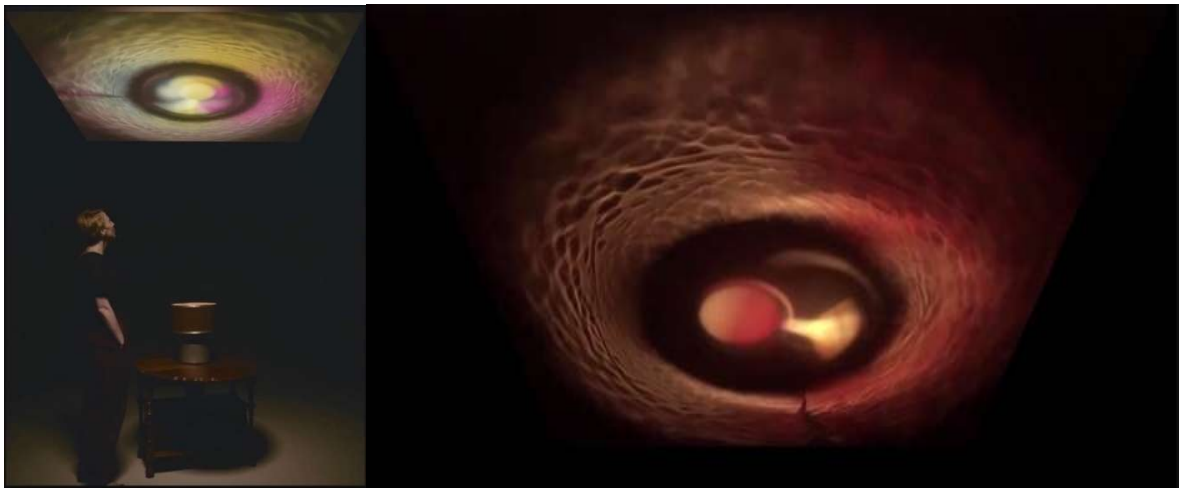


Figure 15 Lumia Op.162 and Lumia #50 by Thomas Wilfred.

³ Shanken, E.A. (ed.) (2009) *Art and electronic media*. New York: Phaidon Press.

***Laserium* (1973)**

Format: Light performance

Artist: Ivan Dryer

As a derivative light artwork based on Thomas Wilfred's *Lumia* (1920s–1960s), *Laserium* (1973) is a pioneering form of laser entertainment combining music with visually stunning laser light shows. First introduced at the Griffith Observatory in Los Angeles in 1973, it quickly became a popular attraction. For the light performance, the laser artists use translucent discs with sculptured surfaces to bend light into abstract patterns, projecting them onto the building's dome. *Laserium* (1973) was the brainchild of Ivan Dryer, who established the world's first continuously operating mechanism for laser entertainment. It has since expanded to locations across the United States and the globe, captivating viewers with its innovative laser effects. It continues to produce new shows and maintain its status as a unique art form.⁴ Influenced by *Laserium* (1973), Funki Porcini created a light performance in 2021 that synchronised laser patterns with electronic sounds.⁵ *Lumière* (2013–2017) is another artwork that explores audio-visual music through laser motion graphics synchronised to music.⁶

Reflection

As another key light artwork, it encouraged me to explore light aesthetics using a laser and various materials as an 'optical transformer' (see Figure 16). It also inspired me to investigate the predetermined relationship between moving light patterns and the physical qualities of materials. Maintaining my focus on using light as a visual element synchronised with music, I

⁴ Schaller, B (2021) *Laserium: the gods of light*. Available at: <https://www.imdb.com/title/tt7361762/>.

⁵ Porcini, F. (2022) *The Laserium at Iklectik*. Available at: <https://funkiporcini.net/things/news/the-laserium-at-iklectik/>.

⁶ Laser Animation (2013–2017), *Lumière*. Available at: <https://roberthenke.com/concerts/lumiere.html>.

explored audio-visual experiences by testing the musicality of materials and investigating how objects with a rhythmic structure can produce aesthetic movements similar to music.

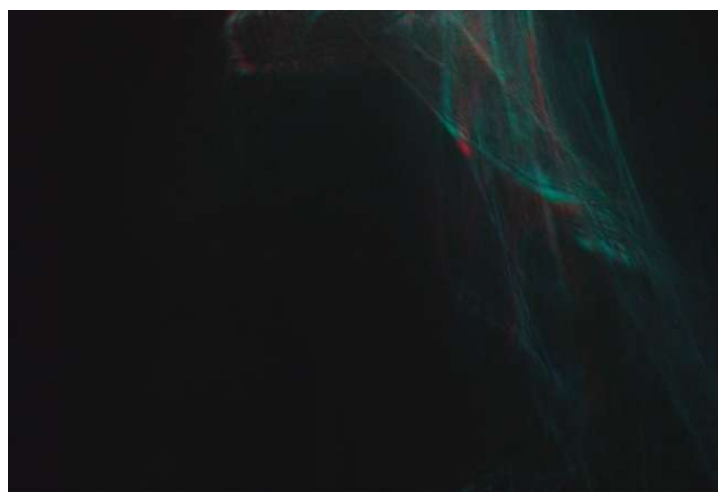


Figure 16. The early experiment of Laserium and optical transformer.

Light Projection (1967–2017)

Format: Light installation

Artist: James Turrell

Place: Long Museum, Shanghai, China (2017)

James Turrell's light projection experiments began in 1967 when he began using high-intensity projectors to cast light onto the corners of walls, creating geometric shapes and altering the perception of space. In 2017, a light exhibition called *Immersive Light: James Turrell* (2017) presented several of Turrell's light artworks in Shanghai, China. While visiting, I was enthralled by a piece called *Light Projection (1967–2017)*, in which a yellow light projects a hexagon shape onto the corner of the gallery (see Figure 17). Viewed from a distance, this creates the illusion of a cube suspended off the ground. When approached, the illusion disappears and is revealed to be a flat projection of light. During the visit, I moved towards the shape while continuously gazing at the sculpture, which provided a dynamic vision of light through the gradual transformation of a cube into a flat shape.

Reflection

Turrell's work is characterised by its ability to manipulate light and space to produce optical illusions and evoke an active seeing of light. His installations are not only visual experiences; they also engage the viewer's senses and invite the viewer to explore the boundaries of perception. This encouraged my contemplation and introspection regarding the observation of light as an active experience. My own experience while viewing Turrell's work made me realise how it challenges the traditional approach of viewing light from a static perspective, enabling a dynamic and continuous viewing of light through bodily movement. This inspired me to use active viewing of light in my artwork *Corner Light Projection* (2023).



Figure 17. Light Projection (1967–2017) exhibited in Shanghai by James Turrell.

***Skyspace* (1974)**

Format: Light installation

Artist: James Turrell

Skyspace (1974) is James Turrell's most famous series. These are architectural installations that feature an aperture in the ceiling that opens up to the sky (see Figure 18). Using sunlight as the primary medium, Turrell invites the viewer to engage with the subtle nuances of light and colour, challenging the viewer's passive perception of space and time by focusing on the act of seeing light as a conscious activity.

Reflection

Turrell's use of light as a perceptual phenomenon highlights our active perception as the content of his artwork. This innovative exploration of light as a perception of space and time inspired me to produce a similar perception of light using projector light as a primary medium

in my film *Corner Light Projection* (2023), creating an active viewing of the projected light in the film. Contemplating the passive experience of film encouraged me to further explore ‘film illusionism’ in the context of light, motion and time.⁷ In addition, my observation of the passage of time through changing sunlight prompted me to investigate the temporality of light through experiments with refractive light and sunlight. Finally, Turrell’s work encouraged me to use sunlight as a proxy for objective time to explore the perception of subjective time through the frame gap in my work *One Day in One Minute* (2024).



Figure 18. *Skyspace* (1974) by James Turrell in Guggenheim Museum.

***Model for a Timeless Garden* (2011)**

Format: Light installation

Artist: Olafur Eliasson

Place: Hayward Gallery, London

⁷ Wees, W.C. (1992) *Light moving in time: studies in the visual aesthetics of avant-garde film*. Berkeley: University of California Press.

Model for a Timeless Garden (2011) consists of 27 water fountains, each uniquely designed to interact with strobe lights that flash at precise intervals, creating a stroboscopic effect that momentarily freezes the motion of the water. This optical illusion transforms the flowing water into seemingly solid, sculptural forms, capturing a static moment in time and presenting it as a frozen image (see Figure 19).

Reflection

This light installation explores the fundamental aspects of human experience, inviting the viewer to contemplate the nature of perception, particularly the passage of time. The strobe effect not only attacks the appearance of the water but also influences the viewer's contemplation of time. This interaction between natural phenomena and human perception prompted me to consider how changes in the intensity of light can interrupt the continual flow of water, highlighting the perception of the continuum of time in the background. Eliasson's manipulation of light also demonstrates that the temporality of light can induce a transcendental perception of time. Its interruptive approach, which the frame gap uses to disjoint the continual motion in a cinema, prompted me to consider how this unique experience in film can engage the perception of time through phenomenology.

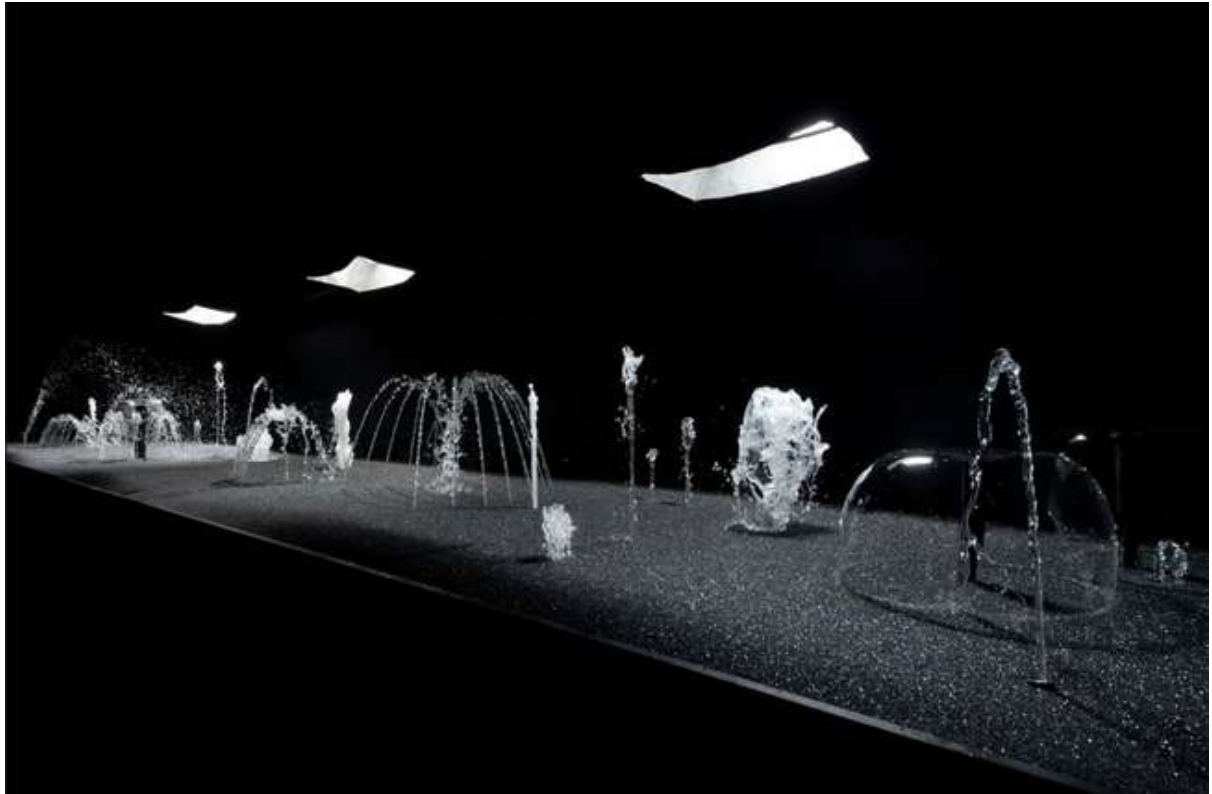


Figure 19. Model for a Timeless Garden (2013) in Hayward Gallery

Cold Dark Matter: An Exploded View (2022)

Format: Light sculpture

Artist: Cornelia Parker

Place: Tate Britain, London (16 July 2022)

Cold Dark Matter: An Exploded View (2022) was displayed in a large square room, with objects suspended by threads, creating a striking visual effect. A light bulb at the centre of the installation cast dramatic shadows on the walls, simulating the moment of an explosion (see Figure 20). According to the exhibition brochure (see Figure 21), the objects were the remnants of a garden shed that Parker had blown up with the help of the British Army. She then meticulously collected the fragments to recreate the scene.

Reflection

The interaction of light and shadow creates the illusion of dynamic movement, making the static objects appear to be flying towards the viewer. This effect is mainly caused by the objects being suspended in the air rather than placed on the ground, transforming a static sculpture into a dynamic environment. This concept resonates with my works *Transient Reflection* (2017) and *Durational Reflection* (2022), where I used static glassware to generate light motions. In these works, the interactions between light and static objects create a dynamic visual narrative based on the sculptured structure of the objects.

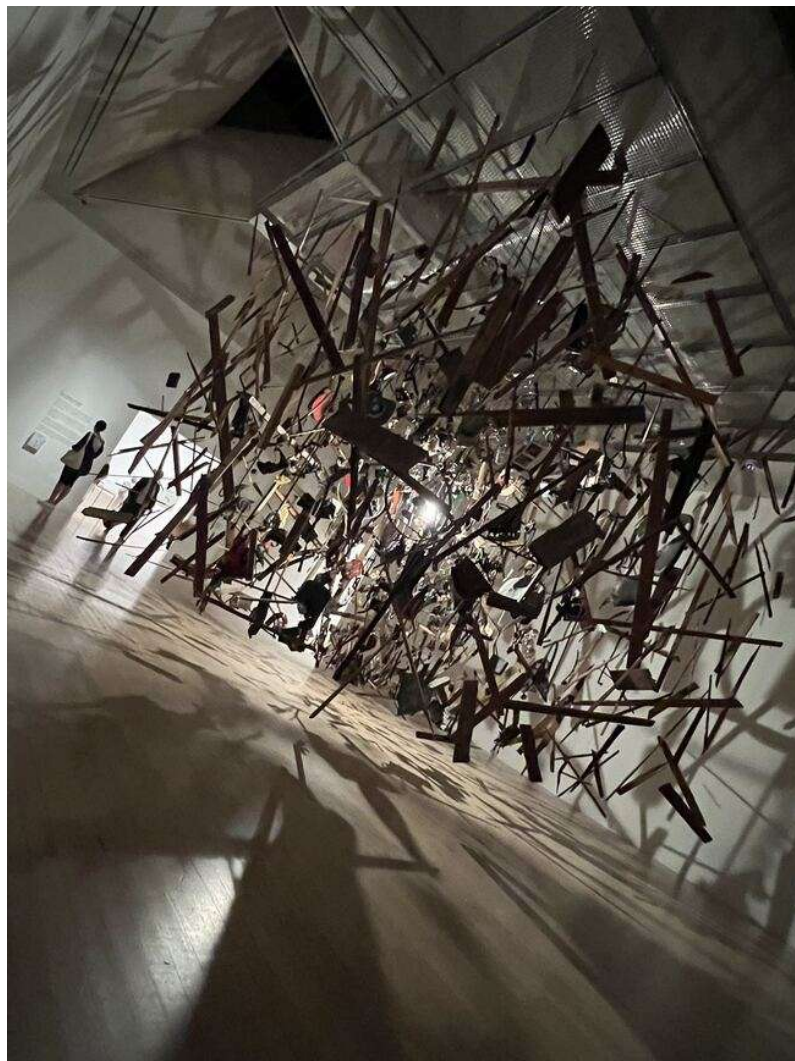


Figure 20. *Cold Dark Matter: An Exploded View* (2022) by Cornelia Parker in Tate Britain

3 COLD DARK MATTER: AN EXPLODED VIEW

'We watch explosions daily, in action films, documentaries and on the news in never-ending reports of conflict. I wanted to create a real explosion, not a representation. I chose the garden shed because it's the place where you store things you can't quite throw away.

The shed was blown up at the Army School of Ammunition. We used Semtex, a plastic explosive popular with terrorists. I pressed the plunger that blew the shed skywards. The soldiers helped me comb the field afterwards, picking up the blackened, mangled objects.

In the gallery, as I suspended the objects one by one, they began to lose their aura of death and appeared reanimated. The light inside created huge shadows on the wall. The shed looked as if it was re-exploding or perhaps coming back together again.

The first part of the title is a scientific term for all the matter in the universe that can't be seen or measured. The second part describes a diagram in which a machine's parts are laid out and labelled to show how it works.'

Figure 21. A brief introduction of *Cold Dark Matter: An Exploded View* (2022) in the booklet provided by Tate Britain.

UVA

Format: Light installation

Curator: 180 Strand Studio

Place: 180 The Strand, London (18 March 2022)

The *UVA* exhibition is an exploration of light and sound as art, featuring innovative installations by various artists. Among these, *Topologies* (2022) is a kinetic light sculpture that

explores the sensory experience of space. Using lasers and a fog machine, this installation creates two distinct sensory spaces divided by a plane of light. The laser's coherence and directionality illuminate the smoke, forming a visible yet intangible plane that moves subtly within the space, inviting the viewer to interact with it by walking through it or touching it (see Figure 22).

Another notable installation is *Vanishing Point* (2022), which involves laser beams interacting with a series of typologically arranged screens. This configuration provides a unique perspective on light, emphasising its sensory physicality within space (see Figure 23). In addition, a further installation, *Vortex* (2022), begins with a circle of smoke emitted from a hexagonal sculpture. This smoke travels between light columns, creating a flicker effect that intermittently reveals the smoke. The synchronised movement of the smoke and the stroboscopic light creates a rhythmic visibility that enhances the sensory experience (see Figure 24).

Reflection

These light artworks showcase the dynamic interaction of light, space and time and highlight the sensory experience. For my artwork *Corner Light Projection* (2023), I drew inspiration from the typological set-up, which provided an experience of perspective. The spatial configuration of this work not only highlights the active viewing of light artworks but also emphasises the physical experience of space and time within an immersive environment. This active engagement motivated me to experiment with various materials to further understand how they can contribute to a sensory experience of light and time. By reflecting on these installations, I sought to create artworks that prompted contemplation and introspection about the nature of perception. Synchronising light and sound, some of these artworks

explore temporal perception by manipulating the visibility of light, which inspired me to think more critically about time.

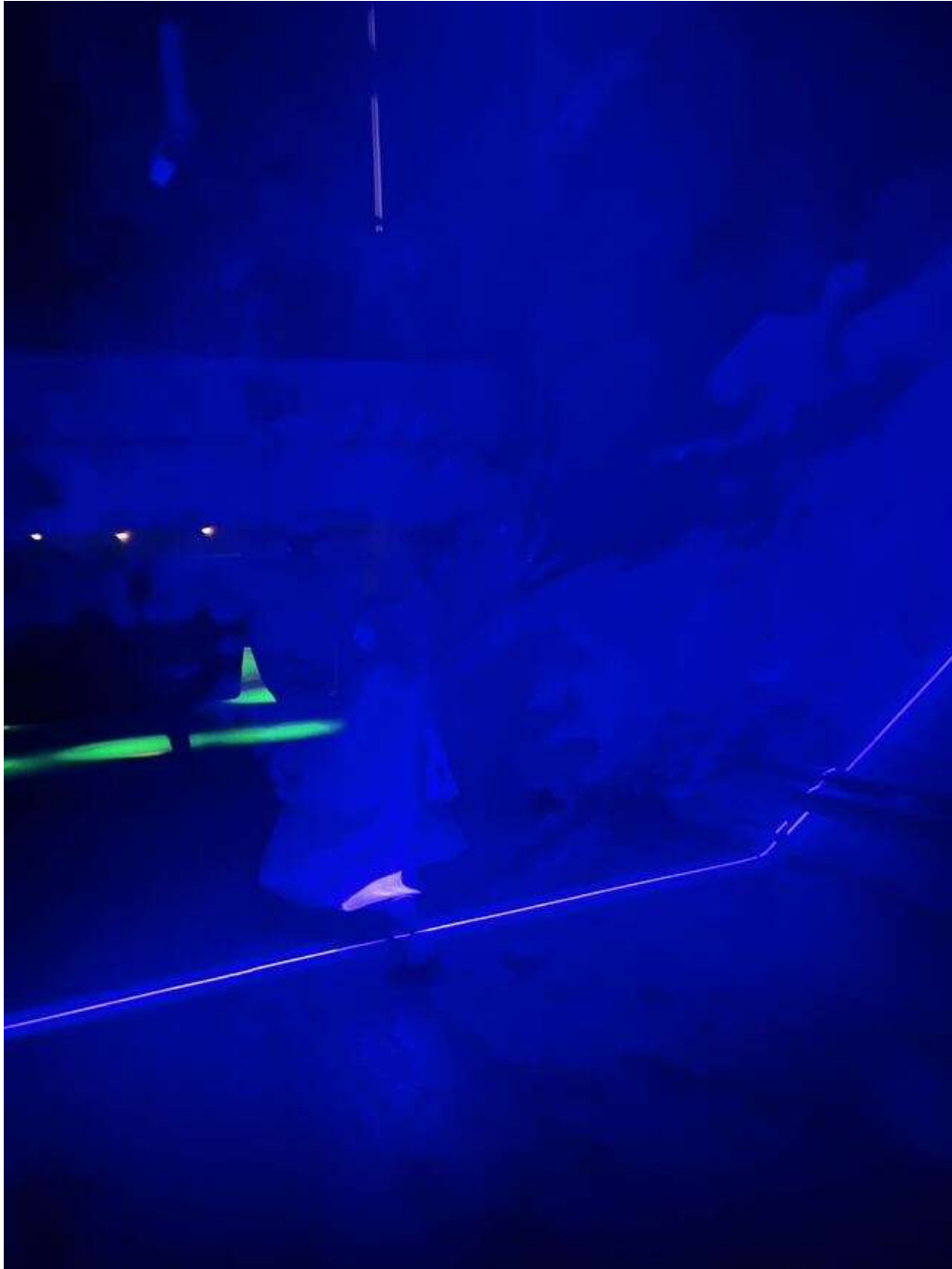


Figure 22.A documentary photo of Topologies (2022).

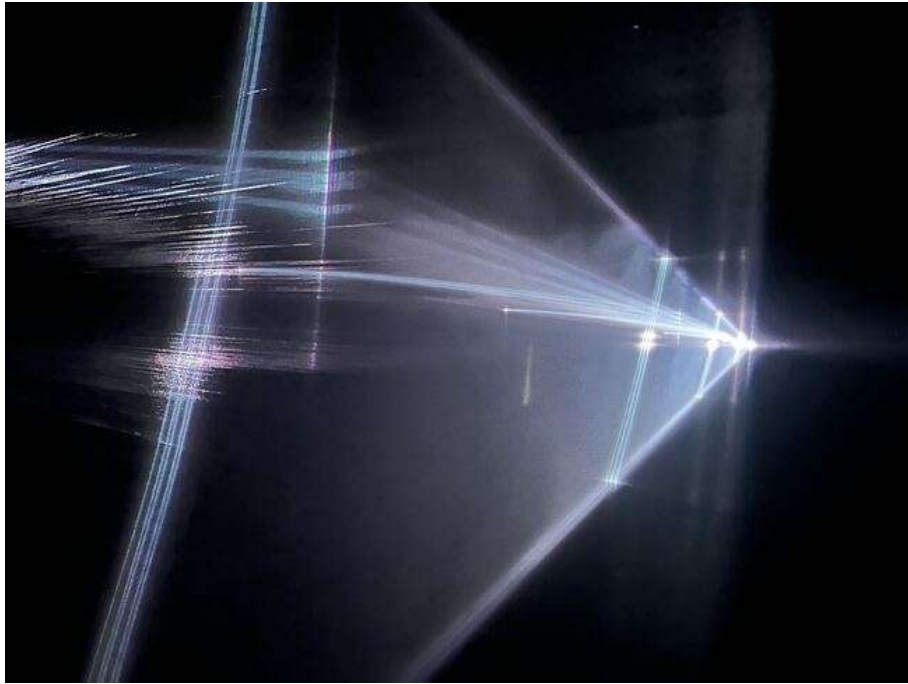


Figure 23. A documentary photo of Vanishing Point (2022)

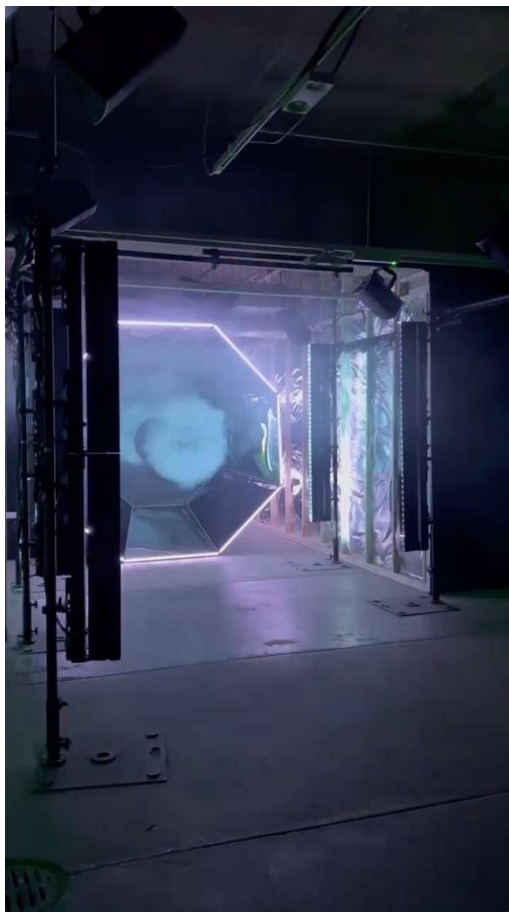


Figure 24. A light installation, Vortex (2022), presents the vanishing smoke via the flicker lights.

Thin Air (2023)

Format: Light performance

Curator: Thin Air

Place: The Beams, London (13 April 2023)

Thin Air (2023) was an exhibition held in an abandoned factory in London, showcasing large-scale installations that combined light performances with sound. This exhibition featured works and collaborations by several light artists, creating an immersive experience that engaged visitors through sensory spatial-temporal interactions. Two notable installations were by *404.zero (2023)* and *S E T U P (2023)*, in which LED lightbars were configured as light columns and a light roof. These elements performed a synchronised light show in harmony with digital sounds that featured strong beats. When I wandered through this immersive experience, I perceived the seamless synchronisation of the light flickers in space and the rhythmic sounds in time, creating a sensory spatial-temporal experience of engagement with light and music (see Figure 25).

Another intriguing installation was by Kimchi and Chips in collaboration with Rosa Menkman. This piece merged optical science with light, using concave mirrors to form two mirrored walls that reflected light rays. A computer program controlled the rotation of these mirrors, shaping the volumetric light rays into various geometric forms enhanced by the presence of fog (see Figure 26).

Matthew Schreiber's large-scale installation used a laser of a particular shape to create a sensory experience. The laser's typological set-up created beautiful symmetrical geometric patterns in the form of a light sculpture. This sculpture engaged with the visitor's spatial

perception and provoked interaction with the light (see Figure 27, which shows a visitor attempting to grab a beam of light and climb it like a light rope).

Reflection

Please see page 57 for my reflection on the commonalities between this exhibition and the UVA exhibition.



Figure 25 An audio-visual light performance using flicker lights synchronised with beats.



Figure 26. A light installation using the rotated concaves to reflect volumic light.



Figure 27. A light sculpture using laser as a typological shape.

Parabola (1937)

Format: Film

Artist: Mary Ellen Bute

As a pioneering work that uses light as pure expression in film, Mary Ellen Bute's *Rhythm in Light* (1934) is a groundbreaking piece that exemplifies the fusion of music and light as visual art. *Parabola* (1937) continues this audio-visual exploration and features geometric sculptures captured in various positions and motions under bright, contrasting light. This creates a dynamic interaction between light and shadow, stasis and motion, and form and music (see Figure 28).

Reflection

By utilising sculptures that embody parabolic shapes to explore motion, Kristian Moen investigates Bute's aesthetics of motion, highlighting that the parabolic shape is not only a static form but also conveys a motion aesthetic in itself.⁸ This inherent movement within the sculptured qualities creates cinematic qualities, generating a multi-layered motion aesthetic through contrasting images. Inspired by Moen's innovative use of model-making in animation, my film *Durational Reflection* (2022) uses glassware with distinctive rhythmic decorative patterns to manipulate light. These particular patterns echo Bute's parabolic objects, which convey an intrinsic motion aesthetic in the object itself.

⁸ Moen, K. (2019) 'Expressive motion in the early films of Mary Ellen Bute', *Animation*, 14(2), pp. 102–116.



Figure 28. A still photo of Parabola (1937).

The Text of Light (1974)

Format: Film

Artist: Stan Brakhage

In this film, Stan Brakhage uses a crystal ashtray to refract and distort light and captures time-lapse images using a frame-by-frame technique. The refracted light encounters light processing in the camera, creating a kaleidoscope of light shapes with cinematic movement, while the frame-by-frame technique generates a noticeable jerky motion (see Figure 29).

Reflection

Stan Brakhage's exploration of film materiality and visual perception is a profound investigation into the core aspects of light that structure the cinematic experience. By using light as a pure expression, Brakhage highlights the role of light as an essential component of

film. This is further emphasised by William Wees, who identifies ‘time and motion’ as two other crucial elements of this medium.⁹ Brakhage’s work reveals how the jetty motion of light reveals the frame structure as a predetermined feature of film. This suggests that frame manipulation can significantly affect the aesthetics of motion – a realisation that prompted me to investigate the materiality of film through the illusionary experiences of light, motion and time, laying the groundwork for my frame gap concept. Brakhage’s focus on the interaction of light and texture invites the viewer to reconsider the act of seeing. This film, with its non-narrative imagery, is similar to abstract paintings that engage the viewer’s subjective imagination, producing an experience of open-endedness.¹⁰ This film contributed to my contemplation of the viewer’s active experience of time in *L I G H T* (2023), furthering my exploration of the discourse of the materiality of film and perceptual experience.



Figure 29. A still photo of *The Text of Light* (1974).

***Man with a Movie Camera* (1929)**

⁹ Wees, W.C. (1992) *Light moving in time: studies in the visual aesthetics of avant-garde film*. Berkeley: University of California Press.

¹⁰ Brakhage, S. and McPherson, B.R. (2001) *Essential Brakhage: selected writings on filmmaking*. Kingston: Documentext.

Format: Film**Artist: Dziga Vertov**

Dziga Vertov's *Man with a Movie Camera* (1929) is renowned for its groundbreaking filmmaking techniques, including double exposure, fast motion, slow motion, freeze frames and jump cuts. Among these techniques, his intuitive editing collapses traditional narrativity by jointing two irrelevant shots. Given this feature, this work has been re-evaluated and celebrated as a pioneering work of anti-narrative film.

Reflection

This film primarily reflects the key concept of 'Kino-Eye' introduced by Vertov, which revolutionised the way film is perceived by emphasising the camera's ability to capture reality in a manner that transcends human vision.¹¹ This approach highlights cinematic quality as its self-expression, which encouraged me to investigate Peter Gidal's adhesive concept of 'anti-narrative' in structuralist film, engaging with film's physical experience as a real perception.¹² In addition, Vertov's disruption of conventional narrative coherence is reflected in Gilles Deleuzes' concepts of 'time-image' and 'crystal image',¹³ which inspired me to consider the frame gap as intervals between shots that not only break narrative coherence but also stimulate the awareness of time.

¹¹ Vertov, D. (1929) *From kino-eye to radio-eye*, p. 90.

¹² Gidal, P. (ed.) (1976b) *Structural film anthology*. London: British Film Institute.

¹³ Deleuze, G. (1986b) *Cinema 2: The time-image*. Minneapolis: University of Minnesota.

The Flicker (1966)/Arnulf Rainer (1960)/T,O,U,C,H,I,N,G (1968)

Format: Film

Artist: Tony Conard/Peter Kubelka/Paul Sharits

These three films are important flicker films that belong to the canon of structuralist film. As films that belong to a genre that explores the materiality of film itself, they reveal mechanical flickers as a physical phenomenon by altering the stroboscopic rate. By prolonging the lengths of flickers, flicker films use meticulous frame manipulation to reveal problematic light flickers as a perceptual phenomenon, thereby engaging with the physicality of film (see Figure 30).

Reflection

The problematic flicker effect in these flicker films is a stereotype of the frame gap, which challenges traditional cinematic norms. This effect adheres to Peter Gidal's concept of 'film materiality', which emphasises the importance of revealing film's physical attributes as part of the non-illusionistic process.¹⁴ Flicker films use single-frame editing to highlight these hidden material attributes, creating an anti-illusionist schema. By extending the contrast between images, these films aim to maximise the perceptual distance between frames, enabling the viewer to become aware of the gaps. Inspired by these films, I introduced the frame gap to the digital medium using single-frame editing in my film *L I G H T* (2023). The objective was to determine if the viewer could perceive these gaps when they created intolerable ruptures between frames – similar to how flicker films challenge the seamless perception of motion in traditional film – prompting the viewer to reconsider their understanding of time intervals. This exploration was further contextualised through insights

¹⁴ Gidal, P. (ed.) (1976b) *Structural film anthology*. London: British Film Institute.

gained from neuroscience and phenomenology, which provided a framework for my examination of how humans perceive time.

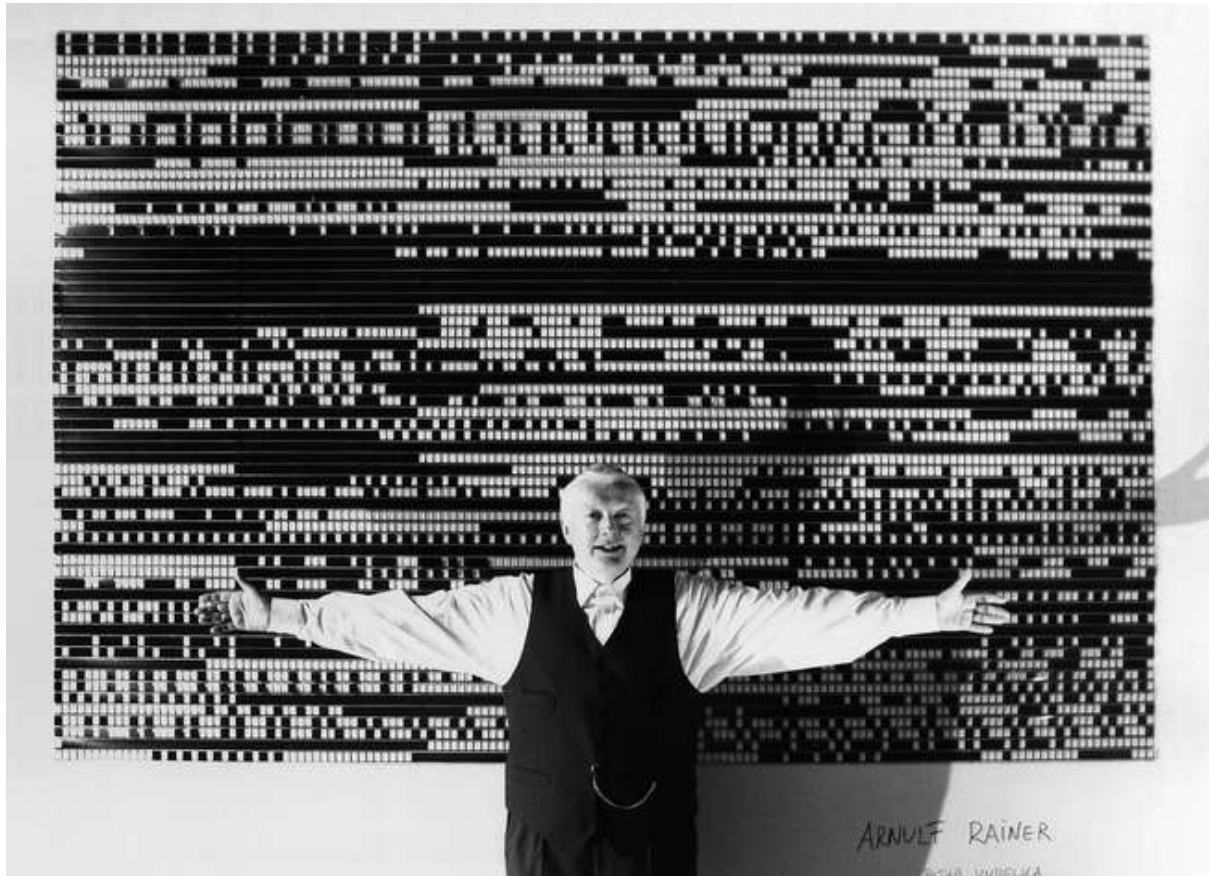


Figure 30. The presentation of Peter Kubelka's frame manipulation in Arnulf Rainer (1960).

***Au Bord Du Lac* (1994) and *La Plage* (1991)**

Format: Film

Artist: Patrick Bokanowski

Patrick Bokanowski's *Au Bord Du Lac* (1994) and *La Plage* (1991) are experimental animations that showcase his innovative approach to filmmaking. These films use an array of optical devices, including pinholes, mirrors, prisms and mercury, to create visually striking imagery that challenges the narrative images of mainstream animation. These films present several

visually stunning images and motions through his special usage of particular techniques, such as hammering a mirror for each frame.

Reflection

In Bokanowski's films, the metamorphosis of his images is intricately linked to his innovative use of distinctive materials. This approach emphasises the concept of the materiality of animation, where the choice of materials significantly influences the aesthetics of motion due to their inherent physical properties.¹⁵ Bokanowski's films often feature elements such as hammered mirrors and flowing liquids, which serve as reflective or refractive media, creating unique visual effects and dynamic imagery (see Figure 31). This materiality in Bokanowski's work is a deliberate artistic choice that challenges conventional animation techniques. Inspired by Bokanowski's pioneering use of materials, I embarked on this research project to further explore interactions between various materials and light sources.

¹⁵ Torre, D. and Torre, L. (2019) 'Materiality, experimental process and animated identity', in Harris, M. and Husbands, L. (eds.) *Experimental animation: from analogue to digital*. London: Routledge, p. 86.



Figure 31. *The still photos of Au Bord Du Lac (1994) and La Plage (1991) showcase the distinctive visual effects through different material use.*

Rhythm (1953)/Neighbours (1965)

Format: Film

Artist: Len Lye/Norman McLaren

Len Lye and Norman McLaren are two pioneering artists in the history of experimental animation. The films *Rhythm* (1953) and *Neighbours* (1965) use elliptical editing and jump cuts within their narratives. In *Rhythm* (1953), the film's narrative is centred around the assembly of a car, a process that Lye transforms into kinetic aesthetics through his mastery of montage. Furthermore, his rapid-cut technique creates a collage-like aesthetic, creating visible ruptures in the narrative that challenge traditional notions of narrativity and continuity. A similar phenomenon is seen in McLaren's *Neighbours* (1965), where the story revolves around the conflict between two neighbours who engage in a destructive argument over a single flower. Technically, this film uses 'pixilation', where live actors are captured in stop-motion animation, and his jump editing creates a surreal and exaggerated portrayal of human actions.¹⁶

Reflection

Employing innovative techniques, including elliptical editing and jump cuts, Len Lye and Norman McLaren manipulate the frame structure, challenging the perception of coherent movement. This technique emphasises the aesthetic of animation through its physicality, aligning with Norman McLaren's assertion that animation is 'the art of manipulating the invisible interstices that lie between the frames'.¹⁷ In addition, these two pioneering animations embody the concept of 'animation materiality'. Paul Taberham suggests that a common method of revealing this materiality is to disrupt the sequence of images until the flickers become noticeable to the viewer rather than maintain smooth motion.¹⁸ This disruption highlights the editing process as a cinematic phenomenon of discontinuous motion

¹⁶ Cavalier, S. (2011) *The world history of animation*. Berkeley: University of California Press, p. 301.

¹⁷ Furniss, M. (1998) *Art in motion: animation aesthetics*. Sydney: John Libbey & Company Pty Ltd.

¹⁸ Taberham, P. (2019) 'It is alive if you are: defining experimental animation', in Harris, M. and Husbands, L. (eds.) *Experimental animation: from analogue to digital*. London: Routledge, pp. 31–32.

achieved through frame manipulation. Inspired by these animators, I adopted these editing techniques to create the frame gap in my works to examine the physicality of animation and film.

Bouquets (1994–2022)/Cornish Knitting Pattern (2014)

Format: Film

Artist: Rose Lowder/Jennifer Nightingale

Rose Lowder's *Bouquets (1994–2022)* series is a collection of 1-minute films that intricately weave frames together to capture the same natural scene at different times. This technique creates a dynamic interaction of light and movement, creating jerky motion and flicker effects. Jennifer Nightingale uses a similar frame manipulation technique, where each frame of the film corresponds to a stitch in her knitting pattern. The camera's shutters are connected to individual threads of her knitting yarn, with each stitch triggering the camera to capture an image. These frames are then sequenced according to her intricate knitting patterns, creating a visual flicker effect that mirrors the complexity of her knitting designs (see Figure 32).

Reflection

These two contemporary films challenge traditional cinematic narratives and invite the viewer to engage with the medium of film in a novel way. Their creative frame manipulation maintains the tradition of single-frame editing in flicker films and experimental animation, foregrounding the concealed frame gap as an exploration of the materiality of film and animation. In addition, their interwoven frames, captured at different spaces and times, create a glitchy image as a cinematic phenomenon embodied by the frame gap, which encouraged me to consider how the frame gap can manipulate humans' perceptions of time and space. The distinctive light conditions in the images deconstruct the sense of fluidity and

continuity, manifesting the temporal gaps of production time between the static photos. This innovative technique creates an awareness of time contextualised by phenomenology. Almost all my films duplicated their technique of frame manipulation to create the frame gap. Sharing a similar cinematic phenomenon with their films, the discontinuity in their films also provoked me to consider the significance of the relationship between time perception and the frame gap.

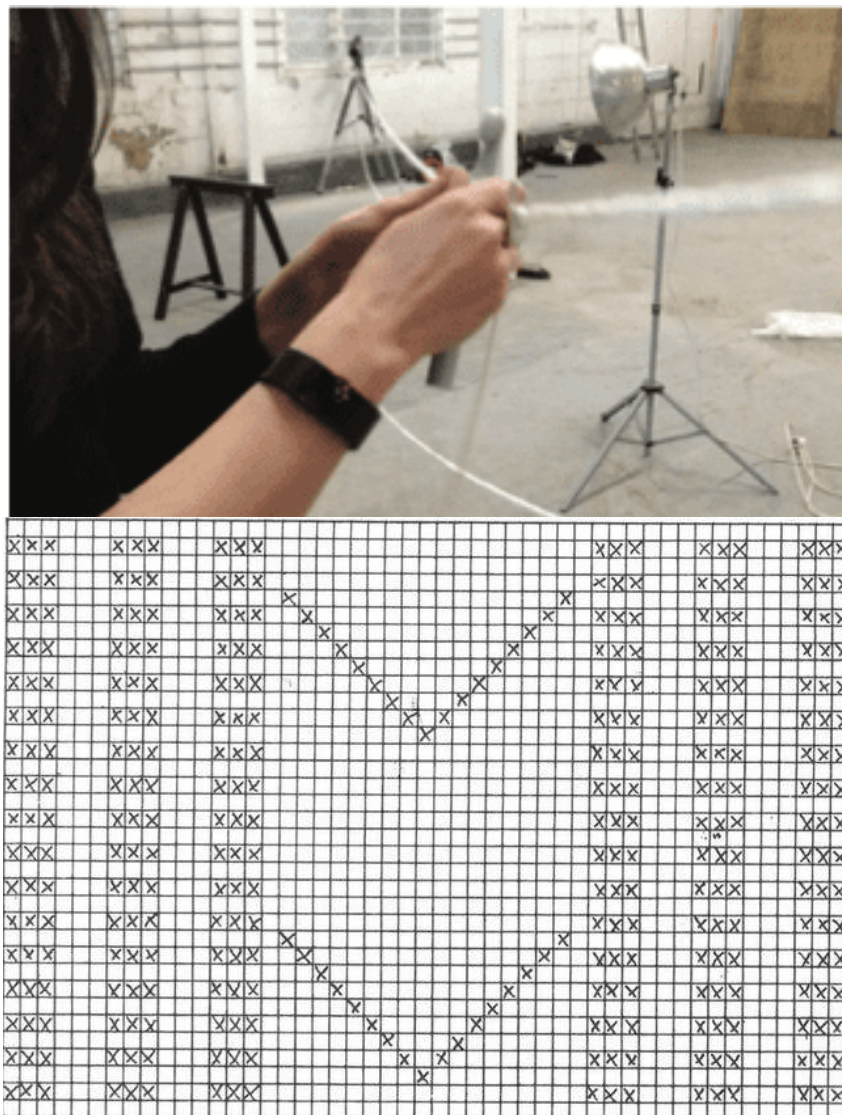


Figure 32. Two photos demonstrate Jennifer Nightingale's frame manipulation through the Knitting Pattern in *Cornish Knitting Pattern* (2014).

Format: Film**Artist: Michael Snow**

Wavelength (1967) is a structuralist film that is well-known for manipulating cinematic space and time, achieved through a singular, continuous zoom shot that traverses the length of a loft space. It begins with a wide shot of the loft before gradually zooming in on a photograph pinned to the far wall (see Figure 33). This slow zoom is accompanied by the sound of a rising sine wave, creating an auditory tension that mirrors the visual journey. The superimposed images of past events are occasionally used as flashbacks during this journey, creating a thought-provoking meditation on temporal awareness.

Reflection

Wavelength (1967) represents a seminal work within the structuralist film genre, in which Peter Gidal advocates resistance to the suppression of time and space in narrative editing.¹⁹ Responding to this anti-narrative strategy, this film departs from traditional narrative forms through a deliberate lack of editing. By maintaining a singular, narrowing angle of view throughout the work, Snow emphasises the transformation of space and time as a continuous, unbroken experience rather than one fragmented by cuts and edits.

James Peterson further elaborates on this concept by suggesting that *Wavelength* (1967) embodies the temporality of film itself, which is intertwined with humans' perception of time. The film's continuous forward movement evokes a sensation of time that parallels the linear progression of objective time. This is contrasted with the superimposed flashbacks within the film, which represent memory as a perception of the past and overlap with the

¹⁹ Gidal, P. (ed.) (1976b) *Structural film anthology*. London: British Film Institute, p. 4.

present to create a sense of temporal depth. This interaction between past and present invites the viewer to engage with the film on a phenomenological level, contemplating the nature of time as experienced through cinema.²⁰ This film is an important work that examines the physical experience of film as a mirroring of the human perception of time contextualised by phenomenology.



Figure 33. A still photo of Wavelength (1967).

Mothlight (1963)/Post Office Tower Re-towered (1977)

Format: Film

Artist: Stan Brakhage/Ivan Kerr

²⁰ Peterson, J. (1994) *Dreams of chaos, visions of order: understanding the American avant-garde cinema*. Detroit: Wayne State University Press.

These two films demonstrate a unique creation process in filmmaking known as 'direct film'. Instead of capturing footage with a camera, direct film highlights the manoeuvring of the filmstrip as the primary method of film production. In *Mothlight* (1963), a notable film in this genre, Brakhage crafts a film by pressing natural materials, such as moth wings and flower petals, between two strips of perforated tape (see Figure 34). This method produces flickering imagery that evokes the characteristic of the frame structure as a discontinued feature. A similar approach is used by Ian Kerr in *Post Office Tower Re-towered* (1977), where an animation is created using a cropped postcard of the Post Office Tower (now known as the BT Tower) in London (see Figure 35). This method creates a fragmented panning-down vision different to the human eye, offering a unique perspective on a familiar frame structure in film.

Reflection

Both films highlight direct film as an experimental method of filmmaking, challenging the narrative frame structure as a unique mode of seeing following Dziga Vertov's 'Kino-Eye'.²¹ In these films, the materials transcend the boundaries of the filmstrip, creating a discontinued motion as flicker imagery similar to the light flickers in flicker films. This cinematic phenomenon exposes the disjointed nature of the frame structure, suggesting the frame gap is an uneliminated element during projection. In addition, this particular form of seeing from the perspective of the 'camera-eye' reflects Vivian Sobchack's concept of 'film intelligence' through its self-perception.²² By imbuing film viewing with human seeing, this disrupted seeing frees the passive viewer from immersive viewing. As a consequence of embodiment,

²¹ Vertov, D. (1929) *From kino-eye to radio-eye*, p. 90.

²² Sobchack, V. (1992) *The address of the eye: a phenomenology of film experience*. Princeton: Princeton University Press.

this artistic filmmaking creates an awareness of the film's presence as an intelligence through this filmic phenomenon.



Figure 34. The found objects layered on the filmstrip in Mothlight (1963).



Figure 35. The postcards of the tower layered on filmstrip in *Post Office Tower Re-towered* (1977).

***Outer Space* (1999)**

Format: Film

Artist: Peter Tscherkassky

Outer Space (1999) is constructed from existing footage and is a testament to Tscherkassky's unique filmmaking process. With this technique, he layers an unexposed filmstrip on top of the original footage and re-exposes the footage through the manual operation of a laser pen. These double-exposed images depict translucent masks on top of the original images and move in a fragmented and glitchy motion, deconstructing the narrative of the original footage (see Figure 36).

Reflection

This innovative approach to filmmaking exemplifies the intersection of traditional techniques and digital media. By layering re-exposed filmstrips as masks over the original footage, Tscherkassky demonstrates how the language of digital media is deeply embedded in traditional filmmaking methods. Tscherkassky's method responds to the classical matte painting technique used in computer-generated imagery films, which also employs multi-layered painting in digital filmmaking. Thus, it reinforces Lev Manovich's notion that new media has evolved from these traditional techniques.²³ This exploration encouraged me to develop the frame gap within the context of digital media by drawing on the collapsed frame structure seen in flicker films. Tscherkassky's method, similar to other direct films, uses a filmstrip to create disjointed motion that reveals the intrinsic nature of film's frame structure, which highlights the frame gap concept.



Figure 36. A still photo of *Outer Space* (1999) presenting the mask effect.

²³ Manovich, L. (2001) *The language of new media*. Cambridge: MIT Press.

Paper Landscape (1973–2015)/Man with Mirror (1976–2011)

Format: Film

Artist: Guy Sherwin

These two artworks by Guy Sherwin use film as a performance. *Paper Landscape (1973–2015)* uses a transparent screen and white paint to create a dynamic interaction between the filmmaker and the projected image. The performance involves Sherwin applying white paint to a clear plastic screen, gradually revealing and obscuring the projected film. In *Man with Mirror (1976–2011)*, Sherwin uses a hand-held mirrored screen to manipulate the projected images, reflecting light in real time.

Reflection

These films exemplify the principles of expanded cinema through their exploration of spatial perception. By using film as a performance – a typical feature of expanded cinema – Sherwin blurs the boundary between the physical space of the performance and the illusory space of the film. In *Man with Mirror (1976–2011)*, the film projection creates an illusory space on the mirror, while the reflected light illuminates the gallery space, challenging the viewer's perception of physical space.

Similarly, *Paper Landscape (1973–2015)* uses a transparent screen to create a unique interaction between the visible and the invisible. When the screen materials interact with light, the screen changes into a paint-like canvas, with the projected images being both revealed and concealed by the paint reflecting the light. This technique invites the viewer to reconsider the nature of film as a medium that relies on light and to consider its capacity to convey an authentic spatial perception on the screen.

This interaction between the real and the illusory encourages the viewer to actively engage with the film, transforming the viewing experience into a participatory event. This active viewing of space, which challenges the illusory experience of narrative film, encouraged me to explore the frame gap as a temporal perception through active viewing.



Figure 37. Two documentary photos of Guy Sherwin's light performance: *Paper Landscape* (1973–2015) and *Man with Mirror* (1976–2011) in live.

***Phase Loop* (1971–2018)/*Light Music* (1975)**

Format: Film**Artist: Guy Sherwin/Lis Rhodes**

Phase Loop (1971–2018) is a film performance that uses 16 mm film projectors, film loops and optical sound to create an immersive environment. The performance is characterised by asymmetrical editing of visual and auditory elements (i.e., 24 and 26 frames as a loop). This technique not only deconstructs the visual continuity but also creates an asynchronisation of vision and audition. Lis Rhodes' *Light Music* (1975) also uses the physical properties of celluloid to create sound; however, it produces an environment where sound and imagery are intricately linked. Rhodes' drawings are printed onto filmstrips, forming abstract patterns of black and white lines and corresponding sound (See Figure 38). However, the visual patterns are projected on opposite screens, preventing simultaneous viewing.

Reflection

By manipulating the film stock, Sherwin and Rhodes encourage the viewer to engage with the medium, drawing attention to the physical processes underpinning the cinematic experience. This approach aligns with the tradition of structuralist film, which emphasises the physical properties of film rather than narrative content. Sherwin's technique generates a nuanced asynchronisation of the visual and auditory tracks, creating a 'temporal experience engaged with the film's physicality'.²⁴ Similarly, Rhodes' approach creates a subtle difference in visual patterns that requires the viewer to engage in comparative viewing of the two screens. This dual projection adopts the concept of spatial temporality in expanded cinema, creating a multi-layered temporal perception by splitting two timelines into separate locations. Their precise editing and multi-screen projection contribute to understanding the temporal

²⁴ Windhausen, F. (2012) 'Patterning time: on Guy Sherwin's sound cuts', *The Moving Image Review & Art Journal*, 01(02), pp. 207–214.

experience in *L I G H T* (2023), where the frame gap creates five parallel movements with nuanced editing differences through multi-screen projection.



Figure 38. A documentary photo of Light Music (1975) in live.

***The Clock* (2010)**

Format: Video installation

Artist: Christian Marclay

Christian Marclay's *The Clock* (2010) is a 24-hour video installation that intricately weaves together thousands of film and television clips to create a real-time cinematic experience. Each clip in the montage features a clock or watch that displays a specific time that corresponds to the actual time it represents. This creative technique enables the viewer to experience the passage of time through narrative images.

Reflection

Marclay's masterful exploration of time through splicing and editing pushes the boundaries of storytelling, challenging the traditional view of time in narrative film. Through its innovative use of real-time synchronisation, the film invites the viewer to engage time in a deeply personal and conscious way (a characteristic of expanded cinema). The interwoven clips of the narrative and clock imagery blur the boundaries of Malcolm Le Grice's notions of 'spectator time' and 'narrative time' (also explored in other works of expanded cinema),²⁵ encouraging me to look at the nature of time and its impact on human experience in my films.

Line Describing a Cone (1973–2024)

Format: Film installation

Artist: Anthony McCall

Line Describing a Cone (1973–2024) is a film installation using a cinema as a light sculpture. This piece projects a white dot that gradually expands to form a complete circle, creating a three-dimensional cone of light in a darkened and foggy space as an immersive film experience (see Figure 39).

Reflection

Anthony McCall's work challenges traditional cinematic experiences by transforming light into a tangible medium, which encouraged me to use light as an exploratory medium in almost all my artworks. This work also emphasises the physicality of light in projection, inviting the viewer to engage with the projected beam as a physical object. Presenting this solid shape of light changing also encourages an active viewing of perceiving real time and space, which Jonathan Walley maintains is 'a direct physical experience of duration' and 'a

²⁵ Le Grice, M. (2011) 'Time and the spectator in the experience of expanded cinema', in Rees, A.L. (ed.) *Expanded cinema: art, performance, film*. London: Tate Gallery Publications, p. 161.

multi-perspective experience'.²⁶ Influenced by McCall's work, Walley encouraged me to consider the real cinematic experience rather than the illusionistic experience of light, movement and time in narrative films. This investigation also inspired me to explore these perceptual elements in my films, engaging with perception in phenomenology.



Figure 39. A documentary photo of *Line Describing a Cone* (1973-2024) I captured live.

***Limited B: The Lake* (1973)**

Format: Film

Artist: Jean Otth

Limited B: The Lake (1973) uses video as a medium to challenge the viewer's perceptions. It frames the serene yet dynamic reflections on a lake's surface, where the horizon line is drawn

²⁶ Walley, J. (2007) 'The paracinema of Anthony McCall and Tony Conrad', in Graf, A. and Scheunemann, D. (eds.) *Avant-garde film*. Amsterdam: Rodopi, pp. 367–368.

by the reflections of light on the water. However, there is an electronic line created by the video technique that always remains static in the frame. As the light flickers and shifts, this extra line remains constant, creating a contradictory point amid the ever-changing visual landscape (see Figure 40).

Reflection

Limited B: The Lake (1973) is characterised by its exploration of the boundaries between reality and representation. As François Bovier stresses, '[T]his video is used to phenomenological thinking, allowing us to understand cinematic reality'.²⁷ The juxtaposition of stability (electronic line) and movement (reflective lake) encourages the viewer to reflect on a real physical perception through the video's presence. Thus, this is a video artwork that weaved together the principles of phenomenology, paving the way for my investigation of the frame gap as a physical presentation in digital systems engaging with a real perception of time in phenomenology.

²⁷ Bovier, F. (2022) 'Jean Otth and video art networks: exhibitions, festivals, open encounters – about the agency of a medium', *The Moving Image Review & Art Journal*, 11, p. 236.



Figure 40. A still photo of The Lake (1973).

Penpal (I Can't Wait to Finally Meet You!) (2023)

Format: Film

Artist: Rhona Eve Clews

Place: LUX, Waterlow Park Centre, London (21 June 2023)

Penpal (I Can't Wait to Finally Meet You!) (2023) is a film composed of a series of still images of a geyser taken from a webcam that are presented as an animation in the style of a presentation. The photography information is provided at the top of the screen, synchronised with a subtle click sound, revealing the artist's act of browsing these online images. As a static feature of photography, the film shows the discontinued, fragmented moments of the same scene, similar to a collection of online pictures rather than continually moving images.

Reflection

This unique approach enables the artist to reveal the filmmaking process as a direct experience, and it shares two key characteristics with structuralist film. First, the static camera freezes the movement, while the photography information on the screen reveals that the image sources are online photographs from webcams as a sensual element. Second, the frame-by-frame structure deconstructs the mainstream narrativity, highlighting a non-narrative structure. A further reflection is that this film evokes a similar awareness of time as the frame gap by sequencing static photographs with deliberate time gaps between their capture. Thus, they are perceived as fragmented time, which not only emphasises the intervals between frames but also encourages a conscious reflection on the nature of time itself.



Figure 41. A documentary photo of *Penpal (I Can't Wait to Finally Meet You!)* (2023) I captured live.

The Waiting Room (2023)

Format: Film installation

Artist: Sarah Sze

Place: The Waiting Room, Peckham Rye Station, London (3 July 2023)

The Waiting Room (2023) is a large-scale film installation exhibited in the waiting room of an abandoned railway station (Peckham Rye Station). The main body of this film installation is a sculpture in which projectors and screens are mounted on a scaffold as a light sculpture. In the middle of this structure, a globe geometry is covered by several pieces of torn paper displaying film through a multi-screen projection. Behind this globe sculpture, several rotating projectors illuminate the room by projecting the moving image on the ground, roof and walls, resulting in an immersive experience (see Figure 42).

Reflection

Through its use of multi-screen projection and film as a projection performance, this artwork inherits the traditions of expanded cinema. These dynamic projectors illuminate the environment, creating a spatial perception of the gallery space rather than an illusory space on the screen. This spatial perception is reinforced by rotating projectors that convey two perceptual motions as active viewing: the image movement within the projection image and the rotation of the projection light in real space. The creative use of moving projectors also emphasises light as a conscious medium in the film, which inspired me to use a projector to explore active experience in *Corner Light Projection* (2022). When the light projected images on my body and the mottled walls as a dynamic projection, it engaged my awareness of light as a real perceptual element moving in space and time rather than serving the narrative in

conventional films. Following this anti-narrative strategy, I examined light, time and space as actual experiences through my practices.

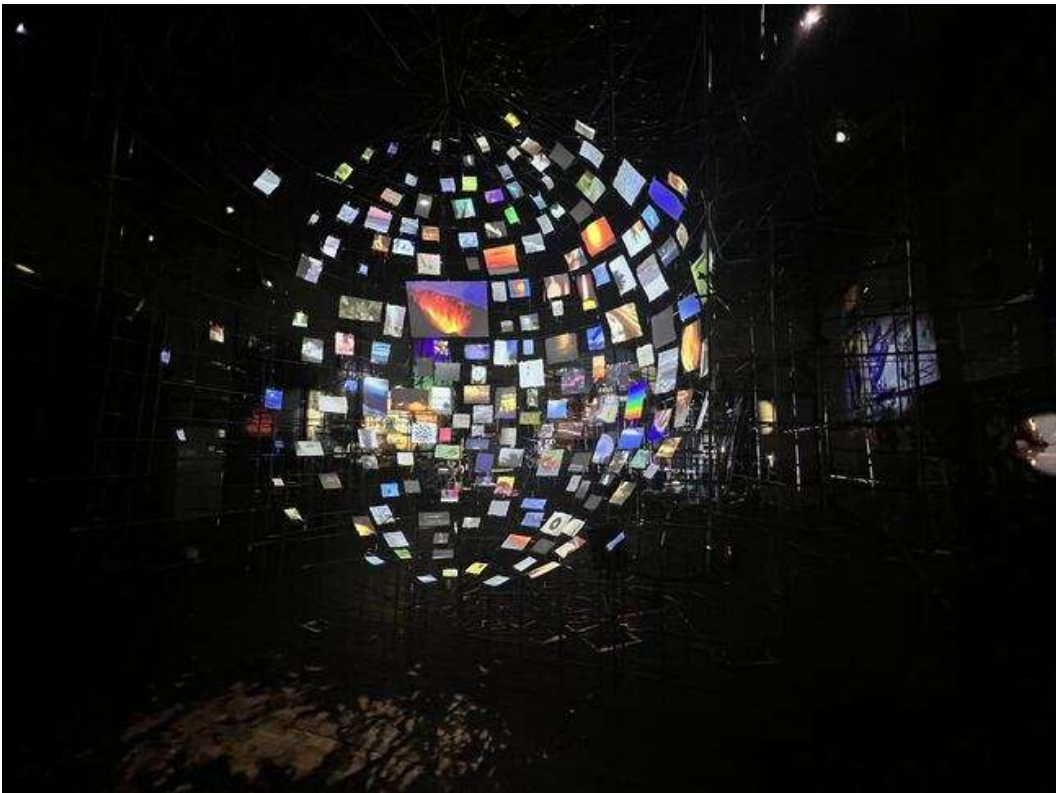


Figure 42. Two documentary photos of *The Waiting Room* (2023) I captured live.