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Concrete, Space and Time: Mixed Reality and Nonlinear Narratives

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Abstract

In an age where spatial computing and immersive technology are rapidly developing and increasingly impacting on our everyday activities, there is an urgent need to examine how such technology presents opportunities for creativity within the arts and humanities. This thesis explores the topic of virtual reality storytelling, with particular regard to mixed reality experiences and the recreation of places, people and memory. After outlining the history and potential of Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR), collectively known as Extended Reality (XR), I argue that XR displays unique attributes that do not collectively appear in existing mediums—such as cinema, literature or photography—and has the capacity to alter our perception of space and time via immersive experiences. Although the experiences of VR and AR may be relatively new, some of the possibilities which are now available—or within close reach—have been the subject of science fiction for decades. I argue that the ideas and concepts within visionary art, literature and film are a guide for future storytelling within XR environments and that multi-sensory XR technology, combined with the memories and imagination of the users, could facilitate a sensation of nonlinear time consciousness or 'time travel'. I also highlight several 'non-VR' artists who provide a footprint for the use of XR within the arts and humanities, demonstrating possible techniques for the display of audio and visual material in mixed reality environments and the management of the sensorial tableaux within such experiences. My research also includes the creative practice piece *Schema*, a VR artwork produced in parallel to the writing of this thesis. Inspired and informed by my research, *Schema* seeks to demonstrate that VR can be utilised as a genuine, unique, platform for art within its own right and not solely as an extension of television, cinema, videogames or a form of 'immersive documentary.'

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For Amey, Angel & Lucas.

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1.0 Introduction

The majority of academic study surrounding virtual, augmented and mixed reality to date has been primarily concerned with recreating and repurposing the human sensorium. Much of this research activity has been in various realms of engineering, science and medicine—predominantly in areas concerned with industrial technical capability, phenomenological experiments or potential health benefits—with comparatively minimal contributions from the arts and humanities community. In this aspect, very little has changed since Aylett & Louchart remarked in 2003 that 'VR researchers have primarily focused on its technological capabilities, while in comparison to the previously mentioned narrative media, little account has been given of theoretical concerns.' Extended reality (XR) has given rise to a new artform which is inherently linked to an emerging technology and, consequently, there currently exist relatively few examples of theoretical framework or narrative theory compared to mediums such as literature, theatre or film. If we consider how the internet has changed and shaped society, the impact of this emerging artform is likely to be considerable and possibly extend beyond the effects of theatre, film and television. Consequently, extended reality and immersive storytelling demand more academic investigation for artistic endeavours. As we enter an exciting new phase in the development of XR experiences, my interest is in researching XR from a cultural standpoint, looking at the impact and potential of this emerging technology from an arts and humanities perspective.

By the beginning of 2021, it was estimated that 59.5% of the world's population had internet access (Johnson 2021) and 63% of the UK had Facebook accounts (Tankovska 2021). Many people are accustomed to their online social network accounts being personalised and often use their accounts to share highly personal information, thoughts and feelings with friends and, sometimes, strangers. This level of interaction and personalisation is absent in literature, audio and film but is an integral part of the majority of mixed reality environments. For his project *Thresholds* (2017) at Somerset House in London, the artist Mat Collishaw recreated an early photography exhibition by William Henry Fox Talbot at King Edward's School, Birmingham, in 1839. The experience was a fully immersive portal to the past; visitors in London in 2017 walked the same paths as those in Birmingham in 1839 whilst viewing high-definition digital versions of pieces which, in reality, have now faded almost beyond recognition. The experience was further augmented by recreating the heat from a coal fire

with electric filaments and the sounds of Chartist protesters outside. It would already be difficult to simulate the multi-sensory phenomena of Collishaw's exhibition with purely image, audio or film – but what of the possibilities of even more advanced mixed reality environments in the future?

How much more powerful would such an experience be if the narrative came from our own memory or imagination? Could this effectively become a form of psychological time travel? We are already living in an era where deceased actors are being digitally revived for cameos in blockbuster films; it will now only be a matter of time—and further leaps in technology—until actors who died decades ago take the lead roles in major new motion pictures (Quetteville 2018). Could the same standard of revival be achieved for our lost family, friends and loved ones within a mixed reality environment? Would the science fiction of *Solaris* (Tarkovsky 1972) then effectively become science fact? In the summer of 2016, countries around the world experienced an augmented reality phenomenon when Niantic and Nintendo released *Pokémon Go*, the first AR game played by tens of millions of people. Pesce (2021) describes the events in Australia at Peg Paterson Park in Rhodes, New South Wales, during the initial throes of *Pokémon Go* fever, as large numbers of people flocking to the small location to observe virtual animals prompted crowd safety concerns and an eventual police presence: 'The story of Peg Paterson Park reveals the contours of a future where the blending of the real and the algorithmic could be used – indeed, has already been used – to generate social outcomes' (p. 8). The spectacle of crowds gathering at seemingly random locations to view augmented reality content on their mobile devices became a regular occurrence in 2016, confusing many non-players as to the appeal of the game – however, as Pesce (2021, p. 9) summarises: 'At its most basic level, this new technology of 'augmented reality' works like an engine that generates hallucinations – phantasms, projected within the real world.' By current standards, the virtual creatures were relatively primitive – neither interacting with players or showing any visible connection to their surroundings – however, their virtual presence was enough to capture the imagination of the audience. The fact that players had to visit a specific physical space to see a virtual character was reason enough for them to play the game and be enthralled for days, weeks and—in some cases—months. As the various elements that constitute immersive technology develop and diversify, they appear to not supersede each other – from VR to AR to MR – but co-exist, showing their own distinct qualities in terms of use and purpose. Some of these qualities appear distinctive in extreme ways, as Mark Fell highlights when describing VR's attempt to be 'a complete

replacement of all the sensory inputs to your neurocognitive machinery', to a degree where it 'wants to completely monopolise on all levels and shut everything else out' (Fell 2020).

Extending the qualities of certain elements of the immersive experience could lead to numerous new seams of research, some of which may be markedly distant from the uses originally intended by the creators of the technology involved. Dr Brennan Spiegel, Director of Health-Services Research at Cedars-Sinai Medical Center, Los Angeles and a Professor of Medicine and Public Health at UCLA, has been using VR in his research since 2014. In his book *VRx* (2020) Spiegel details how he has reduced the need for surgery and opioids within his practice and successfully treated a range of conditions by prescribing the use of a VR headset: from burns victims to patients suffering from schizophrenia; reducing the pain of childbirth and helping multiple patients overcome phobias and anxiety. Now a passionate advocate of the healing power of VR, Spiegel (2020) enthuses: 'VR is not just for gamers anymore; it is a new type of medicine that not only has the potential to heal but can also strengthen the bond between doctor and patient' (p. 5). Spiegel (2020) describes a life-changing visit to Mel Slater's lab at the University of Barcelona where he experienced an out-of-body simulation in VR:

> Even now, long after the demonstration finished, I feel differently about my relationship to my body … I can testify that it reduced my own personal fear of death, if even just a tiny bit. Understanding how it did this offers insights into the power of VR to alter mind and body, in both the short and long-term. It helps us explain the unique ways that immersive therapeutics can improve health. (p. 17)

If experiments utilising relatively basic VR headsets are able to trigger such extraordinary responses and remarkable results, what phenomena could augmented reality experiences in space and time generate in the mind of the immersant? However, intelligent computer software and seductive consumer electronics cannot deliver an experiential revolution on their own, as Bazalgette (2017, p. 55) identifies: 'Immersive experiences require novel narrative mechanisms & new language of production... The best technology will not produce the change needed without equal excellence in content production and understanding of immersion as a narrative form.' In order to fulfil the promise of immersive technology, a whole range of creative practitioners – from painters to musicians, writers to choreographers – will need to become familiar with the platform and express themselves through it,

commanding hardware and software as comfortably as holding a paintbrush or baton, while understanding how the creative output of this emerging artform impacts their respective audiences. As the amorphous family trees of hardware and software continue to be refined, developed and converge, artists and creators of all kinds will be presented with an opportunity to discover new ways of presenting their ideas and thoughts and, ultimately, reimagining the experience of being human. According to Pimentel & Teixeira (1993), within our society we empower artists to not only 'express ideas and emotions through various media' (p. xvii) but also challenge the world around us and 'provide insight into the nature of perception and consciousness' (p. xvii). Mixed reality enables us to stand in the footprints of digital ghosts and look into the past, while also helping us to visualise potential futures; I hope that this research will help to instigate a deeper cultural conversation about the possibilities, goals and future hopes for mixed reality experiences.

1.1 Aims and objectives

We are approaching an era where human beings are unable—or unwilling—to differentiate the natural from the computer-generated, or the real world from the virtual. Ng (2019) states: 'Spurred by contemporary media culture such as reality TV, the found-footage genre, and augmented and virtual reality applications, screen edges are under constant erosion' and—while such an environment may be daunting for some—it undoubtedly provides a new and unique platform for sharing our stories, experiences, knowledge, thoughts and dreams. This thesis will review existing texts and creative works, highlighting and examining creative outputs (predominantly screen-based work) which are relevant to the development of an understanding of a more 'art-based' spectrum of extended reality immersive experiences. Some of these works are drawn from my own creative practice—working with a collaborative team—and are inherently intertwined with my research. Ultimately, the goal of this thesis is to ascertain why virtual reality is different to other forms of media and offer a definition of the potentialities of extended reality (XR) in the arts and humanities. Consequently, my research argument is focussed on the following questions:

– What is the potential of applications of XR in arts and humanities contexts?

– What technological aspects and textual features of XR facilitate the creation of immersion?

– How are these potentialities realised in XR artworks, including my own creations?

Alongside this written thesis, I have developed a creative practice piece, *Schema*, a VR experience which is both a product and proof of my scholarly investigation. Developed during the writing of this thesis, *Schema* examines how XR technology could facilitate experiences such as returning a mediaeval castle to the landscape or restoring an urban landmark to the fabric of a city within a nonlinear narrative. Emerging and future XR landscapes blur the boundaries between digital and real-world content; *Schema* both predicts and tests this by combining real 360 footage with different aspects of CGI imagery containing varying levels of realism. *Schema* aims to provide a snapshot of an immersive journey through space and time, exposing the viewer to multiple dimensions and parallel places within multiple, connected, virtual environments.

1.2 Research methodology

My research builds on the structural framework and 'dynamic systems view of narrative' suggested by Aylett & Louchart (2003) and, in particular, their argument that 'Being there' is … the defining characteristic of VR.' However, 'An approach towards a narrative theory of VR' (Aylett & Louchart 2003) was published four years before the release of the first Apple iPhone and ten years before Oculus launched their Kickstarter for a new, consumer-level, VR 'Rift' headset in 2013. In subsequent years, there has been a resurgence within the realm of virtual reality—in terms of technology and creative content—and I will highlight work which both supports the arguments of Aylett & Louchart (2003) and extends them in ways which they could not have foreseen. Examining VR/non-VR screen-based works from artists who craft with ambiguity—in particular John Akomfrah—and including my own 360 film *Schema* (2020), I will highlight parallels with Bordwell's theory for 'Art-Cinema Narration' (1985). I will also draw from key texts by Pimentel & Teixeira (1993), Ryan (2015) and Lanier (2017) and analyse previous VR works including *Memory/Place: My House* (Rothberg 2014–15),

Thresholds (Collishaw 2017), *We Live in an Ocean of Air* (MLF 2018), *To The Moon* (Anderson & Huang 2019) and my own VR journey *The Virtual Hole in the Road* (2016).

While I have an understanding and appreciation of the computer science involved in VR projects, my research does not focus on technology but the unique artistic and cultural opportunities it provides, together with the emotional response from the audience. I approach the topic using textual analysis of literature, film and works of fine art, combined with a series of interviews with a range of individuals from various creative and critical backgrounds in order to develop multi-disciplinary scholarly research alongside my own creative practice. The interviewees are all involved in artistic practice that relates to, or is explicitly part of, emerging immersive technology; some of them inform the research directly with their views on the development of extended reality and artificial intelligence, while others have influenced my practice-led research with their creative output and unique experiences surrounding the capture—and subsequent re-telling—of memory. I selected the interviewees from a deliberately diverse range of areas and specialities: musicians, curators, artists, writers, technologists – in order to provide an interwoven overview of experience regarding the current state and potential future of XR technology. The interviewees do not all share the same views; the majority of them could be described as enthusiastic advocates of VR/AR experiences, others are more concerned about the potential misuse of XR technology and cynical about any future benefits. The valuable individual insights and stories collectively form a diverse and rich pool of source material for my mixed-method approach, complementing existing scholarship with practitioner voices and proving critical to the development of the thesis, particularly my ideas surrounding future directions within immersive creativity and how current work is/has been perceived.

In order to examine the phenomenon and impact of 'spatial presence' within three-dimensional VR environments, I experienced numerous VR films and 360 worlds both physically—at film and media festivals and in gallery settings—and remotely via my own VR headset and handheld devices. This practical experience provided a rich source of material for my mixed-method research approach, in combination with a review of current literature from academics, writers and technologists—notably Bucher (2017), Gleick (2016), Lanier (2017) and Slater (2020)—and the views of those I interviewed, particularly Mark Atkin, Mark Fell and Dr Rachel Genn. The exploration of existing VR works was also an

essential component when examining the tangibility of mixed-reality environments, and proved invaluable when paired with key theoretical works from writers such as Foucault (1967) and Kerby (1991). My argument for the increasing realisation and relevance of XR narratives also involves identifying examples from literature or film, such as the reincarnation of Rheya in Lem's *Solaris* (1961) or the appearance of an identical self in Ballard's short story 'Zone of Terror' (1960), and subsequently matching them with innovations within emerging XR technologies, such as the recreation of a child for a grieving mother in *Meeting You* (2020) or the proliferation of holographic human entities within the entertainment and leisure industries. As emerging AR technology gives rise to the prevalence of 'holographic' human entities, the ethics of such simulacra become increasingly salient. When examining the potential benefits and problems associated with recreating real people, I have drawn from a wide scope of literature; from the opposing views of Baudrillard and Lévy on the subject of simulacra (Ryan 2015) to the recent attempts of Slater et al (2020) to formulate 'rules of engagement' with their paper 'The Ethics of Realism in Virtual and Augmented Reality', in which they effectively appeal for the creation of a 'code of conduct.' All of these sources are central to understanding and developing virtual places and people, and also contribute to my further argument that, through XR, simulacra could transcend imitative origins and take on a life of their own to ultimately become irreplaceable.

The unique qualities of mixed reality storytelling (compared to literature, audio or film) can be examined on many levels: technically, artistically, emotionally, philosophically, etc – however, my main aim is to ascertain the potential cultural, theoretical and civic impacts of these emerging technologies and how they might reframe personhood, time and narrative. My interdisciplinary approach to this question mainly involves identifying the sensorial differences of XR experiences and why they 'rewire' our cognition and view of the world and others within it, in answer to a 'spiritual need' (Tarkovsky 1988). The process for this research involves three main stages of investigation, namely: what is currently unique about immersive experiences; how might they change or evolve in the future and, ultimately, what possibilities do they represent in terms of storytelling and creative expression? Extended reality presents an opportunity to discover new ways of presenting our ideas and thoughts and, ultimately, reimagining the experience of being human. Highlighting examples from cinema and interactive artworks, I also discuss how mixed reality is a powerful new tool for maverick storytellers to create nonlinear narratives and will become increasingly so as immersive technology develops further. Given my own background within the fields of visual

art, design and creative direction, I have opted to combine this written thesis with a creative practice piece formed directly from the research. The resulting VR artwork – *Schema* (2020) – is an audio-visual piece inspired and informed by the textual analysis of my research, in particular visionary works of science fiction: *2001* (Kubrick 1968), *Solaris* (Tarkovsky 1972), the opening sequence of *The Time Machine* (Pal 1960) and the non-documentary output of John Akomfrah. *Schema* builds on existing works of immersive storytelling and personal narratives of artists working in film or other audio-visual media, while also attempting to crystallise the views of futurists, writers, theologians, philosophers, technologists and artists cited in the thesis, including those I interviewed personally. Consequently, *Schema* is effectively the culmination of multiple dialogues, which have subsequently been embedded into my research, utilising extended reality technology to test and expand on the themes of this thesis.

1.3 Definition of terms

The meanings of the terms 'virtual' and 'immersive' are often fiercely contested, even within the parameters of technology. Ryan (2015, p. 8) suggests three different definitions for the use of 'virtual': 'optical' ('the virtual as illusion'), 'scholastic' ('the virtual as potentiality'), and 'technological' ('the virtual as the computer mediated'). As she points out, virtual reality incorporates all three of these: 'technological', 'because VR is made of digital data generated by a computer'; 'optical' as 'the immersive dimension of the VR experience depends on the reading of the virtual world as autonomous reality' and 'scholastic' as 'VR offers to the user a matrix of actualizable possibilities' (Ryan, 2015, p. 8). For the purpose of this thesis, 'virtual' refers to 'virtual reality' – abbreviated to 'VR' – and the work and theory surrounding virtual reality technology and creativity. Virtual reality is 'an immersive, interactive experience generated by a computer' (Pimentel & Teixeira, 1993, p. 11) and an essential part of the virtuality continuum, also known as the mixed reality continuum, which consists of four key segments: reality, augmented reality, augmented virtuality and virtual reality, with mixed reality being a combination of two or more of these areas (Milgram & Kishino 1994). While 'reality' is taken to mean the world around us, 'virtual reality' is a human-constructed computer-generated environment, none of which is 'real.' 'Augmented reality'—or AR—refers to a real-life setting containing computer generated elements, such as a virtual character or information overlays. The term 'augmented reality' was first used by Caudell and

Mizell in their work at Boeing 1992 which, according to Schmalstieg & Höllerer (2016), 'sought to assist workers in an airplane factory by displaying wire bundle assembly schematics in a see-through HMD.' AR is a predominantly virtual environment which also features some pieces of the real world, e.g: the face of a real person or sections of live action video. Schmalstieg & Höllerer (2016, p. 31) manage to define AR in just three key components: '(1) the combination of virtual and real information, with the real world as the primary place of action and (2) interactive, real-time updates of (3) virtual information registered in 3D with the physical environment.'

'Immersive' has been used as a term within theatre and performance for many years (Bucher 2017, p. 81) and as Ryan (2015, p. 9) reminds us 'we can be immersed in a crossword puzzle as well as in a novel, in the writing of a computer program as well as in playing the violin.' Similarly, Allen & Tucker (2018) cite Moeller when defining that immersion falls into two main categories: 'being immersed in a space (spatial immersion) and being mentally immersed (strategic immersion, narrative immersion and tactical immersion).' Within this thesis, I use the term 'immersive' to describe emerging and established digital platforms within the scope of virtual, augmented and mixed reality technology. In addition to this, when comparing different narrative forms, I adhere to the four distinct qualities for examination proposed by Aylett & Louchart (2003, p. 3): contingency, presence, interactivity and narrative representation, which they define in the following terms:

> By contingency, we mean how far the time and space of the narrative is contingent on real time and space; by presence how far the spectator/user physically shares the time and space of the narrative; by interactivity how far they interact with the story process and by narrative representation the characteristic form of narrative in the medium.

Pimentel & Teixeira (1993, p. 15) highlight interactivity as 'a crucial aspect of VR' alongside immersion, outlining the 'two unique aspects of interactivity in a virtual world: navigation within the world and the dynamics of the environment.' Zabel (2014) expanded on this theory, arguing that virtual worlds contain 'six dimensions' that distinctively differentiate the art created there from other types of digital media:

1. Immersion
2. Interaction

3. Ambiguity of identity
4. Environmental fluidity
5. Artificial agency
6. Networked collaboration

Zabel (2014) claims that 'Immersion' and 'Interaction' are both essential factors in creating a virtual world, the properties of which are governed by the remaining four dimensions. 'Ambiguity of identity' relates to the experience offered by an immersive environment where the user may choose a non-conformist bodily presence or one which differs greatly from real life in terms of appearance (age, race or gender). 'Environmental fluidity' describes the constant flux of a digital realm where, as Zabel (2014) describes, 'constancy is the exception rather than the norm' (p. 147). Within such environments, 'Artificial agency' is the introduction of AI and virtual characters that seamlessly embed as interactive and responsive narrative elements. 'Networked collaboration' is the possibility offered by the remote hosting of the virtual world and—while admitting that this in itself is not unique to spatial universes—Zabel (2014) concludes that this combined with the other five 'dimensions' is what makes this emergent artform so truly unique.

When discussing VR it is essential to consider presence and the sensation of being placed in a virtual environment via spatial computing. Heeter (1992) identifies three dimensions of presence: Personal Presence, Social Presence and Environmental Presence. Scarborough & Bailenson (2014) define presence in terms of the spatial, the self and the social: 'Spatial presence is the feeling of being *there* … Self-presence is the feeling that my avatar is *me* … Social presence is the degree to which users feel that *others are there* as well…' All three of these aspects are vital to the successful creation of presence and agency within immersive experiences, although admittedly some VR experiences only need to be able to replicate 'being there' and/or that the avatar is you—and not all of of them are multi-user/communal—however, if all are used effectively then the overall sensation of immersion will be heightened. For some people, just 'being there' and having a sense of spatial immersion is sufficient, while others demand more presence and the company of others (Zabel 2014, Allen & Tucker 2018). When an individual is immersed within a 3D environment, they have the ability to feel the space around them which can result in a cerebral unleashing of 'spatial memory' – a dynamic and powerful effect that is difficult to match via photography, video, or any other imagery on a flat 2D surface.

The term ‘virtual reality’ is generally attributed to Jaron Lanier who coined (or, according to some, popularised) the phrase in 1987. Often referred to as ‘The Father of VR’, Lanier is currently employed by Microsoft as part of the HoloLens development team, a role which is based on his groundbreaking work during the late ’80s and early ’90s. In his autobiography *Dawn of the New Everything: A Journey Through Virtual Reality* (2017) Lanier combines personal and career reflections with his views and hopes for immersive technology. Dispersed throughout the book are fifty-two attempts to define virtual reality in one sentence, which are collectively inspiring, thought-provoking and suitably visionary. Lanier (2017) describes VR as a ‘palette cleanser’ that enables the user to see the real world with fresh eyes: ‘Virtual reality peels away phenomena and reveals that consciousness remains and is real’ (p. 55). He likens this to the parts of a car being slowly replaced with components from a helicopter, to the extent where the car will eventually become a helicopter. However, a VR tourist can experience numerous identities, bodies and changes and still remain the same person, in other words, transcend the experience. This revelation leads to his twelfth definition: ‘VR is the technology of noticing experience itself’ (Lanier 2017, p. 55). During what he now refers to as his ‘Classic VR Talks’ which were delivered 1980-81, Lanier (2017, p. 296) offered an hypothesis for what VR could deliver in the future, including the phenomenon of turning figments of the imagination into physical reality—for example, virtual musical instruments with the ability to emit objects as well as sound—described in his forty-eighth attempt at a definition as ‘a shared, waking state, intentional, communicative, collaborative dream.’ Lanier (2017) claimed that VR could be the vehicle to deliver a fuller human existence, one which would avoid many of the pitfalls and restrictions of everyday life, as he states in his fiftieth definition: ‘A hint of the experience of life without all the limitations that have always defined personhood’ (p. 297). With this definition Lanier suggests that VR offers possibilities of transcending the traditional roles of society and escaping the restrictions placed on citizens within communities, family and relationships, effectively providing a licence to redefine what it means to be a human being.

When referring to Mixed Reality—or MR—I follow the definition offered by Milgram & Kishino (1994) which has subsequently been globally adopted within academia and industry alike, stating that MR involves the ‘merging of real and virtual worlds somewhere along the ‘virtuality continuum’ which connects completely real environments to completely virtual ones.’ Benford et al (1998) expand on this and suggest a concept of ‘mixed realities’ formed

by multiple displays ‘based on the construction of transparent boundaries between real and virtual spaces’ (p. 185). Within their paper ‘Understanding and Constructing Shared Spaces with Mixed-Reality Boundaries’ (1998) they propose a system of classification to shared spaces, taking into account properties of ‘transportation, artificiality, and spatiality’ (p. 189). In order to do this they present a survey of shared digital platforms such as media-spaces, video-conferencing and collaborative virtual environments (CVEs), and then introduce the three dimensions (‘transportation, artificiality and spatiality’) as a method of measuring the range of virtual spaces. To illustrate this, Benford et al (1998) describe a poetry performance from November 1996 which was staged within real and virtual realms during Nottingham’s NOWninety6 media arts festival. Four poets performed to a theatre audience and, simultaneously, within a unique CVE designed specifically for the event to a virtual audience of 10 people – in a nearby cafe – who were able to communicate with each other via the virtual portal and freely explore the environment during the performance. The complex experience of the performance motivated the team to consider ‘a systematic approach to mixing realities’ (Benford et al 1998, p. 185). The result of this is that, to work effectively, mixed reality needs to utilise and harmonise a range of multi-disciplinary skills for wearable tech and dynamic content including, but not limited to: product design, ergonomics, sensory physics, cognitive science, visual design, psychology, computer science, cultural studies and storytelling. I will refer to many of these areas in more detail when further explanation is required throughout this thesis.

In terms of narrative theory, I follow Bordwell’s *Narration in the Fiction Film* (1985), particularly when discussing more technical aspects of scene selection, framing and the positioning of the viewer. The screen-based works featured in this thesis align with the ‘Diegetic Theories of Narration’ proposed by Bordwell (1985, p. 16) which traces the origins of memetic and diegetic storytelling back to Aristotle and Plato. After considering both models of storytelling, Aylett & Louchart (2003) conclude that, although there are elements of both within VR experiences, neither are solely appropriate for a narrative theory of VR and, instead, ‘a process view of story, as opposed to a chronological view of narrative, should be adopted in order to provide VR with a more participative narrative form.’ In light of this, they propose that Live Role Playing Games (LRPG), together with interactive and improvisational theatre, are in fact far more aligned to VR narratives than television, film or more traditional theatre. Considering the development of video games since Aylett & Louchart’s 2003 paper, I

would argue that some forms of multi-person gaming have narratives similar to those within Live Role Playing Games and interactive theatre and, consequently, would consider some video games narratives as being aligned to those within VR and mixed reality experiences. I will also specifically draw on Bordwell's theory for 'Art-Cinema Narration' (1985, p. 205) in order to address the topic of 'ambiguity' within various creative outputs; assessing how such qualities are an essential component within the work of visionary writers, filmmakers and visual artists, and how they can potentially be utilised further within VR and mixed reality experiences.

1.4 Chapter synopsis and structure of thesis

Following this introductory first chapter, in Chapter 2.0 'Escaping the rectangle – a Literature review' I present an overview of the development of immersive technology and examine how the creative potential of this new medium differs to those within more established art forms such as literature, audio or film. Via the narrative potential and spatial presence of mixed reality, I explore to what extent immersive stories have unique emotional and/or psychological qualities that are harder to achieve with more traditional media. Highlighting academic work from the technological, theoretical and cultural histories of the virtual reality continuum, I identify key developments and how we could mediate the sci-fi promise of this emergent artform and the potential negative and positive civic impacts of such experiences. After examining existing visions and future hopes for virtual reality (VR), I highlight unique aspects of immersive art, including the potential to produce a deep level of empathy. I also explore VR as a method of provoking emotion and/or better understanding of the complexities of human existence and other people's lives, mediation of the immersive experience, and the possibilities of branching narratives via artificial intelligence (AI) and VR technology. Within the chapter, I address the feeling of spatial presence and 'being there' within VR experiences and argue that, for some people, this sensation alone negates the need for detailed sensorial interaction. The chapter addresses the impacts of the absorption of VR into daily life, the potential danger of virtual poverty, and if VR technology could change our understanding of what it means to be human.

Within Chapter 3.0 'The Virtual Hole in the Road' I introduce and outline an immersive storytelling work from my own creative practice which recreated a former brutalist landmark

in Sheffield city centre. I then discuss various examples of mixed reality storytelling in order to assess the potential cultural and psychological impacts of this emerging technology and demonstrate its potential for reframing our understanding of personhood, time and narrative. The chapter also includes sections of my interview with musician Richard H. Kirk (Cabaret Voltaire) who had a significant life event faithfully recreated with live actors and a theatrical set, and I assess the possibility and potential effects of similar experiences becoming an everyday phenomenon for the majority of people via XR storytelling. I include insights from maverick storytellers such as Akomfrah, Ballard, Borges, Lynch, Tarkovsky and Wells, showing how their output pioneers an nonlinear approach to narrative with 'ambiguity' (Bordwell 1985), effectively forming a historic guide for current work in extended reality (XR) and immersive creativity. Examining liminal spaces and VR experiences from a documentary background, I highlight examples of exemplary immersive creativity which have stretched the boundaries of storytelling such as *ManicVR* (Bertin 2018) and *Notes On Blindness: Into Darkness* (2016). I also address how extended reality (XR) is an ideal tool for future nonlinear narratives, with insights from industry experts and creative practitioners—Mark Atkin (director, producer and curator), Caroline White (creative producer and consultant) and Dr. Rachel Genn (artist and neuroscientist)—and examine digitally native multiform stories such as *Thresholds* (Collishaw 2017), *We Live in an Ocean of Air* (MLF 2018) and *To The Moon* (Anderson & Huang 2019), with specific reference to videogame storytelling, the V&A Museum exhibition *Videogames: Design/Play/Disrupt* (Foulston & Volsing 2018) and the ideas of the *Realtime Art Manifesto* (Harvey & Samyn 2006). After arguing that believability is more essential within VR artworks than reality, I contrast and compare examples of immersive environments within art and popular culture such as *Second Life* (2003), *Memory/Place: My House* (Rothberg 2014–15), *Dream English Kid 1964-1999 AD* (Leckey 2015) and *The Virtual Hole in the Road* (2016). Finally, questioning place and its relationship with subjectivity, I argue that—as human beings—we already effectively augment various media with our own memories, thoughts and experiences and, consequently, extended reality is essentially a natural extension of such narratives.

Chapter 4.0 'Schema' details the content, conception, production and relevance of *Schema* (2020), a creative practice piece inspired by my research and developed simultaneously. A surreal journey through time and space where the past, present and future collide, *Schema* is a virtual reality artwork which draws inspiration from the canons of sci-fi and speculative fiction; specifically, *2001* (Kubrick 1968), *Solaris* (Tarkovsky 1972), the opening sequence of

The Time Machine (Pal 1960) and sci-fi landscapes from the work of John Akomfrah. As science fiction transforms into science fact, *Schema* provides a creative suggestion of parallel places and multiple dimensions; examining the creative process and different components of the artwork, I explore the numerous influences that shaped them; from multiple screen narratives and domestic memories, to mediaeval castles and brutalist housing estates. After describing the content and creation of the piece, I outline the various versions that were made; explaining the differences between them and why they were created, where the work was shown, the varying target audiences for each format and location, and how *Schema* can help us to imagine future journeys involving nonlinear time consciousness. In an age where deceased actors are being digitally revived and interaction with virtual beings increasingly common, I address the topic of digital simulacra within various environments and explore how science fiction has informed the development of mixed reality immersive technologies and narratives. In forming my argument I draw from the literature of William Gibson, Stanisław Lem and Philip K. Dick, the films of Andreas Tarkovsky, Steven Soderbergh, Eirini Konstantinidou and Metahaven, recent stories within popular culture based around simulacra and virtual beings, such as *Westworld* (2016-18), *San Junipero* (2016) and the work of Slater et al (2020). I will broadly outline the opposing views on 'the virtual' held by Baudrillard and Lévy and how these affect our perception of XR experiences, particularly within a virtual reality 'mirrorworld.' The chapter also explores the role of AI in recreating real people, virtual characters in XR narratives and/or real life, our acceptance of such phenomena and how these elements could be mediated in the future. Within the chapter I support my argument with insights from my interview with Mark Fell—a creative practitioner regularly using technology to explore time and space—and, by illustrating various forms of 'inner space', 'non-places', virtual selves and nonlinear time, I hypothesise that certain types of XR experiences could be regarded as a form of 'time travel', inspired and informed by the ideas and imagination of Wells and other visionaries of science fiction. Drawing from examples of literature, fine art, cinema and television signposting the development and potential of 'inner space time travel'—including the 'Holodeck'—I suggest that similar virtual reconstructions could be fulfilled by artificial intelligence, utilising digital material from social media channels to recreate events or make new stories featuring familiar places and people from our individual pasts.

Finally, in Chapter 5.0 I summarise my conclusions, examine the convergence of previous chapters, revisit my original questions and suggest directions for future work.

It should be noted that much of the latter half of the research (March 2020 – May 2022)—including the creation and exhibition of *Schema* (2020)—took place during the Covid-19 pandemic, however, remote working and virtual supervision meetings did not directly affect the research process which, in itself, could be perceived as an indication of the possibilities of virtual life.

2.0 Escaping the rectangle – a literature review

In this chapter I review existing theorisations of VR and extended reality (XR) in various contexts, evaluating and considering them in relation to applications of spatial computing and XR within the arts and humanities. In doing this I highlight the difference between the creative potential of XR and more established art forms such as literature, audio or film. This chapter also includes a brief overview of the development and taxonomy of spatial computing and XR technology, examining academic work from the technological, theoretical and cultural histories of the virtual reality continuum. After exploring to what extent immersive stories have unique emotional and/or psychological qualities—which are often unachievable with more traditional media—I align this with the narrative potential and spatial presence of mixed reality. I also highlight possibilities for mediating the sci-fi promise of this emergent artform and the potential negative and positive civic impacts of such experiences.

When formulating a narrative theory for VR experiences, Aylett & Louchart (2003) recognise that VR is often viewed via the same frameworks as film or television, much in the same way that narrative in early film was grouped with forms of literature such as the novel. In their quest to define the narrative medium of VR, Aylett & Louchart (2003, p. 4) draw on narrative theory from Plato, Aristotle, Barthes, Boal, Bordwell, Metz and other literary critics, cinema critics and theatrical dramaturges as they argue that 'VR should be considered as a specific narrative medium alongside other narrative forms such as theatre, literature or cinema.' After highlighting the intensities and aspects of various narratives from one medium to another, Aylett & Louchart (2003, p. 2) conclude 'Virtual reality, as a narrative medium, through its interactivity and other particularities, presents characteristics that none of the previously mentioned narrative forms usually possess, and should be recognised as such.' Ted Schilowitz, Futurist at 20th Century Fox, broadly expresses the creatively empowering qualities of immersive narrative in his foreword to John Bucher's *Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives* (2017): 'Once we cracked the code of the rectangle, the technology afforded the opportunity to build story all around us. Now we are finding different and unique ways to do this and finding the boundaries that we thought we used to have no longer exist' (Bucher 2017, p. x). Some of the narrative opportunities that Schilowitz describes may be rooted in literature, cinema, theatre, theme

parks or videogames, but they are increasingly establishing a new form of creative practice and artistic expression. This is mirrored by Aylett & Louchart (2003, p. 3) who signpost the 'active' nature of VR, as opposed to the 'passive' nature of other media, and how the participant is a 'user' as opposed to purely a 'spectator', resulting in a 'dynamic process' of 'storyfication' and, ultimately, argue for a 'participatory, process-oriented narrative, with particular attention to specificities and particularities of stories and their possible representation, adapted to the narrative medium VR' (p. 2).

Ryan (2015) argues that the term 'immersion' is now regularly stretched beyond its actual meaning and outlines the structure required for immersive texts to prepare the reader or viewer for narratives: 'it must create a space to which the reader, spectator, or user can relate, and it must populate this space with individuated objects' (p. 9). Ryan continues that the text should then 'construct the setting for a potential narrative action, even though it may lack the temporal extension to develop this action into a plot (p. 9). Ultimately, Ryan concludes that 'this fundamentally *mimetic* concept of immersion remains faithful to the VR experience, since the purpose of VR technology is to connect the user to a simulated reality' (p. 9). If we look at interaction, Aylett & Louchart (2003) highlight the possibilities of a dynamic systems theory (Luenberger 1979) and story-surface approaches (Cavazza et al 2001) and conclude that an ideal narrative form for VR is one where interactivity and user satisfaction are the 'basis for the construction and unfolding of a narrative, flexible enough in its articulation to bring maximum satisfaction to the user (i.e. in terms of experience, enjoyment and interest).' This signifies a very different narrative form to those traditionally used in literature, theatre, film and television; leading to their conclusion that Live Role Playing Games and interactive theatre—and I would now also include first-person video games—use a narrative theory model ideally suited for VR and mixed reality experiences.

The experience of a viewer within a 'first-person' video game or virtual reality experience directly links to Bordwell (1985) outlining Pudovkin's theory of cinema direction as though one is present at each scene as an observer. Bordwell describes this 'invisible observer'—or 'invisible witness'—form of filmmaking which later evolved into 'the camera itself as the film's storyteller, the narrator's "point of view" on the action' (p. 9), until eventually

becoming ‘classical film theory's all-purpose answer to problems involving space, authorship, point of view, and narration’ (p. 9). This kind of careful framing, in which the director skillfully leads the audience to see each scene through the eyes of another, has been widely adopted as a framework for the majority of VR storytelling to date. The process places the viewer as ‘an observer ideally mobile in space and time’ (Pudovkin 1970) which is a very accurate description for most VR experiences – however, certain camera angles, while being visually dynamic and entertaining, are not particularly realistic in terms of the human viewer and ‘could hardly be justified as faithful renditions of perception’ (Bordwell, 1985, p. 9). This is occasionally the case with VR experiences, although the majority tend to exploit the 360 degree potential of the medium and faithfully adopt an ‘invisible observer’ stance, particularly where the visual content is a panoramic video of a physical location. Additionally, VR experiences involving scenes that are exclusively computer-generated animations—for example *Notes On Blindness – Into Darkness* (2016), *The Virtual Hole in the Road* (2016), *Vestige* (2017) and *Schema* (2020)—often still adhere to an ‘invisible observer’ point-of-view in order to promote more aesthetic reality and/or an increased sense of presence in the virtual setting.

Bordwell (1985, p. 9) describes Pudovkin’s theory that ‘the camera lens should represent the eyes of an implicit observer taking in the action.’ However, this descriptive method of framing and Pudovkin’s idea that ‘by concentrating on the most significant details of the action, the director compels the audience ‘to see as the attentive observer saw’’ (Bordwell, 1985, p. 9) does not apply in VR experiences as—even in the most basic 360 VR film—the viewer has the freedom to choose where to look. Each new medium brings its own unique challenges and a substantial question for those involved in the creation of VR stories is how to guide the attention of the viewer through the experience. Sometimes, the eyes of the viewer are simply left to ‘roam’ until they ascertain the focal point of the scene. Alternatively, directors of VR experiences often utilise techniques from video games in order to capture the attention and lead the gaze to a specific place via characters, objects, graphic alerts or sound.

When assessing VR as a ‘Form of Art’, Ryan (2015, p. 50) draws on Michael Heim describing VR as the ‘“Holy Grail” of the artistic quest’, and claiming ‘Rather than control or escape or [merely] entertain or communicate, the ultimate promise of VR may be to transform, to redeem our awareness of reality’ (Heim, 1993, p. 124). Part of this

awakening—on a personal or societal level—may be evoked by a reduced awareness of the technology delivering the experience, so that the human creativity involved can emerge more freely. Ryan (2015) highlights this by stating that the first chapter of Pimentel and Teixeira's seminal book on VR (2003) is called 'The Disappearing Computer' and that 'transparency is not an end in itself but the precondition for total immersion in a medium-created world' (p. 43). He also quotes Lanier (Biocca & Lanier, 1992, p. 166) when he claims 'With a VR system you don't see the computer anymore—it's gone. All that's there is you.'

2.1 The virtuality continuum – a brief history

The first system now considered to be VR was constructed in 1965 by Ivan Sutherland, a computer scientist recognised for his achievements in the area of computer graphics. Three years later, whilst working at Harvard University and MIT Lincoln Laboratory, he produced the first three-dimensional head-mounted display (HMD). The device, which was sufficiently heavy to require support from the ceiling to prevent impact injury to the user's head, neck and shoulders, became known as 'The Sword of Damocles.' Sutherland showcased his achievement, which included technology for head-tracking and see-through optics, with the research paper 'A head-mounted three-dimensional display' at the IFIPS (International Federation for Information Processing) Fall Joint Computer Conference in 1968. In his abstract Sutherland stated: 'The fundamental idea behind the three-dimensional display is to present the user with a perspective image which changes as he moves' (Sutherland 1968). His final article published in the conference proceedings was illustrated with diagrams and photographs of 'The Sword of Damocles' headset in use, opening a door to a new way of seeing the world.

There are many stories within the history of VR involving ideas far ahead of their time and the limited technology available to demonstrate them, and further developments following Sutherland's 1968 breakthrough were relatively slow due to the constraints of hardware and processing power during the 1970s and '80s. However, as early as 1974, the 'Videoplace' artwork installations of Myron Krueger—which he described as 'artificial reality' (Lanier 2017, p. 237)—featured interactive graphic overlays. During the same period, other artists – including Dan Sandin and Scott Fisher – also combined human interaction and computer-generated graphics within their respective artworks which Schmalstieg & Höllerer

(2016, p. 5) argue effectively formed the first artistic experiments in augmented reality. In their text for a 1989 product brochure promoting Lanier's VPL research lab, Pimentel & Teixeira claim: 'VR is shared and objectively present like the physical world, composable like a work of art and as unlimited and harmless as a dream' (Pimentel & Teixeira, 1993, p. 53). With the benefit of hindsight, and no doubt disappointed by the comparable lack of progress for two decades following his predictions in the early eighties, Lanier (2017) began to realise that the creative innovations required to develop VR were more likely to appear from an entirely new sector, free from existing constraints. He encapsulates this in his forty-third definition of virtual reality: 'A new art form that must escape the clutches of gaming, cinema, traditional software, New Economy power structures, and maybe even the ideas of its pioneers' (p. 237). Lanier was observing various interested parties trying to control the future of VR – some of which he was a central part of – and envisaged that the solution lay elsewhere, from those unaffected by the issues that had plagued VR's development. Ultimately, Lanier's research shows that it is difficult to plan the art of tomorrow with the tools (and mindset) of today – in order to be free, a new art form must be made and controlled by artists external to the grip of corporate interest or the egos of VR technology instigators. This is reflected in contemporary issues surrounding the development and control of virtual reality and the Metaverse by huge corporations – for example, Facebook/Meta or Google – while seeking to promote independence and autonomy for the artists involved in creating content and expressing themselves within the XR environment.

In *Radical Technologies* (2017) Adam Greenfield reconsiders our relationship with the technologies that are transforming everyday life and asks what the cost might be to our humanity tomorrow. Tracing the timeline of augmented reality, Greenfield highlights how the inception of AR technology was closely tied to the development of information displays for jet fighter pilots: 'In the fraught regime of jet-age dogfighting, even a momentary dip of the eyes to a dashboard mounted instrument cluster could mean disaster' (Greenfield 2017, p. 66). As a means to avoid this potentially lethal distraction, crucial information – speed, altitude, weapon status, etc – were projected onto a glass pane in the pilots line-of-view, hence the first 'head-up display' or HUD was born. In response to the potential of AR technology – primarily to highlight potential legal and policy issues that the wide use of AR could present – the interdisciplinary Tech Policy Lab at the University of Washington published *Augmented Reality: A Technology and Policy Primer* in 2015. The paper includes a very concise working

definition of augmented reality, identifying six features that are common to most AR systems, namely: sensing properties about the real world (with video cameras, microphones, haptic sensors, GPS or motion signals), processing in real time, overlaying information to the user (unlike VR which places the user in an entirely new environment) via a variety of devices (screen, speaker, haptic feedback), providing contextual information (e.g: locational transport updates or real-time language translation), recognising and tracking real-world objects and being mobile or wearable (e.g: AR glasses).

Boosted by the popularity of cyberpunk via authors such as Neal Stephenson and William Gibson (who coined the term 'cyberspace' in 1982), the notions and promise of virtual reality enjoyed a significant cultural platform during the late 1980s and early '90s. The first major Hollywood film to feature VR headsets and gloves and introduce a global audience to the concept of virtual reality was *The Lawnmower Man* (1992) featuring Pierce Brosnan as the lead scientist of Virtual Space Industries Dr. Lawrence Angelo. The character of Angelo was loosely based on Jaron Lanier who became further linked with the production as numerous scenes featured genuine VR hardware prototypes from his own research labs at VPL. The script was based on a short story of the same title by Stephen King which was originally published in the May 1975 issue of Cavalier magazine; however, the author immensely disliked the treatment and requested that his name be removed from the credits. Despite its numerous shortcomings, the film was a huge commercial success and introduced a broad audience to the basic concept of VR while highlighting the concept of virtual existence as a possibility. Angelo is repeatedly shown at work and play in his basement packed with a heavy-tech tangle of computer cables, headsets, VR gloves and rotating chairs (which, in 1992, would amount to a multi-million dollar assembly). This environment contrasts with his research lab at VSI, a clinical minimalistic shrine to technology in which more serious work is conducted and scientific understanding is challenged on a daily basis. This depiction became an accepted representation of the VR industry when, in truth, the real VR research that was being carried out at Lanier's VPL lab was conducted in a more haphazard setting, very similar to Angelo's basement.

In October 1991 the first VIRTUALITY VR machines were installed in videogame arcades around the world (such as the London Trocadero near Piccadilly Circus), providing an opportunity for 'cyberpunks' to finally experience virtual reality for themselves. While the large head-mounted displays and vibrating platforms certainly offered a sense of immersion,

the overall experience was some distance from *The Lawnmower Man* or other VR environments depicted in popular film and television of the time. VIRTUALITY VR games such as *Dactyl Nightmare*—where up to four players could challenge each other while avoiding a rampant pterodactyl—proved to be undeniably enjoyable for many but lacked the experiential revolution in cognition envisaged by Gibson and his contemporaries. As the 1990s progressed it became clear that the main emerging digital technology of the decade was to be the World Wide Web or Internet, which appeared to be a natural portal for the future depicted in the novels of Gibson and *The Matrix* (1999). Consequently, investment and interest in virtual reality technology became less vital and development suffered accordingly.

2.2 Inter-dimensional humanity

Virtual reality displays inherent qualities that set it apart from other forms of media and make it an exciting tool for future creative endeavours. According to Ryan (2015, p. 50): 'VR technology has a number of practical applications, from flight simulators to remote-control surgery and the exploration of the terrain of distant planets, but from the very beginning it has been the potential of the medium as a tool for creative self-expression that has fascinated its advocates.' VR environments provide the opportunity for experiences outside of normal temporal or physical constraints, such as viewing the world through the eyes of a fly or floating through space like an asteroid (Pimentel & Teixeira, 1993, p. 155). In addition to being able to place the viewer in seemingly impossible places and situations, VR can also endow humans with athletic 'superpowers' such as huge leaps through the air and the ability to fly unaided. Mixed reality allows the user to have further 'superpowers' such as the ability to see through solid objects in the real world, for example, using a Microsoft HoloLens headset to survey electrical wiring inside a wall by augmenting the view with a 1:1 scale circuit diagram.

The most unique physical aspect of immersive art forms is that they escape the rectangle which has dominated centuries of creative practice, as well as challenging traditional 'non-rectangular' art forms such as sculpture and performance. Cinema, photography, television and web content are all framed within a rectangular shape, as is the majority of painting (even circular paintings are on a flat surface). When we look at sculpture, no matter

how abstract or huge, we still walk around the piece as opposed to it surrounding us. The majority of theatre and performance—including live music—takes place on a stage, usually directly in front of the audience who have no requirement to look behind or around them as part of the experience. There are exceptions to this, such as musicals that are staged 'in the round'—quite often in a large arena setting such as the O2 in London—or theatrical performances where the stage is positioned centrally. As a popular artform, the most recent attempt to immerse the audience has been via gigantic IMAX cinema screens—so huge they fully encompass the viewer's peripheral vision—an experience often enhanced with 3D glasses. The format has undoubtedly been successful – by the end of 2017, over 1,300 IMAX screens were installed in 75 countries (Markets Insider 2017). However, the experience is not one of 180 degree immersion – the moving image is projected onto a slightly curved surface which is still essentially a rectangle in front of the viewer and, as with traditional cinematic presentations and television programmes, the decision of where to look and when is made for the viewer by the director. Within a typical VR environment the visitor can direct their gaze to any part of their surroundings whenever and for as long as they like. This factor obviously places additional requirements on the creator of the experience to ensure that the entire 360 vista is convincing, rather than just a front-facing view – however – the reward is in the immersive world that the surrounding environment generates. For many years, theme parks and theatre have engaged in immersive activity described by Ted Schilowitz as 'spatially oriented entertainment' (Bucher 2017, foreword p. ix). Schilowitz highlights the difference between these experiences and VR: 'We have developed 3D technology, which gives us a pseudo-illusion that there's depth, but depth is different than space. Virtual reality is more than just adding depth to entertainment, it's adding actual spatial universes' (Bucher 2017, foreword p. ix). By this Schilowitz is referring to virtual 'spatial universes' which the visitor can occupy and roam freely, as opposed to a 2D image being given a false sense of depth, as is the case with 3D cinematic presentations.

Virtual reality and its related artforms provide the viewer with choice and agency within an immersive environment which, ultimately, means the ability to change a situation with your actions and/or interact with other characters, something videogame players have enjoyed for decades. This is also a sensation that has been explored within experimental theatre productions such as Punchdrunk's *Sleep No More* (2011), a site-specific retelling of Macbeth via multiple rooms and a large company of actors, where the audience can choose which spaces to enter and how long they spend there. For many VR users, just being given the

choice of where to focus your gaze within a 360 environment represents adequate interaction and provides a sense of agency. The viewer can choose where and when to look and this promotes a feeling of control and 'being there', in contrast to Lanier's (2017) assertion that – in order for the VR visitor to feel truly immersed – they must be able to interact and alter elements within their direct surroundings. For others – possibly those more used to videogames – an option to directly interact with their virtual surroundings and effect/alter/change elements within it is essential.

Much has been written about the potential within immersive technology to foster empathy – to have an opportunity to (virtually) experience life as another human being, maybe someone of a different gender, age, ethnicity, sexuality or position in society – to try on another's skin in an act of 'body tourism.' According to Pimentel & Teixeira (1993, p. 232), 'Virtual travellers who experience several points of view or reside inside several different personalities will become confronted by questions of identity and the social masks they wear.' Chris Milk suggests a reason for this heightened sense of empathy and states that what makes VR 'so unique is that it's actually capturing or constructing that human experience and broadcasting it to us as a firsthand human experience' (Bucher, 2017, pp. 101-102). As curator Mark Atkin says: 'It (immersive art) breaks down the barrier of "otherness"' (Atkin 2019) – this unique quality of VR immersion is a sensation that other artforms often approach but are unable to deliver quite so powerfully. Such immersion also affords the viewer an opportunity to make their own decisions and not purely decode the story of another. Pimentel & Teixera (1993, p. 17) also enthuse over the potential of this direct impact, claiming that VR has the potential to be more impactful than other forms of communication 'because it doesn't require you to convert your ideas into abstract symbols with restrictive semantic and syntactic rules' which is one possible explanation for its huge appeal as a universal artistic medium. Similar to Milk (Bucher 2017), what Pimentel & Teixera are referring to is a platform for transferring ideas that does not require the visitor to know a specific written or spoken language or understand a predetermined set of symbols. The experience can be appreciated universally, much in the same way as instrumental music or field recordings.

The potential empathic qualities of future immersive VR were effectively demonstrated in the popular TV series *Quantum Leap* (1989-93) in which the main protagonist Sam Beckett—an inadvertent time traveller—finds himself in the body of a different and seemingly random figure in history for each episode. Within each adventure of 'body tourism', Sam is provided

with a task in order to move forward (or back) to the next story in time. These dynamic scenarios effectively place him in the middle of the ultimate videogame experience, one in which he is required to quickly understand and orientate his character accordingly whilst convincingly communicating with those around him in order to succeed, survive and—ultimately—have a chance of returning to his own time and body. We are already seeing early signs of how such an experience could be conducted within an XR environment and how these journeys produce feelings of empathy and increased understanding of other human beings, for example with the documentary VR companion piece *Notes on Blindness* (2016). Unlike *Quantum Leap*, maybe the 'body tourist' will not be required to 'do' anything, other than experience a few minutes, or an hour, or a day of life in the form of another – sometimes just 'being there' is enough.

2.3 Being there

In their quest to define a narrative theory of VR, Aylett & Louchart (2003) ultimately declare that 'being there' is 'the defining characteristic of VR.' Nearly 10 years earlier, Heeter (1992) made a very important distinction in her paper 'Being there: the subjective experience of presence' that I would argue is still too often neglected despite subsequent technological advances: 'presence' should be measured not by how much a virtual world resembles reality, but how much the immersant actually feels they are 'there.' Within VR environments, believability is not the same as verisimilitude – you can believe you are within an environment without it looking particularly 'real.' In 1993, Pimentel & Teixeira identified that 'the immersive/interactive quality of VR removes the traditional chasm between art viewer and art object, pointing the way to a new kind of awareness as the viewer becomes a participant "inside" the art' (p. 232). There are existing parallels between the immersion that a viewer feels within VR and the sense of 'being there' within the work of certain film directors. Forrest (2020) highlights 'an active participatory mode of spectatorship' within realist film, describing two approaches of 'conspicuously observational and more distanced perspectives' – one of which he terms a feeling of 'being with' a character and the other a sense of 'being there' – in which 'our view of the characters and their locations is necessarily and wilfully restricted, depending on the particular 'conventions' of realism the film-makers choose to deploy.' (p. 6). I would argue that this distinction is one which could be equally

applied to VR and mixed reality experiences. For example, in Aaron Bradbury's award-winning VR narrative *Vestige* (2017), there is a palpable sense of not just 'being there' but of also 'being with' the central character of Lisa, a grieving wife. In one scene, the viewer stands awkwardly between two quarrelling lovers and feels a genuine sense of intrusion. Later, as Lisa looks directly at the viewer and sobs hysterically, it is difficult not to feel an increasing discomfort; a powerful mix of sympathy, embarrassment and helplessness.

When discussing the camera technique of director Andrea Arnold, Forrest (2020, p. 84) describes a method which 'enables an immersive mode of portraiture, because, as she puts it, her films are 'usually about one person and their experiences of the world' (Robinson 2016).' This form of 'invisible observer' (Bordwell 1985) narrative, according to Forrest (2020, p. 84) 'evokes an embodied and textured sense of 'being there', but the proximal nature of her aesthetic creates a more involved effect to foster the illusion of 'being with.'' This intimate or 'proximal' (Forrest, 2020) form of presentation is explicitly present in *Vestige* (2017), as the volumetric captured figure of Lisa moves in and around the personal space of the viewer. In an immersive environment we experience people in a shared physical space and their presence is far more impactful; we see them moving around us at the correct size—not as beings we can fit in the palm of our hands—and this scale and physicality has a very direct impact on our relationship with such virtual individuals. When discussing sound, Forrest (2020, p. 193) describes how Clio Barnard uses audio within her films 'to produce a highly textured sense of 'being there' in a locational sense and 'being with' in the psychological realm.' This fluid mixture of diegetic and non-diegetic sound is now regularly employed within VR experiences and readily translated and understood by an audience already primed by similar audio narratives via cinema and television.

A future update of *Vestige* or similar VR experiences would benefit from incorporating eye-tracking technology, providing CGI characters with the ability to notice when you are not paying attention to them, and utilise interactive gloves and a haptic jacket enabling you to comfort them and/or be comforted with a hug. Such technology provides exciting new possibilities for triggering sensations of 'being with' and 'being there' and transcend the sensorium of visual/audio systems currently employed within film and television. This is underlined by Lanier (2017, pp. 55-56) when he enthuses: 'Most technology reinforces the feeling that reality is just a sea of gadgets … VR is the technology that instead highlights the existence of your subjective experience. It proves you are real.' As Lanier (2017) points out,

an individual's social media presence (Facebook page, Twitter or Instagram feed, etc) could potentially be continued following their death but their own personal VR experience could not.

In an age when the attention-span of large sections the population is being increasingly dominated by audio-visual digital stimuli on mobile devices – such as streaming content, a multitude of apps and various social media platforms – it is entirely imaginable that virtual reality could become a welcome form of escape. Such an opportunity, which can be viewed as a 'cognitive monopoly' (Fell 2020) of the senses by VR, is just one of numerous aspects that immersive technology offers – an escape from the demands of multi-tasking, as suggested by Dr Rachel Genn (2020):

> In the future, VR might be the only way to get 'bored' again … the only way to not be distracted and have some quality time where your attention is not being dragged. I feel that boredom – what T.S. Eliot calls 'a passionate boredom' – is where creation begins, so we may need to reassess that in the future. (quote from interview with author)

The majority of VR experiences would be amplified if shared with another – possibly someone in the same room, or a remote collaborator. The strong communal aspect of VR experiences can be considered alongside how we might interact with a partner during a concert, theatre visit, sporting event or theme park experience; how we enjoy, disseminate and memorise the activity can be very dependent on their participation and behaviour. Equally, as those around you unavoidably form part of the experience and become inseparably ingrained in the memory, an increased sense of social presence, a feeling 'that *others are there* as well' (Scarborough & Bailenson 2014), will undoubtedly strengthen the the effect of such immersive activity and allow the user to connect with others in a way which television or other flat-screen solo experiences are unable to do.

2.4 A new layer of humanity

Despite being written nearly three decades before the expected impact of mixed reality technology, the opening lines of Mark Weiser's seminal 1991 article 'The Computer for the

21st Century' could be used as a description of what may await us: 'The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it' (Weiser 1991). Given that many people have spent two decades accessing the internet via an increasingly portable array of devices, the next logical step would surely seem to be utilising a non-physical method with seemingly no physical mediation at all other than hand gestures, facial movement or speech – however, not everyone agrees with this. Assessing the challenges of invisible systems of mediation, Dow (2008) centres on 'an immersive and interactive story called *AR Façade*' in which the user/visitor interacts with an animated couple experiencing marital conflict in an augmented reality environment. Dow (2008) cites empirical evidence from a Georgia Tech concept lab demo and an installation at the Beall Centre for Art and Technology to form a convincing argument which contradicts aspects of Murray's *Hamlet on the Holodeck* (1997). Dow (2008) challenges that an 'illusion of non-mediation', as promoted by proponents of the *Holodeck*, is not ideal in order to achieve 'embodied narrative engagement', concluding that an 'immersive interface should be mediated to provide clear mechanics to support player agency (the feeling of empowerment over events) and allow the player to manage their distance from the designated character role.' In other words, the overall sense of agency is deteriorated by invisible mediation; in order to embody a sense of control, the participant needs to be provided with a visual form of navigation.

Once the mechanisms for how we access XR experiences become established and available to mainstream society, we can expect that the inevitability of immersive technology assimilating into our daily lives will create new issues and questions; the struggle to differentiate between the virtual and the real – in terms of places, characters and experiences – will become increasingly problematic (Slater 2020). The inability to distinguish between the virtual and the real has been used in various science-fiction narratives such as *Zone of Terror* (Ballard 1960), *We Can Remember It For You Wholesale* (Dick 1966), *Neuromancer* (Gibson 1984) and *San Junipero* (Brooker 2016) and is increasingly due to become a fact of everyday life which will bring with it a wide range of pleasures and dangers. The inevitability of immersive ubiquity is something identified by Palermos (2017, p. 134), who describes the likely expansion of dependency as AR use grows and predicts that it 'will likely take over most aspects of our daily interactions with surrounding objects and human beings'. Palermos (2017, p. 134) envisages that in the future we will depend on AR devices 'much in the same

way that most people can no more leave their house without making sure they have their mobile phones on them.'

Within such technological ubiquity, the potential to 'exist' in another dimension and have relationships and sensory encounters solely in that space means that our personal capital in such an environment could be much higher, or possibly lower, than in 'real' life (Rymaszewski 2007). This mirrors individual presence within current online portals but potentially will lead to a far more extreme version of social media disparity; one could enjoy a rich and fulfilled virtual existence as a fully contributing member of the immersive community and yet be totally isolated and anonymous in the 'real world.' Many people – predominantly those under thirty-five, but increasingly the population in their forties and beyond (ESA 2017, p. 7) – already spend long periods of their free time locked in a virtual world. In the United States, 66% of the population over the age of 13 regularly spend on average 11% of their weekly leisure time playing video games (Nielsen 2018, p. 17). Often the experience may be shared with those that live locally (real friends) or further afield (virtual friends), but for some it involves a solitary challenge. What unites these experiences is that – beyond involving other individuals within the same virtual landscape – they do not interact with the outside 'real world.' The difference with these leisurely pursuits and a scenario where the population constantly relies on wearable devices for more routine activities is that 'normal' life could become very challenging or even impossible without them.

Greenfield (2017, p. 67) examines our dependence on sensory technology within the democratisation of knowledge and, ultimately, power which is bestowed on the user of modern mobile electronic devices, to the extent that the technology—a direct descendant of the jet fighter pilots HUD—creates 'an aura of omnipotence positioned as a direct extension of our own senses.' The concept that so much information can be instantly summoned and, quite literally, appear in the eye of the beholder is certainly one with undeniable appeal to a global population already heavily dependent on their pocket devices and interactive tablets (Palermos, 2017, p. 134). According to Lanier (2017, pp. 55-56) this ongoing convergence of hardware, software and knowledge provides us with an opportunity to 'rediscover something in ourselves that transcends technology' and reconnect with an aspect of humanity that we have long forgotten. In doing so we may well find a sense of being which is beyond our current definition of 'human.'

3.0 The Virtual Hole in the Road

In order to assess the potential cultural and psychological impacts of this emerging technology, in this chapter I highlight various examples of extended and mixed reality storytelling which demonstrate the potential for reframing our understanding of personhood, time and narrative. Included in this is a detailed description of my own creative practice piece *The Virtual Hole in the Road* (Bax 2016) and the unique findings from the project. Revisiting Lanier's definitions of VR, I examine aspects of place, personhood and memories within virtual worlds and immersive storytelling, using insights from my interviews with professionals working in this field. Within these conversations is my interview with musician Richard H. Kirk who had a significant life event faithfully recreated and I assess the possibility of similar experiences becoming an everyday phenomenon via mixed reality storytelling. I also discuss place and its relationship with subjectivity, contrasting and comparing examples of immersive environments within art and popular culture such as *Second Life* (2003), *Memory/Place: My House* (Rothberg 2014–15) and *Thresholds* (Collishaw 2017). By highlighting the work of maverick storytellers such as Akomfrah, Ballard, Borges, Lynch, Tarkovsky and Wells, I show how they have pioneered an 'ambiguous' (Bordwell 1985) and often nonlinear approach to narrative and effectively forged a guide for current work in extended reality (XR) and immersive creativity. Combining examples of digitally-native multiform stories and works of exemplary immersive creativity from a documentary background with insights from industry experts and creative practitioners, I highlight how VR/AR/MR is an ideal tool for future nonlinear narratives and, following on from Bordwell's (1985) theory for 'Art-Cinema Narration', I identify non-documentary extended reality artworks that display 'ambiguity' and do not adhere to traditional narrative formats as being 'Art-XR.' Drawing from artworks such *Memory/Place: My House* (Rothberg 2014–15) and *Dream English Kid 1964-1999 AD* (Leckey 2015) I also argue that, as human beings, we already effectively augment various media with our own memories, thoughts and experiences and, consequently, extended reality is essentially a natural extension of this cognition.

'It is the mind which creates the world around us' – a quote by the renowned British novelist George Gissing (1857–1903) – is cast in concrete capital letters in his hometown of Wakefield, West Yorkshire, as part of a feature wall designed by the artist Jo Fairfax. Situated

outside Kirkgate Railway Station, the wall effectively serves as a gateway to the town centre and—at 1.8 metres high and 21 metres in length—provides an acoustic and privacy barrier for the adjacent Wakefield District Housing residential properties. The design of the structure echoes railway aesthetics, and features a series of holes that mirror the windows of a carriage. According to the artist this was inspired not just by the location of the artwork, but also by Gissing's quote which evokes 'the spirit of taking a journey and how one's mind tends to wander and wonder' (Fairfax 2016). Set in relief as gigantic capital letters spanning the length of the concrete wall, Gissing's words also remind travellers that not all journeys involve physical travel, and our thoughts can form the start, end, or entirety of any experience. Such concepts can be demonstrated within the realm of extended reality (XR) – using the mind and memory to create a place ('the world around us') – encompassing transition, travel and memory.

My own personal research journey in immersive art began in 2012 when I conceptualised, curated and led 'Computer Love' – a virtual art gallery which was commissioned as part of the University of Sheffield's 'Festival of the Mind' (*The Guardian* 2012). Two years later the collaboration between the University's Department of Computer Science and the designers at Human was revisited and updated in 'Computer Love 2.0', a virtual reality experience utilising an Oculus Rift VR headset allowing the visitor to to freely roam several gallery spaces, one of which led to an outdoor woodlands scene complete with bird sounds and gigantic insects. The galleries were filled with a selection of virtual items from three of the University's collections—The Denny Museum, The Turner Glass Museum and the National Fairground Archive—with some of the artefacts more than ten times their physical size, allowing the virtual visitor to examine them in extreme detail. The unique environment of 'Computer Love 2.0' was an experimental and innovative format for displaying collections and, when the festival began in September 2014, long queues of people waited to visit the virtual museum. Following this success I wondered if we could recreate a real environment that people would recognise – given the capabilities of VR it seemed logical to construct a space that was either no longer accessible or no longer existed. My colleague Chris Smith suggested that we could recreate Sheffield's Castle Square—more commonly known as the 'Hole in the Road'—and, as an enthusiast who had collated a definitive image library for the iconic destination, offered his services as a consultant for the project. Officially opened on November 27th, 1967, Castle Square was a former underground network of pedestrian walkways which soon proved a very popular addition to the fabric of Sheffield's modern city

centre. By 1994, following years of neglect, the location had fallen into a state of disrepair and was eventually closed, decommissioned, filled-in and covered with tarmac.

The Virtual Hole in the Road (Bax 2016) was instigated with a dual aim: to provide a unique opportunity to 'relive' the experience for those that remembered the original location and a taste of what it was like for those that could not; maybe because they were too young or simply not living in the city between 1966 and 1994. The intention was not to create a 'retro experience' or virtual 'nostalgia trip' – the immersive space was envisaged as an alternative reality where the 'Hole in the Road' still existed, restored and re-loved in a similar way to Sheffield's Park Hill flats – another iconic creation of the city planning department's utopian vision during the 1960s. I wanted to show the space in all its communal splendour rather than the neglected and intimidating place that it eventually became – some graffiti was digitally positioned on the walls, exactly replicating pieces from the late '80s that had been photographed in the 'Hole in the Road' and items of litter—crisp packets, newspapers and bottles—were selectively dropped around the tunnels, however, the space generally looked and felt relatively clean. Furthermore, the strategy of setting *The Virtual Hole in the Road* in a parallel reality meant that the installation mirrored something of the way in which memory of place works: the present is augmented with our memories of what was there before. Effectively, the architectural experience becomes a virtual palimpsest, where the layers of fresh paint are scraped away to reveal the memories and adventures of past decades and former lives. The project became an experiment to create a digital record of a former place, as a realistic virtual model and the memories and recollections that it provoked. Beyond this, *The Virtual Hole in the Road* was also an early investigation to research if a VR experience could provoke feelings or responses beyond more traditional media forms, such as film, audio and photography. Rather than an excuse for pure nostalgia, *The Virtual Hole in the Road* was an exercise in imagination, stretching beyond a simple process of archiving and presenting a former place; by rejecting more familiar media forms and presenting stories in a virtual setting, those experiencing the location were able to think of it in a new and exciting way, as the inaugural visitors did when walking through the hub for the first time in 1967.

The creative team assembled at Human to work on the project consisted of Michaela Mckone (now Michaela White), Dan Fleetwood and myself. We continued our association with Professor Guy Brown and Dr Steve Maddock from the Department of Computer Science, University of Sheffield, and their PhD student Matthew Leach who assisted us with technical

problems and software engineering. To provide the final VR experience with a stronger local and personal narrative, we decided to include some thoughts and stories of those who had recollections of the real place. The Human team had recently worked with Professor Brendan Stone (School of English, University of Sheffield) on the website for the 'Storying Sheffield' project (2016) and discussions of how memories could be captured for a VR experience led to the recruitment of PhD researcher Adrian Scott, a 'Storying Sheffield' contributor. Adrian's work around poetry, memory, identity and place seemed an ideal match for our goals in creating a unique immersive sensory experience. The 'Hole in the Road' may have been held highly in the city's affections but it was not properly documented, a factor possibly due to the seemingly mundane nature of what was essentially a pedestrian tunnel complex. The space was filled-in long before any Sheffield citizens owned a mobile phone equipped with a camera, consequently, only around 120 photographs were known to exist in 2016; some of which were taken professionally but the majority being grainy amateur snapshots that were developed and eventually posted online. In order to make the virtual model as accurate as possible the project team were granted access to the 'final drawings' held by the City Planning Department at Sheffield City Council. Satwinder Samra from the School of Architecture at the University of Sheffield, an expert in modern and Brutalist architecture, joined the team to provide a critical eye on the architectural accuracy of the virtual space. To augment the visual environment with a layer of sonic presence, Professor Guy Brown made binaural audio recordings around the city and then reworked the files specifically for the virtual space; these stereo sounds of traffic, trams and crowds were then blended with the voices of Sheffield folk, producing a sonic brew unique to the VR experience.

Figure 3.1 Screenshot from *The Virtual Hole in the Road* (Bax 2018)

Earlier Human VR projects had involved the user being able to navigate around the virtual space at will in their own time—as a 'free roam'—however, due to the sprawling nature of the space, the team was concerned that people may become 'stuck' in one location, disorientated, and/or lose the enthusiasm to explore further. Consequently, it was decided that the journey should become a 'guided tour' in which the visitor could experience an overview of the space—including the central area, the fish tank and the steel escalators—accompanied by a selection of verbal testimonies. This approach also removed the need for a keyboard, mouse, or any kind of navigational tools, other than changing your surrounding view by simply moving your head, making *The Virtual Hole in the Road* more accessible to those with zero computer or gaming skills. As the project developed and the team began to solve the various technical difficulties it became apparent that what we were really creating was a new way of presenting stories, thoughts and memories. After eight months of development, *The Virtual Hole in the Road* was finally exhibited at the *Futurecade* in the Millennium Gallery, Sheffield, from 16th–25th September 2016, as part of the University of Sheffield's 'Festival of the Mind.' Many people had expected the main demographic interested in the virtual reality experience to be those most likely to play video games, however, once the exhibition was open to the public, the range of people wishing to experience the virtual space ranged from preschool toddlers to senior citizens, some of whom just wanted to put on a VR headset for the first time, while others wanted to hear the real-life stories of the 'Hole in the Road.'

The *Futurecade* exhibition was a huge success and hosted over 9,000 visitors in nine days. *The Virtual Hole in the Road* demonstrated the potential of virtual reality environments to construct new narrative paradigms in which readers become participants whose memories and histories are dynamically woven into the experience of virtual texts.

3.1 Time tourism and memory

The Virtual Hole in the Road project proved that awareness and enthusiasm in local heritage can be achieved with immersive reconstructions. Many visitors expressed to the invigilators how the replication of the former landmark was extremely accurate and the spatial presence of the virtual interior created an overall sensorial effect of 'being back there.' Others were unaware the experience was a representation of the same space after refurbishment and considered its appearance to be too clean and free of graffiti. Even without immersing themselves in the virtual environment, many people wanted to offer their own stories about the space—with comments both online and verbally with the staff at the gallery—although those that did journey through *The Virtual Hole in the Road* seemed more likely to offer their own recollections. From my own observations, some visitors simply enjoyed being immersed in 'another world' for five minutes, an aspect noted by Darnell & Hutchinson (2016) after completing their VR story *Invasion!*:

> VR is so new that the viewer can be invested in the VR experience even without story or characters. Just the fact that they can look all around, that they feel like they have been transported to and are immersed in an alternate reality, can be enough.

The staff in the Millennium Gallery exhibition space were frequently engaged by 'time tourists' who recalled their own memories of the original space unprompted. Regardless of their memories or age, all those who travelled through *The Virtual Hole in the Road* had something to say about their virtual journey when the Oculus headset was removed and they were asked about their experience. One unexpected outcome of the project was the strong reaction from the city to reviving a place that had not even been properly recorded or archived. A utopian concrete structure that was taken for granted in the past was now being viewed as an iconic and important piece of lost heritage. Features highlighting the project on Radio Sheffield and in the *Sheffield Telegraph*, *Sheffield Star* and *Yorkshire Post* no doubt

helped to raise this awareness within the city—as did inclusion in the main marketing campaign for Festival of the Mind—but an affection for Sheffield's former 'Civic Circle' was undoubtedly already present.

Figure 3.2 Installation view of *The Virtual Hole in the Road*, Millennium Gallery, Sheffield, 17 September 2018. Photograph taken by the author.

During initial discussions around the project it was anticipated that local people would enjoy reliving their past journeys through the space. There was also an awareness that, for the vast majority of visitors to the exhibit, this would be their first virtual reality experience. I also suspected that the real memories some people had from the actual location would somehow augment and enhance their experience whilst travelling through the virtual 'Hole in the Road.' However, an unanticipated factor was the raw feelings the sensorial virtual experience could evoke. The invigilation team overseeing the exhibit each day reported several occasions when visitors became very emotional during their virtual journey, with several participants 'welling up' as the sensation of being in the 'Hole in the Road' came flooding back to them in an unexpected way. It is extremely doubtful that they felt such a high level of

emotion when walking through the mundane concrete structure thirty or forty years ago — the powerful feelings that they experienced were almost certainly the result of remembering their former lives, with the VR environment serving as a powerful trigger for memory, as Fairclough (2016, p. 32) articulates:

> 'The Virtual Hole in the Road' has given me goosebumps, although I find it difficult to rationalise the cause. And as I begin the climb out of this digital subterranean oddity and head towards a brilliant white light that turns out not to be the blinding luminescence of the heavenly host, but simply the screen that prompts me to remove the headset, I offer my flustered thanks to the attendant, attempt to keep my emotions in check, and head back out into the grey, damp Sheffield where the Hole in the Road no longer exists.

The feelings that many visitors experienced could be compared to the sensations prompted by a photograph or video capturing an occasion from their past. Such media reminds the viewer of a precise moment, perhaps maybe serving as a unique reminder of how they felt in terms of emotion and wellbeing at that particular stage in their life. Obviously, when viewed by someone not involved in the scene, the same image would not have equal significance and emotional impact. The crucial difference with a virtual reality simulation, compared to a photograph or film, is that it is an invention and the viewer was never really there. It may be a convincing recreation of a particular place or event; however, unless the VR experience is formed from 360 filming, the elements within it are not genuine recordings of real places, people or objects from our world. Murray (1997) alludes to this in her comments on the desire of people to accept the virtual world around them: 'We do not suspend disbelief so much as we actively create belief. Because of our desire to experience immersion, we focus our attention on the enveloping world and we use our intelligence to reinforce rather than question the reality of the experience' (p. 136). Photographs are snapshots of time, film captures a period of time — an historical VR environment is not an actual record or piece of a time from real life, but a virtual re-creation, in order for it to serve as anything more the viewer needs to engage their imagination, consciously or otherwise.

In terms of civic pride and local heritage, choosing to digitally restore an iconic architectural space that was unique to one city undoubtedly magnified the impact. Consequently, such feelings of local pride and interest also suggest it is highly unlikely that the exhibit would

have solicited the same response and attendance had it showcased a similar utopian structure from London. Equally, if *The Virtual Hole in the Road* was shown outside the region, it is doubtful that there would be such significant interest from the general public in something so 'Sheffield-centric.' It would seem that faithfully recreating a destination that was predominantly perceived as mundane added to the reality of the sensation – those who had walked through the structure in the past possibly had not noticed how unique and distinctive it was until they revisited the space in virtual reality. With this in mind, it is also possible that the experience would have been less believable (and visitors more critical) had the location been somewhere more ornate or historically revered. For some individuals, the virtual reality environment provoked unexpected and overwhelming emotions; one explanation for this could be that participants did not expect to remember their physical awareness of the space so vividly, consequently the virtual experience simultaneously provided a strange and familiar feeling which took them by surprise. This link between memory and current virtual presence could explain why those affected by the experience did not feel similar sensations when looking at photographs or footage of the same location. The emotional response to *The Virtual Hole in the Road* raises many questions about the cognitive possibilities of VR, both as a potential tool for remembering a precise time or location and as a possible stimulant for other memories. I would argue that VR has huge potential to unlock recollections deeply buried in the subconscious than more traditional or 'passive' media (such as photography, film or audio) due to the unique sensorial impact of replicating spatial presence that it provides. In addition to this, Zagalo et al (2003, p. 3) claim:

> In a way VR can be seen as a new virtual interpersonal form of communication, mostly because of its significant differences from film, that is, the concrete perspective of the first person in the story and at the same time the fact that the user is no longer merely witnessing depicted events, but also experiencing face-to-face communication, with human interactions and contexts.

What is described as an 'apprehension of the structure' (Zagalo et al, 2003) is very much part of a multi-level VR experience where the narrative is not fixed but 'a form of evolution of the whole virtual storytelling ecosystem' (Zagalo et al, 2003). This potential to unlock information within the participant is also explored by Dr. Rachel Genn when discussing the interaction of format and narrative (Genn 2020):

> Having normal storytelling conventions and trying to convert them into ones that can be realised in a new space might be limiting, and I think we need time to test out how the formats and narrative techniques can interact with each other. I want there to be more possibility to explore what is known in psychoanalytic terms as the 'unthought known' – some of the most satisfying points in receiving or interpreting a story are those where you didn't realise that you knew something already – you knew it but hadn't thought it yet. (quote from interview with author)

What Genn (2020) refers to as the 'unthought known' (Bollas 1988) or 'that which is known but not yet thought' (Bollas 1988, p. xv) could be applied as a description for how many of those who experienced *The Virtual Hole in the Road* felt whilst experiencing the immersive environment – as a trigger for them to remember the unique civic space and also as a term to describe how previously disregarded memories from deep in the mind of the viewer are suddenly brought to the foreground and become powerful parts of the narrative. When combined with the stories and memories of others (within the virtual experience) the viewer is then immersed in an experience of place which is a realistic virtual representation further enhanced by their own thoughts and feelings. After experimenting with VR to create a piece of sculptural art for the Royal Academy exhibition 'From Life' (2017), artist Anthony Gormley remarked: 'This is the paradox about VR, in many senses it is a trick on consciousness that takes people out of their pre-occupations, exactly as meditation does, and frees the mind to go somewhere else.' When one considers the meditative possibilities of VR, beyond Zen-like minimalist colourfields and serene sun-kissed beaches, there is a more complex prospect of a space which is familiar to the viewer but presented in a non-familiar way. In such scenarios, it could be that the viewer augments their virtual experience, consciously or subconsciously.

Figure 3.3 Installation detail of *The Virtual Hole in the Road*, Millennium Gallery, Sheffield, 17 September 2018. Photograph taken by the author.

As *The Virtual Hole in the Road* appeared to surface recollections and feelings from the collective consciousness of a city, it raises the possibility of creating a more personal VR experience – one that is tailored to the story of just one family unit or individual. For her installation *Memory/Place: My House* (2014–15) the artist Sarah Rothberg recreated her childhood home using a 3D model populated with historic family photographs and VHS home videos. Before accessing the environment via an Oculus Rift headset, participants were first acclimatised to the domestic setting with genuine 'real world' items; a comfy swivel chair, an authentic 'old style' cathode ray tube television set and a shaggy rug. Rothberg reveals the highly personal nature of her source material and explains her intentions on the project website:

> Using primarily a set of videos from 1988 and 1989 taken by my dad, who later died in that home after suffering from dementia, I stitched together photos and videos which are triggered by the users' presence. In making this I was imagining the

> emotional impact that future archiving technologies could have on personal memories in the wake of Facebook's 2014 purchase of Oculus VR.

This statement from Rothberg reveals two aspects of the work that would not be obviously apparent to anyone experiencing it. Firstly, this unique immersive family album is also a comment on the delicate and precious nature of memory to those that record it. The digital content – recordings of special occasions and family activity – serves as testimony to replace the absent memories in her father's mind as the events became increasingly vague and alien to him. Secondly, Rothberg identifies the personal memory implications—and subsequent potential advantages and dangers—of the social media giant Facebook purchasing a leading company in the field of VR research (Oculus). As we continue to digitally archive our personal photographs and videos to the cloud and social media platforms, Rothberg examines the potential 'emotional impact' on those involved when such highly-personal and emotionally-charged material is subsequently viewed in an immersive environment. For *Memory/Place: My House* (2014–15), Rothberg lovingly and sensitively curated her own family material to represent her childhood and to offer others a highly personal immersive presentation of the environment in which she was raised. In doing this she questions if an algorithm generated by Facebook or another online entity would be able to recreate a similar, uniquely-tailored, experience with the same level of sensitivity and care. And – if such a 'human' feat is possible – should it be permitted and/or encouraged? This is an aspect that Caroline White refers to when discussing immersive technology and using social media to explore time and place (2019):

> Facebook are doing it very badly... with loads of really insensitive things like: 'here you are having a party' — and your mum died the next day and they never mention that, and they don't know that. You don't want to disassociate people from where they are so much by throwing-up past and future images constantly. (quote from interview with author)

This highlights the most prominent potential problem when machines organise and present our personal memories: while they can understand and decode when or where an image was taken or video recorded, they are unaware of the personal implications, historical importance, or emotional impact that are inherently connected to them. For example, using facial recognition software, a computer could detect if those featured in a video are happy or sad,

but the machine would still be incapable of knowing how the person who recorded or posted the video feels when they see it. Another potential complication with our personal content being selected by a machine, as highlighted by White (2019), is that an emotionally unconsidered and uncoordinated montage of past and future imagery could lead to confusion and discombobulation, with such sensorial experiences being particularly unwelcome for those who are already confused or in a sensitive state of wellbeing. An understanding of the link between past and present is essential, as Shaw (2018) writes: 'In landscapes saturated with memory and stained with history, protagonists ultimately find that, no matter how complicated the relations between past and present, they are inextricably connected; one is always necessary to define the other' (p. 109). However, beyond timestamps and geographic locations, this is not a connection that a machine can understand without instruction. This inseparable link between the past and the present is one which the human mind can instinctively decode, and yet is beyond that of even the most powerful computer. What technology – particularly spatial computing – can do is help us frame such personal material in an immersive world of our making.

The overlap of the past into the present is also cited by Judd (2016) in the curatorial notes for the exhibition *Placelessness* (Illinois University Galleries, 2016) which included Rothberg's *Memory/Place: My House* (2014–15) installation:

> *Memory/Place: My House* provides the viewer an opportunity to consider what makes a place meaningful even if it is only a likeness of a place one once knew. Rothberg's childhood home exists 'outside' of our minds but not in our physical reality: the architecture is informed by the artist's memories, the walls are constructed by family photographs, and the digital space is haunted by a series of moments caught on VHS tapes.

As well as capturing how the immersive space is effectively haunted by the (video) memories of Rothberg's father, the 'low-tech' nature of the media used in the piece—Polaroids, old photos, VHS footage—lends a 'hauntological' (Derrida 1994; Fisher 2012; Shaw 2018) feel to the experience that is reminiscent of the scratchy audio cassette sounds of *Notes On Blindness – Into Darkness* (2016). Judd (2016) also reframes Rothberg's piece within the history of art and immersive experiences:

> Rothberg's installation evokes the same immersive state that inspired virtual experience throughout history: all-encompassing 19th century panoramic paintings, three-dimensional dioramas, the illusion of depth introduced by stereoscopic viewers, and early 20th century military flight simulators, to name a few.

With this observation Judd is reminding us that each generation—and civilization—has their own version and demands of immersive experiences, although we are rapidly approaching a point where the difference between virtual and physical worlds could become indistinguishable. When such a threshold is crossed, the levels of imagination required to realise the virtual worlds surrounding us will be minimal and there will be far less demand on our capacity to 'create belief' (Murray 1997, p. 136).

Some engaging VR experiences, such as *Notes On Blindness – Into Darkness* (2016), are not visually driven and convey an innovative immersive experience and convincing sense of presence predominantly via audio. In his lecture 'Immersive Sound Techniques: Virtual Worlds' (2019), Dr J. Milo Taylor—an expert in Sound Arts and Design at London College of Communication—extols the virtues of the 'sonic hyperfield', stating that 'immersion is a new orthodoxy.' While outlining a new type of 'immersivity', Taylor (2019) describes a form of 'cognitive geography' which he believes is essentially capable of 'exploring expanded human potential' (Taylor 2019). Such concepts are reminiscent of Lanier (2017, p. 297), in particular his 50th definition of VR: 'A hint of the experience of life without all the limitations that have always defined personhood.' Ultimately, Taylor (2019) describes a sense of 'immersive intelligence' which he defines as 'a yearning to merge the boundaries of spirituality.' While Taylor's research is centred specifically around sound art and acoustic immersion, the ideas he suggests could be applied more broadly to immersive art as a whole. I would argue that, as we use XR technology to explore human potential (Taylor 2019) and depend less on our imagination for the experiences to appear convincing (Murray 1997), we will seamlessly create a new world around us and multiple unique experiences.

3.2 The Haçienda Holodeck

Looking at current virtual recreations of contemporary, recent and much older historical landmarks, we can begin to see how our past experiences could be re-lived via extended

reality. *The Virtual Hole in the Road* (2016) demonstrated how a local landmark held in the consciousness of a city's population could trigger memories and various personal narratives; however—as XR technology develops—we will increasingly see virtual recreations tailored for smaller groups of people or, eventually, just one person. In order to understand how this could feel or impact on an individual, we can look to the relatively small number of people who have had events from their lives replicated on stage or screen during their own lifetimes. In 2001, as part of the filming for his feature *24 Hour Party People* (2002), director Michael Winterbottom asked musician Richard H. Kirk to supervise the recreation of a performance given by his band Cabaret Voltaire at the Haçienda in 1986. The Haçienda was a seminal music and performance arts venue in Manchester, ubiquitous with Factory Records, 'Madchester' rave culture and Factory impresario Tony Wilson. Although not signed to Factory Records, Cabaret Voltaire had a long history with the personnel and bands surrounding the label and had performed during June 1978, on one of the first nights of 'The Factory' at the Russell Club in the Moss Side district of Manchester. Following the success of the events at the Russell Club, Wilson and the Factory team launched their eponymous 'Factory' record label and decided to create a bespoke city centre venue, The Haçienda, which opened on 21 May 1982. A unique cultural space fashioned from a former yacht showroom in the Deansgate ward of Manchester, the interior of the club was created by designer Ben Kelly, who took inspiration from the previous tenants with multiple vertical metal beams and a deck-varnished dance floor. Kelly's scheme incorporated solid blocks of vivid colour—black and yellow striped panels and pedestrian road-safety posts—in an aesthetic which extolled the postmodernist Memphis movement and became synonymous with the Haçienda. After gaining a reputation as one of the most important and influential clubs in the world, the venue was closed in 1997 due to combined issues with finance, security and licensing, and was subsequently demolished in 2002. Kirk explains his involvement in 2001 during the principal filming for *24 Hour Party People* (Kirk 2019):

> I got a call – I think it was probably from Martin Moscrop from A Certain Ratio who was a music consultant and asked if I'd be willing to come over and be kind of an unofficial consultant for the Cabaret Voltaire material they were going to recreate, which was basically a concert at the Haçienda. (quote from interview with author)

On arrival in Manchester, Kirk was driven to a secure warehouse filming location and discovered that it had been transformed into an utterly convincing simulacrum of the

Haçienda: ‘I went over there and they’d recreated the Haçienda in an old factory. It was a bit strange because, you know, it just looked like the Haçienda (laughs)’ (Kirk 2019). Kirk (2019) recalls how the spatial presence and detailed historical accuracy of the film set quickly transported him back to 1986: ‘It was just like how I remember the Haçienda. As you came in, opposite the main entrance where you could get a burger and stuff back in the day. I went to the Haçienda a lot from when it opened and they’d done a fantastic job, it was kind of a bit unnerving, you know?’ Once the location is populated with a collection of actors dressed as musicians and Haçienda attendees from the 1986 era, plus a booming soundtrack from the same period, Kirk’s simulacrum Haçienda experience effectively becomes a real-life, physical, Holodeck – a snapshot of time recreated in perfect detail for all the senses. Even the subtle nuances of actors playing real-life people – Kirk’s associates, such as New Order manager Rob Gretton (Paddy Considine) – added to the overall sense of being back in 1986, as Kirk describes: ‘It was spooky watching Paddy Considine who played Rob Gretton, who I knew really well. I remember they were filming some scenes with him and he’d even got that bit where Rob used to do that (pushes top of nose) with his glasses.’ The gesture Kirk describes was long forgotten and yet, seeing an actor perform the movement, the memory was instantly revived along with inevitable fond thoughts of his friend – as with Rothberg’s *Memory/Place: My House* (2014–15) and Leckey’s *Dream English Kid 1964-1999 AD* (2015), it is often the small details that encapsulate and immerse an audience and invoke believability.

Cabaret Voltaire performed at the Haçienda on more than one occasion, and Kirk (2019) surmises that the concert recreated for the filming of *24 Hour Party People* was actually an amalgamation of two events in 1983 and 1986. For this ‘blending of history’, Winterbottom chose the strongest or most appropriate elements from both sources in order to fashion an effective sequence for his film—which, ultimately, was not used. While choosing not to faithfully recreate one specific piece of Haçienda history and effectively distil the essence of Cabaret Voltaire’s performances at the venue, Winterbottom also used the final version of the track *Sex Money Freaks* which was ‘in an embryonic form’ (Kirk 2019) when the reenacted performance took place. This combining of different occasions into one piece of history—at the expense of historical accuracy—mirrors the way that algorithms and AI systems often generate engaging content. Similarly, the algorithms of Facebook draw on a multitude of social media posts when creating a ‘historical summary experience’ for the user—‘Five Years Together’, ‘Holidays in Europe’, etc—and, as such content is formed from GPS data,

timestamps, account tags and/or face recognition software, we can expect similar wide-ranging combinations for future AI-generated mixed reality experiences. However, whereas Winterbottom deliberately distorted history for artistic endeavour, with automated content any inaccuracies are more likely to be mistakes due to lack of information or contextual understanding.

For Kirk, the blending of past and present went beyond the walls of the simulacrum Haçienda and spilled-over into his journey home. At the end of an eventful day that was unavoidably full of memories and nostalgia, the real world offered a blunt reprisal, as Kirk (2019) recalls: 'On the way back to Sheffield I was in a taxi and we went past Whitworth Street where the Haçienda was and they'd just started demolishing it. So that made it a bit strange.' And so, in the space of one day, Kirk witnessed a place that he cherished rebuilt as a physical simulacrum and then destroyed in real-life by a wrecking-ball, in a collision of memory and reality. Such confrontations of reality are addressed by Slater et al (2020) when they ask if increased realism within VR can lead to 'greater confusion between the real and the virtual' or 'a greater chance of negative after-effects' (p. 11). Traditionally, once a building is demolished it can only resurface in photographs or on a screen – however, if one is given an opportunity to revisit the space in a virtual capacity, as Kirk was on the film set of *24 Hour Party People* and Sheffield citizens via *The Virtual Hole in the Road*, then the historical memory of the location becomes less fixed as we move back and forth in time in a nonlinear journey. Discussing his impressions of the virtual Haçienda, Kirk (2019) reflects on memory and the impact of recreating your past experiences:

> For one thing, to try and recreate something with 100% accuracy, you've got to remember that your memories are never right. If you had some experience it's always modified by time, so as you get older and you move on, you might remember – I don't know – maybe 20% of it accurately and the rest your brain kind of reinvents. (quote from interview with author)

This echoes Kerby (1991, p. 24) when he states: 'The question concerning the veridicality of memory, however is not cleared up by simply saying that the past is relived or remembered, for there is always the influence of the present perspective to contend with' – memory is not just the past, but 'the past for me *now*' (Kerby, 1991, p. 24). The portion of a memory that your brain 'reinvents' can also be interpreted as the 'imagination' required to make a virtual

experience believable and, in most cases, elements within any XR environment should enable and assist in this. Such a quality may also help to alleviate any oversights or mistakes by AI or deep-learning systems when generating mixed reality environments, particularly those which recreate historical places or scenarios. In Kirk's case, apart from the accuracy of the film set interior and audio within it, the carefully studied gestures of the actors brought his old friends back to life. The unique historical recreation that Kirk witnessed was essentially a bespoke virtual experience, with a simulacrum of himself from 15 years earlier performing in a replica of a venue that he often visited. If we consider the impact of an immersive XR experience with locations based on those we have visited in real life and 'characters' based on real people, possibly created by an AI interface utilising archive footage or imagery, the potential of such historical recreations become clear. Whether similar mixed reality journeys into time and space would appeal to everyone is another question, as Kirk (2019) quips: 'I can't say I'll be at the front of the queue wanting something like that. I've got a weird enough imagination as it is, without making it worse.'

With ongoing innovative work currently being undertaken in the wide-ranging landscapes of XR technology and storytelling, multiple examples of which I have detailed in previous chapters, the type of experience encountered by Kirk in his journey back to the Haçienda could soon become an everyday phenomenon for many people. Such portals of mixed reality storytelling—combining imagination, memory and technology—will simulate personal journeys through time and space very similar to those first suggested by Wells (1895) and subsequently developed by numerous science fiction writers exploring the possibilities of non-linear time. In some instances, for example moving image sequences triggered by GPS, extended reality experiences could occur without the viewer requesting them, effectively becoming an intrinsic part of an environment. This is a unique aspect of augmented and mixed reality: the potential for data, audio, images, or moving images to be temporarily or permanently tied to a particular location or space, possibly with additional temporal boundaries (Fell 2020, Pokémon Go 2016).

Within literature, radio, cinema, television, photography, or other traditional visual arts, the recipient is required to make a conscious decision to view or hear the content. It could be argued that within an art installation scenario, or in a typical theme park 'indoor' attraction, the viewer is unaware of what they may encounter or when, however, they have still chosen to

visit that location at a specific time. In a mixed reality environment, the autonomy to command an experience – when and where we desire it – could potentially be withdrawn. Wearable augmented reality devices provide the opportunity for an ongoing stream of content; virtual elements overlaid onto our surrounding environments; data, imagery, moving images, audio – all occurring within timeframes and places beyond our control. While some people may find this scenario daunting, it could be compared to any walk through an urban or natural environment, where we are equally unable to control who, or what, we may encounter as we turn any particular corner. One obvious difference is that, on such a walk, we are unlikely to encounter people or scenery from other timeframes – we will always be in the present. Mixed reality creates an opportunity to overlay our environment with 'slices of time'; scenery and people from other eras or places, inhabiting our space, now. When such experiences become as commonplace in our everyday activity as using a mobile device to check email or the weather, our perception of space and time will be permanently altered.

3.3 Maverick storytelling

While mixed reality narratives may be a relatively new and developing artform, the multi-sensory and nonlinear nature of such experiences have been mastered by various artists and authors throughout recent history. I would argue that work from creatives such as Akomfrah, Ballard and Tarkovsky provide a philosophical footprint for equally iconic output in the realm of nonlinear, immersive art; their experiments with time and memory generating maverick guidelines, inspiration and provocation for present-day digital natives pursuing emerging immersive storytelling. Higgs (2019) outlines the colossal potential for immersive technology to deliver an entirely new platform of artistic expression: 'As we create a digital realm we will be, effectively, exploring our own imaginations. Our world could be anything we can dream up… we are looking at a creative opportunity unsurpassed in human history' (p. 235). A common aspect in the work of storytellers such as Akomfrah, Ballard and Tarkovsky is the 'masterful vagueness' (Genn 2020) required to prevent the narrative from becoming too fixed and allowing space for audience imagination and interpretation. This skill involves providing enough information to create interest and intrigue, but not so much that their own thoughts and narratives cannot be engaged and entertained. As Bordwell (1985) says when discussing 'Art-Cinema Narration': 'a realistic aesthetic and an expressionist aesthetic are hard to merge', however 'the art cinema seeks to solve the problem in a

sophisticated way: through ambiguity' (p. 212). When examining this aspect of creativity within the realm of VR and spatial computing, the artist and neuroscientist Dr Rachel Genn (2020) remarks:

> I get drawn back again to the fundamental question of VR which is 'Why am I here?' as Jessica Brillhart asked. For instance, when I read students' work and I start questioning why I'm there, it's because they are not manipulating time and space properly, and this is a huge crafting issue and just so much more difficult to inhibit that question in a reader than you can imagine. So, when it comes to VR, there's going to be lots of questions that need to be asked around 'how do we induce intrigue without too much ambiguity?' (quote from interview with author)

Bordwell (1985, p. 212) claimed that 'art-cinema narration announces its debt to the arts of the early twentieth century by making ambiguity, either of tale or telling, central.' The balance of 'intrigue' and 'ambiguity' is an aspect of Tarkovsky's work highlighted by Bould in his detailed critique of *Solaris* (2014, p. 17) when he says: 'Tarkovsky's films repeatedly present the viewer with meaning-laden images whose meanings are elusive.' This aligns with Bordwell (1985, p. 212) who states: 'Put crudely, the procedural slogan of art-cinema narration might be: 'Interpret this film, and interpret it so as to maximize ambiguity.'' The director and artist David Lynch has expressed similar sentiments in the meaning of his cinematic work: 'It's a dangerous thing to say what a picture is. If things get too specific, the dream stops' (Jones & Woodward, 2017, p. 165). It is equally telling that even though Ballard was fairly open throughout his press interviews, he often saved the most candid and intriguing insights for smaller publications such as fanzines or niche journals that he knew relatively few people would read. Extended reality (VR/AR/MR) artworks – and the unique 'language' that they exhibit – evoke a sense of spatial awareness and a new potential for purely sensorial experiences. Extended reality is a natural tool for maverick storytellers and the worlds they create – providing spaces to dream, room for audience imagination and deliberately ambiguous experiences for interpretation. Following on from Bordwell's (1985) theory for 'Art-Cinema Narration', I will now discuss non-documentary extended reality artworks that display 'ambiguity' and do not adhere to traditional narrative formats as being 'Art-XR.'

Over the past four decades the artist John Akomfrah has developed a unique form of nonlinear storytelling – combining multiple screens and speakers to convey the stories of people and the places and circumstances surrounding them. The multiscreen presentations of Akomfrah—the skilful handling of multiple videos, the introduction of diegetic and non-diegetic sound, the interweaving of material and joining of seemingly disparate dimensions and locations in time—all point towards possible techniques for the display of audio and visual material within mixed reality experiences. In his introduction for the artist's exhibition at the Lisson Gallery in 2016, Nicholas Logsdail proclaims: 'if ever there was a missing link between concept, narrative, sound, still and moving imagery – not to mention a key to how we might view the problems of the past and present simultaneously – it is to be found in the poetic and political work of John Akomfrah' (Alter et al, 2016, p. 3). It is this extraordinary ability to weave narratives from seemingly unrelated material across time in order to tell personal and political stories that sets Akomfrah apart from his contemporaries and provides a template for future mixed reality storytelling, including my own creative practice.

Akomfrah's most ambitious and celebrated pieces are his later large-scale audio/visual installations; *The Unfinished Conversation* (2012), *Vertigo Sea* (2015), *The Airport* (2016), *Precarity* (2017) and *Purple* (2017). In these, he forms multi-sensory strands from a dizzying array of source material to build immersive sensoriums; utilising a line of projected screens encompassing the audience's field of vision in a sensation similar to an IMAX presentation, combined with a multi-channel audio experience that skillfully switches between sound from visual archive material, sound not related to any of the screen visuals, audio-only interviews, and a subtle tonal soundtrack. *The Unfinished Conversation* (2012) is a large-scale, three-screen, video installation which, over 45 minutes, examines the life and work of the cultural theorist Stuart Hall. Born in Jamaica in 1932 and arriving in the UK in 1951 as a student at Oxford, Hall became a major academic figure and was particularly recognised for his work on cultural hegemony, race and ethnicity and the African diaspora. Using archival footage and interviews, Akomfrah weaves a dense narrative of the Windrush generation on a personal and historical level, examining the nature of memory itself as Hall speaks about the importance of recollecting his own journey and that of others. After being commissioned by Autograph ABP, the film was premiered at Bluecoat Gallery as part of the 2012 Liverpool Biennial and subsequently shown at Tate Britain in 2013, a year before Hall's death at the age of 82. The title of the piece is inspired by Hall's description of the topic of identity as an

‘ever-unfinished conversation’ (BALTIC exhibition guide, 2019, p. 4). Pulling together an assortment of seemingly disparate source material from across history, Akomfrah somehow manages to convey the philosophy and work of Hall whilst simultaneously immersing the viewer in the world that challenged, inspired and, ultimately, shaped him.

If we consider the manner in which Akomfrah selects and orchestrates his source material, combining grainy archive footage with his own high-definition sequences of landscapes or detail, there emerges a roadmap for mixed reality environments and the management of the sensorial tableaux that they produce. *Purple* (2017) was installed in The Curve exhibition space at the Barbican Centre, London, from October 2017 to January 2018, impressively spread across 6 huge screens with 16:9 projections and multi-channel sound. Described as ‘not necessarily about the Anthropocene, but a meditation on it’ (Banning & Eshun, 2017, p. 21), *Purple* repeats previous motifs of anonymous figures encountering nature alongside archive footage of industrial scenes and man-made disasters, mirroring the aesthetic of dystopian futuristic cinema. In accordance with Akomfrah’s preceding installation work, the video and audio material is carefully orchestrated to avoid sensory overload while immersing the viewer in a powerful schema of time and memory. In his essay on *Vertigo Sea* (2015) – but equally applicable to *Purple* (2017) – T. J. Demos describes how ‘audiovisual matter unfolds to reveal a dizzying intersection of history, fiction and philosophy, without clear boundaries between them’ (Alter et al, 2016, p. 14). Akomfrah’s obsessions with science fiction and water are central to *Memory Room 451* (1997), a documentary-style short film where twenty-third century ‘dream-riders’ transform into liquid in order to travel through time. The low-paid workers eventually arrive in Memory Room 451 and speak with people from previous centuries, in a story which effectively ‘reflects on our present and past from the future’ (Campt et al, 2018, p. 115). In *Purple* (2017) an array of photographic prints – ghostly, discarded, family snapshots – float gently along pastoral rivers and woodland waters in a ‘stream of memory’, revealing the recollections and lives of others in another powerful signature of Akomfrah’s output. One of the most skillful aspects of Akomfrah’s later work is his ability to gently guide the eye of the viewer across several screens, in a unique take on the ‘invisible observer’ narrative method described by Bordwell (1985) he allows some level of ambiguity while ensuring that a nonlinear story takes place in a coherent fashion. While the works of Akomfrah I have highlighted are not true immersive experiences in the same sense of those which utilise spatial computing, VR, AR, etc—they form essential studies in how to lead the gaze of an immersant in a 360 environment via editing, audio and scene selection.

The work of Akomfrah has regularly featured a dialogue of science fiction and nonlinear narratives framed around the lives and memories of others: from the time-traveller known as 'Data Thief' in *The Last Angel of History* (1995), to the 'dream-riders' in *Memory Room 451* (1997), and his 2012 installation *At The Graveside of Tarkovsky*. In the catalogue for Akomfrah's New York exhibition in 2018 Aram Moshayedi observes how, in *The Last Angel of History* (1995), the Data Thief (Edward George) 'serves up a series of clues for understanding how fragments of the past might come together to assemble an as-yet-unrealised vision of the future' (Campt et al, 2018, p. 34). Adding to this, the photographic style of Akomfrah's more recent films encompasses the cinematic language of dystopian science fiction classics: long, dialogue-free scenes featuring solitary figures gazing toward barren and picturesque landscapes. What is interesting in terms of nonlinear narrative is how Akomfrah—with the Black Audio Film Collective during the 1980s and his larger budget productions of recent times—has effectively invented his own form of time travel, mixing a potential future with the historical past and skilfully blurring temporal boundaries, and subsequently refined the format over the course of his career. As Banning (Banning & Eshun, 2017, p. 22) reflects: 'Akomfrah's temporal image repertoire works against linear proscription and with additional intertitles, which afford pause and deter forward linearity.' *The Nine Muses* (2010) is considered to be within the documentary strand of Akomfrah's activity, although it is actually a collage of archive footage and specially-shot material directed by the artist in Alaska. The beautifully photographed Alaskan sequences of the feature-length film invoke a sensation of arrival, wonder and fear – with the central single figure in each scene depicted as an alien coming to terms with a new and potentially challenging environment – more akin to *The Man Who Fell to Earth* (Roeg 1976) than standard depictions of travel, migration and displacement. Akomfrah has spoken about his use of montage to deliberately create a 'third meaning' from the various visual and audio components he selects:

> Everyone who helped popularise the philosophy of montage was interested in one thing – the third meaning. That somehow when things collide, two opposites collide in a dialectical way, some sort of synthesis is engineered or brought about and – in that – a new form, a new meaning or a new way emerges… it's a dialectical philosophy and I'm absolutely committed to that. (TateShots 2015)

Akomfrah's large-scale multi-screen presentations expand on Bordwell's theory for 'Art-Cinema Narration' (1985) with his exquisite handling of 'ambiguity' or 'masterful vagueness' (Genn 2020) providing a stepping stone for the XR content creators of tomorrow. The origins of montage and immersion in the work of Akomfrah can be found in the audio sampling of Cabaret Voltaire (1973–2021) and the experimental literary format used by J.G.Ballard. While similar to the style of William S. Boroughs, Ballard's early output – particularly work such as *The Atrocity Exhibition* (1970) – can be viewed as a precursor to mixed media and multi-channel digital artforms, with stabs of information and detail gradually forming a nonlinear tableaux. *The Atrocity Exhibition* heralded a new form of nonlinear narrative via numerous linked short-stories or scenarios which the author referred to as 'condensed novels' and became one of Ballard's best-known and most controversial works. With no clear beginning or end, the highly-descriptive vocabulary uses unflinchingly dry detail to piece together the narrative, which is regularly punctuated with violent and gory information. The graphic content may be in the form of words as opposed to on-screen imagery, but Ballard effectively deploys a montage method not unlike that of Akomfrah, where the reader is similarly left to make sense of the details, draw their own conclusions and create their own narrative. The structure of Ballard's writing in work such as *The Atrocity Exhibition* is immensely open—almost to the point of being non-directional—however, the reader is somehow reassured that a narrative is in play and completion will be rewarded. The journey through the headlined paragraphs of *The Atrocity Exhibition* is very much akin to viewing sections of Akomfrah's installations, with each content-heavy segment providing an assortment of stimulation and engaging the audience in different ways, with the sum parts creating a unique 'third meaning' (Akomfrah, TateShots 2015) experience for each individual. I would argue that this dialectical approach to montage could also be expanded to include emerging virtual and mixed reality narratives where traditional audio and video are combined with 'spatial presence'—a consequence of being in a certain place at a specific time—creating a new synthesis of immersive experience with unique artistic merits and possibilities.

The early short stories of J.G. Ballard include many of the themes and concerns of the celebrated Argentinian writer Jorge Luis Borges, whose tales of ancient magic, alternative realities, nonlinear time and murder, could almost be described as 'pre-science fiction.' Borge's story 'The Garden of Forking Paths' (1941) is a precursor of hypertext fiction (Murray 2011) and is also regarded as influential in the philosophical development of

quantum mechanics (Moran 2012). In this short tale of labyrinths, espionage and murder, Borges depicts events from the past, present and future as an ongoing flux, where the possible outcomes in each dimension exist simultaneously. As the main protagonist Dr Yu Tsun is told by scholar Stephen Albert when discussing his ancient relative, the novelist Ts'ui Pên:

> In contrast to Newton and Schopenhauer, your ancestor did not believe in a uniform, absolute time. He believed in an infinite series of times, in a growing, dizzying net of divergent, convergent and parallel times. This network of times which approached one another, forked, broke off, or were unaware of one another for centuries, embraces *all* possibilities of time. We do not exist in the majority of these times; in some you exist, and not I; in others I, and not you; in others, both of us. (Borges 1941/2018, p. 16)

This idea of the plasticity of time – dimensions that are an 'infinite series of times, in a growing, dizzying net of divergent, convergent and parallel times' (Borges 1941) and the relative possibilities of quantum physics – was explored more than seventy years after *The Garden of Forking Paths* (Borges 1941) by director Christopher Nolan in his film *Interstellar* (2014). Ambitiously exploring Einstein's theory of relativity and the properties of spacetime, the film includes a stunning live action sequence where the central character (Cooper) is transported via an interstellar wormhole to the Tesseract – a five-dimensional hyper-cubic structure. Within the Tesseract, time is displayed as a physical rather than linear scale, with various events in the same space – in this case, the bedroom of Cooper's daughter – depicting the branching narrative possibilities described by Borges.

Once the concept of a 'network of times' (Borges 1941) is established, how do we access and navigate such dimensions? Over one hundred years before *Interstellar* and nearly fifty years before *The Garden of Forking Paths*, H.G.Wells released his seminal novel *The Time Machine* (1895). A Victorian gentleman and inventor – named only as 'The Time Traveller' – invents a time machine and travels to the year AD 802,701 where he discovers a future world inhabited by the elegant Eloi and the savage Morlocks. Despite over a century of technology and invention since the release of Well's science fiction masterpiece, his depiction of dimensional transportation remains unparalleled and has been a major influence on the depiction and perception of time travel within popular culture, from *Doctor Who* to *Interstellar*. Central to this literary achievement is Wells' ability to draw on the imagination of the reader, a skill which has kept the book fresh for numerous subsequent generations. The

past and future described in the book effectively render the present as transient, with current readers being able perceive the 'modern day' events of Victorian London as a possible history, whilst still envisaging the world of the Eloi and Morlocks as a possible future for Earth's inhabitants.

This ability to imagine a 'network of times' (Borges 1941) and the mode of travel required for it to be accessible is something which John Akomfrah has spoken of, particularly acknowledging the influence on him from the work of Andrei Tarkovsky, which he regards as 'the limit of cinema' (TateShots 2015). Based on the 1961 novel of the same name by Stanisław Lem, Tarkovsky's *Solaris* (1972) is his most widely known film and also his least favourite (Bould 2014, p. 12). Tarkovsky felt that the film looked too much like a 'space movie' and was annoyed by comments that *Solaris* was the Russian answer to Kubrick's *2001: A Space Odyssey* (1968). In the documentary *Tempo di Viaggio* (1980) Tarkovsky describes *Solaris* as ''not so good, because [I] could not escape from the genre, from the fantastic details', unlike *Stalker*, in which he managed to get rid of all 'science fiction' signs completely'' (Bould 2014, p. 12). Lem also disliked the film as he felt it strayed too far from his original text and Tarkovsky's additional scenes set on Earth were unnecessary. In these, Tarkovsky features sequences from the slow-paced family life of the main character (Kris Kelvin), contrasting with his dramatic and often disorientating experiences whilst orbiting Solaris. This, together with the mysterious appearance on the space station of the crew's family figures from Earth – including Kelvin's late wife – moved the 1972 cinema audience away from a traditional linear narrative and presented the concept of time as a transient entity in which the past, present and future effortlessly interchange. Despite the misgivings of the director and the original author, *Solaris* is undoubtedly a major artistic work that, during a period of great interest in science fiction, was very much a 'non-typical' sci-fi film. This proved to be true even from a critical standpoint, as Bould (2014, p. 10) writes: 'It is rare to see Tarkovsky's films treated as genre movies, to see *Ivan's Childhood* (1962) discussed as a war movie, *Andrei Rublev* (1966) as a historical biopic, or *Solaris*, *Stalker* (1979) and *The Sacrifice* (1986) as science fiction (sf).' Tarkovsky is perhaps the artist with the most to say about his own output, its place in the world and role within society – although he still tends to avoid referencing specific details. In *Sculpting In Time: Reflections on the Cinema* (1988) he writes:

> Cinema should be a means of exploring the most complex problems of our time, as vital as those which for centuries have been the subject of literature, music and painting. It is only a question of searching, each time searching out afresh the path, the channel, to be followed by cinema. I am convinced that for any one of us our filmmaking will turn out to be a fruitless and hopeless affair if we fail to grasp precisely and unequivocally the specific character of cinema, and if we fail to find in ourselves our own key to it. (p. 80)

More than thirty years later, Tarkovsky's comments seem wholly applicable to the growing creative possibilities offered by extended reality technology, particularly his call to find the 'specific character' of the artform. What does XR storytelling offer that cannot be achieved with literature, music, traditional visual art or cinema? While much emphasis has been placed on both the development of the devices to display such content and the software to create and mediate it, this does not provide a reason for its use. While hardware and intuitive applications are essential for the success of emerging VR/AR/MR artforms, they are purely platforms for a field of creativity currently in infancy and finding its place within the realms of artistic expression. As Tarkovsky articulates:

> Each of the arts has its own poetic meaning, and cinema is no exception. It has a particular role, its own destiny—it came into being in order to express a specific area of life, the meaning of which up till then had not found expression in any existing art form. Everything new in art emerged in answer to a spiritual need and its function is to ask those questions which are supremely relevant to our epoch. (1988, p. 82)

If the word 'cinema' is replaced with 'virtual reality', Tarkovsky's quote is transformed into a fitting mission statement for the current emerging state of immersive technology. Is the current 'spiritual need' that Tarkovsky refers to searching for a new way of expressing ourselves via purely digital means, particularly for the generation of digital natives for whom working, playing, communicating and exploring within the digital realm has always been a normality? If so, the current 'spiritual need' is unlike any other and therefore the same rules that applied to previous art forms – painting, sculpture, literature, music, cinema – cannot be imposed onto immersive / mixed reality creativity. It is the task of present-day creators to take inspiration from the artists, writers, musicians, poets, performers and directors who have

excelled in their own respective areas and realise the unique potential for creative expression via extended reality artforms.

3.4 Liminal spaces and aesthetics

Following the examples of maverick storytellers and their groundwork for nonlinear narratives, we could ask: where is the first wave of virtual reality stories and who is creating them? In 2017 filmmaker Kalina Bertin released her award-winning documentary *Manic*, a deeply personal piece which utilises archive voicemail recordings from her brother and sister, Felicia and François, who both suffer from bipolar disorder (as did their father and grandfather). Following the critical success of *Manic*, Bertin collaborated with a team of fellow Canadian directors—Sandra Rodriguez, Fred Casia and Nicolas S. Roy—to create the virtual reality installation *ManicVR* (2018) which premiered at *Alternate Realities*, Trafalgar Warehouse, Sheffield Doc/Fest in June 2018. Situated within a physical installation/simulation of Felicia and François Bertin's bedroom, *ManicVR* allows visitors to virtually experience a concentrated ten minutes of mania, psychosis and depression, forming a very powerful insight into bipolar disorder which is at times disturbing but also overwhelmingly beautiful. The strength of the piece is the carefully choreographed balance between the audio recordings of the siblings expressing their respective states of mind and manic visions which, via a VR headset, the visitor can graphically experience for themselves. Objects appear to magically float, the ceiling dissolves to reveal a cosmic sky and—using hand sensors—you are able to shape star clusters in your palms. In other—darker—moments, the isolation room of a psychiatric ward becomes a claustrophobic environment flooding with water. Finally, as the bedroom mutates into a jungle, the siblings' manic messages no longer seem fictional but simply accurate verbal descriptions of your virtual journey. The sensorium of a virtual reality headset provides a perfect platform for Bertin to tell her powerful story exploring the human mind, especially when combined with the physical recreation of a bedroom as a starting point for the experience. This potential was underlined by co-director Sandra Rodriguez at the corresponding Doc/Fest *Meet the Maker* panel session (Sheffield, 8 June 2018): 'VR gives creators a new palette of senses to work with.' In the case of *ManicVR*, the combination of physical, virtual and archival – crafted with the factual and fantastic – creates a totally new experience unlike that of any traditional or established artform. For me, this piece demonstrated the potential of the medium to convey a story in a

totally unique and powerful way, and in a form which generated huge levels of empathy with those involved. The emotion and impact that I experienced while wearing the VR headset was far more powerful than when watching Bertin's original documentary, however, it was conveying a different, complimentary, version of events which can be understood without viewing the original film or having any knowledge of its contents. Equally, as with existing art forms, some level of background knowledge does tend to add to the depth of experience for the viewer / listener / reader / audience. Effectively, the nonlinear story of *ManicVR* takes feelings, moods, descriptions and soundbites from the original film and presents them to the audience individually in a truly unique and direct, cerebral form that could not be achieved outside of virtual reality.

The sensory potential of VR is further explored in the critically-acclaimed immersive experience *Notes On Blindness – Into Darkness* (2016), which uses innovative audio and visual techniques to simulate the absence of one of our prime senses. After losing his sight in 1983, writer and theologian John M. Hull began keeping an audio diary which was published as the book *Touching the Rock: An Experience of Blindness* (1990) and formed the basis of the feature film *Notes on Blindness* in 2016. The VR strand – *Notes On Blindness: Into Darkness* (2016) – was released as a companion for the narrative of the feature film and also a standalone piece which viscerally demonstrates the sensory and psychological experience – and subsequent understanding – of blindness. The VR project won the *Storyscapes Award* at Tribeca Film Festival (2016) and the *Alternate Realities VR Award* at Sheffield Doc/Fest (2016). *Notes On Blindness: Into Darkness* documents Hull's life as he comes to terms with a pure reliance on listening and 'seeing' the world around him via a growing awareness of 'acoustic space.' The VR piece features five distinct locational scenes from the author's diary which are recreated using real-time 3D visualisations combined with dynamic binaural audio incorporating Hull's original narration recorded on 1980s audio cassettes. *Notes On Blindness: Into Darkness* presents a perspective of Hull's output that would not be possible via any other medium – the unique qualities of spatial awareness provided by virtual reality and binaural audio place the VR visitor directly inside the author's head and magnify the significance of his thoughts and feelings.

While *ManicVR* and *Notes On Blindness: Into Darkness* are two individual artistic creations concerned with very different aspects of the human condition, a common component to both is the innovative use of historic audio recordings. Despite not being originally intended for an

immersive work, the spoken words in each piece fit seamlessly with the surrounding VR environment and provide an additional 'hauntological' (Derrida 1994; Fisher 2012; Shaw 2018) layer to the experience. Both works also feature interactive elements driven by the participant's movement; in *ManicVR* you caress a galaxy in your hands and stretch lines of electrical energy like strands of wool; in *Notes On Blindness: Into Darkness* you are required to look at footsteps in order to move forwards and backwards in the snow, or follow the movements of a bird to progress through a scene. Although these gamified features contribute a heightened sense of interaction and a feeling of autonomy, they often operate as a distraction and obligatory inclusions with the sole purpose of distinguishing the VR pieces from the original documentaries. However, such projects do offer a visceral insight into human experiences via the 'artistic tradition' and narratives of real people, as described by Fradkin (2017):

> ...VR situates itself in the artistic tradition, and seeks to combine the immediacy of visual art with the immersion of literary narrative. That effort at combination isn't, of course, new — it's in many ways the current iteration of an evolution that began with photography and has moved through film, TV, and video games. Arguably, it has even deeper roots in popular theater.

As this quote from Fradkin suggests, some VR experiences side-step traditional narrative and head directly for an exploration of inner-consciousness while utilising objects or props traditionally associated with performance. *Outrospectre* (2017) is a virtual reality installation created by Dutch designer Frank Kolkman with the main objective of tackling 'death anxiety' among terminally-ill hospital patients by simulating a near-death experience. Participants wear a VR headset while standing in front of a vertical stand which is connected to a short dolly-track on the floor behind them. A 3D-printed robotic head is mounted on a platform which moves forwards and backwards on the rail directly behind the immersant. The head contains two 3D cameras – set into each eye – which transmit a live video feed to the corresponding lens of the VR headset, and microphones – set into each ear – which transmit live audio to headphones worn by the participant. The robotic head also follows the movement of the VR headset, giving the immersant a sense of control in studying their surroundings. A haptic element – a hammer which gently taps the user's chest – is also included to add a more physical dimension to the experience. These elements combine to create a sense of displacement, deliberately altering the participant's sense of place, time and

presence. The piece creates a powerful out-of-body experience which Kolkman – a 2015 Royal College of Art graduate – notes: '...is most powerful when you are mentally aware of what is going on, and yet your senses are convincing you otherwise' (Carter 2017).

Alongside other VR works such as *Notes On Blindness – Into Darkness* (2016), *Outrospectre* (2017) subverts traditional ways of reflecting on humanity and uses spatial computing to create a cerebral experience beyond those traditionally offered by established artforms. The potential cultural and societal values of these experiences require much further exploration; we may need to adjust our current understanding to formulate new ways of assessing VR/AR/XR content as current methods may be insufficient, as the film-maker and VR curator Mark Atkin (2019) observes:

> Whenever you see someone who's just come out of seeing a VR experience, it's the natural response of the invigilators or the hosts, or the volunteers – or if the person who made it is there – they just want to immediately ask you 'what did you think of that?' But almost nobody is able to articulate that and so that's really the wrong thing to do, you need to give people some time to let it settle – it's much more of an emotional understanding, not an intellectual one. (quote from interview with author)

This need to approach immersive experiences from a different perspective is examined by Zagalo et al (2003) in their paper *From the Necessity of Film Closure to Inherent VR Wideness* in which they call for immersive technology to concentrate on the new potential for 'wideness', as opposed to film which is described as 'a 'closed' medium, because film structure is made of rigid and resolute time and space.' The paper draws on previous research in the fields of film theory, philosophical narrative and interactive entertainment, including Murray's *Hamlet on the Holodeck* (1997). Murray (1997) promotes three aesthetic principles: immersion, agency and transformation and also calls for a 'kaleidoscopic structure' for immersive projects, emphasising how this approach is markedly different from 'mosaic' and 'collaged' creations: 'The kaleidoscopic approach emphasizes the creation of coherent multisequential narrative forms that foster more complex understanding of systems of behaviour' (p225). In these proposed 'kaleidoscopic' story structures, Murray imagines large sections of content that are individually whole and relatively complete, but can be reconfigured like a kaleidoscopic pattern to give an endless array of possibilities. The interactive and transient nature of immersive content would seem well-placed to deliver such

a concept, as well as answering the call to explore 'wideness' (Zagalo et al, 2003). When discussing the possibilities of what she describes as 'The Multipositional View', Murray (1997) says 'we increasingly see the world and even our own identities as such complex, centerless, open-ended systems, we need a strong environment that allows us to make sense of them by enticing us into exploring a dense narrative world from every possible perspective' (p. 222). Such a structure described by Murray conceptually resembles the Tesseract in *Interstellar* (2014), with endless options and opportunities to view the story from multiple perspectives: 'We can play all the parts, exhaust all the possible outcomes' (Murray 1997, p. 223).

In an early attempt to explore such perspectives within the realm of fine art practice, the Royal Academy of Arts asked a group of renowned artists—including Antony Gormley, Jonathan Yeo, Farshid Moussavi and Yinka Shonibare MBE—to work directly within XR technology and documented the process. The resulting programme – *Royal Academy: Painting the Future* (2017) – showed the potential of immersive technology within creative practice but failed to produce anything as remotely significant as the individual artists' regular work. Despite unanimous enthusiasm to the possibilities of a new conduit for their creative output, the participants mainly perceived the technology to be an additional way of making sculpture or painting – a new tool for their existing practice – as opposed to a totally different opportunity for addressing the senses of their audience. Maybe they were too overwhelmed with the possibilities or the technology did not feel as intuitive as painting a surface or moulding clay. Murray (1997) suggests that this may be a short-lived problem:

> Eventually all successful storytelling technologies become 'transparent': we lose consciousness of the medium and see neither print nor film but only the power of the story itself. If digital art reaches the same level of expressiveness as these older media, we will no longer concern ourselves with how we are receiving the information. (p. 28)

It may well be that the artists who make the most impact within VR are not those already established in other – more traditional – artforms, but digital natives who regard immersive technology as a natural platform for their creative expression.

3.5 Digitally native multiform stories

Extended reality technology provides a new opportunity, a 'spectacular platform for invention' (Harper 2017) and an unrestricted 'portal for possibility' (Harper 2017) for artistic expression. A powerful example of such a digitally native artwork that could not have been created within more traditional artforms is the mixed reality exhibit *Thresholds* (2017), in which the artist Mat Collishaw restaged one of the earliest photography exhibitions from 1839 when William Henry Fox Talbot first presented his prints to the public at King Edward's School, Birmingham. In a fully immersive portal to the past, visitors wearing HMD (head-mounted displays) in 2017 walked the same paths as those in 1839 whilst viewing high-definition digital versions of pieces which (in reality) have now faded almost beyond recognition. The exhibit was originally shown at Somerset House in London and subsequently toured to its spiritual home of Birmingham (Museum & Art Gallery, 2017) followed by Lacock Abbey (2017), the National Science and Media Museum, Bradford (2018) and Yapi Kredi Kültür Sanat Yayincilik A.S., Istanbul (2018). Collishaw's IVE (immersive virtual environment) extends the best of the available immersive technology with some ingenious sensorial features. Housed in conjoined and customised shipping containers, the installation interior initially appears as a bright white space containing several plain tables in the centre of the space, more akin to *2001: A Space Odyssey* (1968) than 1839 Birmingham. Small groups of mixed reality time travellers are equipped with a backpack (containing a hard drive), a HTC Vive HMD and headphones before entering the installation space. Once the IVE comes to life, a sea of grey and brown descends as the immersant is transported to a grand, stone, Georgian museum chamber, featuring wooden arched windows and several oil paintings of historical male figures in all their finery. An impressive wood-panelled ceiling appears high above, solid stone tiles cover the floor of the museum and chandelier candles gently light the interior on a dark winter's evening. The white tables in the room are transformed into traditional wooden museum cabinets with glass top surfaces, displaying various artefacts including Fox Talbot's photographs which can be 'picked-up' and examined in detail using hand gestures. The experience is further augmented by recreating the warm glow of a roaring hearth with an electric bar fire and emulating the sounds of Chartist protesters outside via an immersive sound stream in each participant's headphones. On approaching the windows – which, like the glass top cabinets, reflect the candles of the chandeliers – the angry crowd is visible on the cobbled street below, holding torches in the dark as they begin to riot.

Figure 3.4 Installation view of *Thresholds*, The Waterhall Gallery, Birmingham Museum and Art Gallery, 5 August 2017. Photograph taken by the author.

The ingenuity and execution of *Thresholds* (2017) brings to mind the essence of augmented reality described by Harper (207): ‘take what is real and explore it, add to it, record it, place it in a network which you control, delving in, adding to, reflecting on, and ultimately responding. Augmentation in this sense means reality creation and re-creation, by us.’ With *Thresholds* (2017), Collishaw takes a blank white space and overlays a virtual layer from nearly two hundred years ago—a portal to the past—for us to explore and interact with. Collishaw's choice of subject for his VR experience was not solely as a way of showing fragile material in a sympathetic setting, as he explained to *The Guardian* (Ellis-Peterson 2017):

> I think it [VR] is going to have a similar impact on art as photography did, which is why I’ve chosen this specific moment to explore through VR. That show changed

> how we viewed images for ever and I think VR will bring about the same kind of shift... I believe [VR] is going to change the way we look at the world.

In order to avoid collisions in the installation space with fellow immersants, Collishaw's team integrated a feature where each participant can be 'seen' – via the HMD – as a ghostly glow. A side-effect of this safety function is an increased sense of social presence, resulting in a very strong feeling that others are there with you, sharing the experience. For an area that has to date predominantly involved solo experiences, particularly when using HMDs, this is a simple – and yet strikingly powerful – innovation, adding to the overall unique sense of immersion and time travel. Ironically this sense of 'immersive community' is remarkably similar to that achieved by the far more primitive efforts of the first commercial simulators – for example; VIRTUALITY VR's *Dactyl Nightmare* (1991), which allowed four people to play simultaneously and see their respective avatars within the virtual environment – however, the realism of *Thresholds* environment and higher level of interactivity makes the sensation of social presence far more intense. Also, unwittingly, Collishaw's installation provides the opportunity to vocally summon fellow participants – as the headphones relay audio at a relatively low volume – and then delight as their avatar 'glow' moves towards you in an immersive virtual environment within space and time. Such sensory surprises help to overcome any disappointment created by the limits of CGI (computer-generated imagery) or inevitable glitches in the mixed reality interface.

Figure 3.5 Installation detail of *Thresholds*, showing overhead view of the virtual realm, National Science & Media Museum, Bradford, 1 May 2018. Photograph taken by the author.

This sensation of the physical interplay/interaction between participants within the same virtual environment was further explored by the creative collective Marshmallow Laser Feast (MLF) in their immersive installation *We Live in an Ocean of Air* (2018). Created in collaboration with artist Natan Sinigaglia and musician Mileece I'Anson, the piece powerfully demonstrates the symbiotic bond not only between the virtual participants, but also between humanity and the planet. In an untethered virtual environment, participants wear similar immersive technology equipment to that used in *Thresholds* (Collishaw 2017): backpacks, HMD, headphones and, in addition, wrist devices to enable accurate hand and finger tracking. After being effectively blindfolded by the HMD, each 'immersant' is first required to understand how to recognise the other three people exploring the same physical and virtual space, identifying their virtual presence – much in the same way as *Thresholds* (Collishaw 2017) – in order to avoid collisions in the physical world. Once this is established, they begin to examine the virtual environment – a representation of California's Sequoia National Park featuring a selection of Giant Sequoia trees which, at over 30 storeys high, are the largest living organisms on Earth. Visitors 'step through the canvas and share a breath with the giants of the plant kingdom' (Marshmallow Laser Feast 2018) via an ingenious subtle sensor positioned in front of the mouth, enabling participants to literally 'see' their

breath represented as vivid blue particles and watch the journey of their dissipating exhalations. A constant process of particle interaction and osmosis takes place within the forest setting – participants watch red blood cells circulating in their fingers and a unique sense of cardiovascular activity becomes unlocked; 'capillaries, arteries and mitochondria flow into leaf, phloem and mycelium, placing your every inhale and exhale within a larger reciprocal system' (Marshmallow Laser Feast 2018). The experience is simultaneously available for up to four people, each visible to their co-immersants via the orange glow of their virtual circulatory systems and the blue streams of their VR breaths, providing a surreal sense of 'virtual community' – an awareness of others occupying the same physical and virtual space – as demonstrated in *Thresholds* (Collishaw 2017). Whilst displaying a sense of spatial, self and social presence, the IVE provides a spectacular sensory insight which explicitly highlights the connection between (human) animals and plant life. In common with pieces such as *Thresholds* (Collishaw 2017) and *ManicVR* (Bertin 2018) such an experience would be impossible to reproduce using a more traditional medium – only immersive technology can deliver the exquisitely powerful and all-encompassing artistic vision of *We Live in an Ocean of Air*.

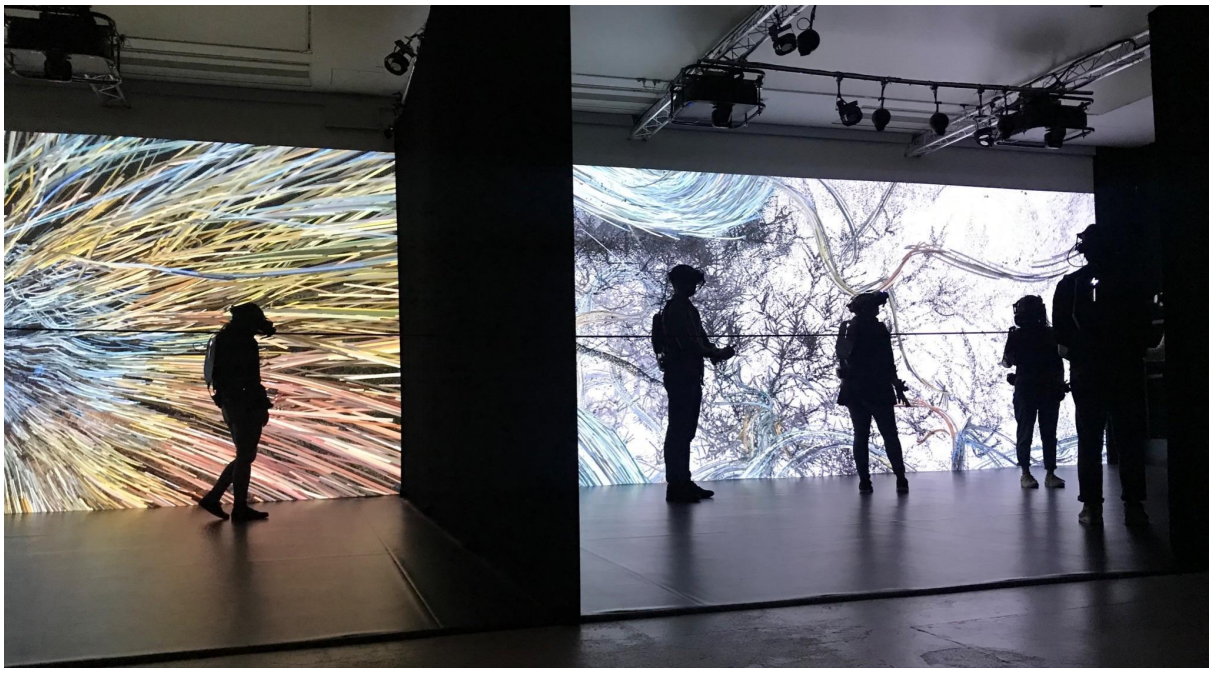

Figure 3.6 Installation view of *We Live in an Ocean of Air*, Saatchi Gallery, London, 15 January 2019. Photograph taken by the author.

As the work of MLF successfully demonstrates the symbiosis between humans and our home planet, *To the Moon* (2019) attempts to go further and highlight our links to environments and systems beyond Earth. A unique 15-minute virtual reality installation with film, images and music created by artists Laurie Anderson and Hsin-Chien Huang, the piece was commissioned by Manchester International Festival (MIF) to celebrate 50 years since humans first stepped on the moon. Small groups of participants are initially welcomed into a darkened gallery holding space in which soft curtain walls display projections of asteroids, the Earth, the Moon and graphic symbols representing constellations and clusters of DNA. As the visitors' eyes adjust to the level of low light they become aware that one of the projected surfaces is actually a semi-opaque dividing curtain, behind which are several seated people wearing VR headsets. When their turn to don the head mounted displays arrives and their VR experience begins, the participants realise that their journey already began within the projected space, and the symbols and imagery that surrounded them are now omnipresent in the immersive environment. What previously appeared as wallpaper style graphics of constellations now animate and assemble intelligently, forming the shapes of animals – a polar bear and a honey bee. The DNA clusters unlock and display the forms of dinosaurs and automobiles, creatively highlighting the origin of fossil fuels. Hovering above the surface of the moon, the immersant is able to control their space-suited arms and fly across lunar mountains, glancing back to see the Earth. Finally, in a surreal narrative twist, the 'art astronaut' glides onto a donkey and rides across the oceans of the moon until finally floating upwards in unification with the constellation of stars above. As you glide above the virtual lunar surface and experience the sensation of human form and celestial bodies entwining, it would seem that – in some part – the promise of *The Lawnmower Man* (1992) has been fulfilled.

Dr Rachel Genn notes that Laurie Anderson writes 'about how mistakes are a catalyst for originality. I think if you have to absolutely plan out how a story is going to be told, you lose that "liveness" in the work that is what audiences crave' (Genn 2020). This alludes to the concept of 'masterful vagueness' and Tarkovsky's call to locate the 'specific character' of an artform. In the Manchester International Festival website for the project *To the Moon* (2019), Anderson says:

> As an artist and performer, I've become increasingly frustrated with stages and screens, and more and more interested in immersive works – music you can walk into

> and images that completely surround you. I also love long extended drone work that fills the physical space and the imagination, and art that is composed and completed by the listener/viewer, who walks into it and experiences it viscerally, emotionally and intellectually. In working with VR, I've had to relearn many of the things I know about narrative and stories. In VR, the beginning, middle and end are shifting states, not sequential ones. I find this way of being in time increasingly interesting and actually true to life. (quote from interview with author)

This quote from Anderson, particularly the concept of 'shifting states', provides a valuable insight into the nonlinear nature of immersive storytelling mirroring the multi-strand, branching narratives suggested by *The Garden of Forking Paths* (Borges 1941) and *Interstellar* (Nolan 2014). It is also a rare glimpse into the appeal of immersive artforms from a multi-disciplinary artist who has enjoyed success and critical acclaim for decades, and can be viewed as a call-to-action for maverick storytellers wishing to pursue and develop nonlinear narratives in their work, while highlighting some of the challenges they may face – and relish – in creating such pieces of art.In contrast with traditional artforms, immersive storytelling can incorporate complex interactivity involving cameras or microphones to increase the sense of agency and/or participation. Immersive experiences can also seamlessly integrate AI systems with the ability to detect your mood as in *RIOT* – a 'neurogame' by UK director Karen Palmer (2016) in which the individual is presented with a series of scenarios and decisions are made via AI detection of the user's facial expressions, effectively combining storytelling with neuroscience. The natural evolution of this type of narrative would involve your own history being replayed or retold by someone (or something) else via digital memories; images, video or audio, embedded into an immersive environment similar to *RIOT* in order to create a unique, personal experience for an individual. In such a scenario, the selection and usage of the material would be controlled by the user or directed by a suitably sophisticated (AI) computer system, with or without the conscious involvement or permission of the individual.

The qualities of immersive artforms – specifically videogames – were showcased and critiqued in the major V&A Museum exhibition *Videogames: Design/Play/Disrupt* (8 September 2018 – 24 February 2019), with the curators Marie Foulston and Kristian Volsing identifying the processes and convergent skills involved in the production of modern videogames. Much of the exhibition was occupied by incredible sketches and design thinking

mined from studios across the world, paired with huge screens showing large-scale productions alongside smaller independent titles. The show also sought to highlight how the videogames industry is tackling issues such as sexism and racism via a range of displays including innovative lifesize projections of interviewees. A more reflective side of gaming was introduced via work such as *The Graveyard* (Harvey & Samyn, 2008) in which you are required to gently guide an elderly woman around a cemetery. Styled like a film noir production – with beautiful, monochromatic, aesthetics – *The Graveyard* (2008) forms a very deliberate antidote to adrenaline-fuelled 'shoot 'em ups' and sports games. Essentially a single ten-minute scene, the 'action' involves walking slowly towards a bench, sitting down and listening to a song – the game ends with the woman leaving the graveyard or dying of natural causes. A 'trial' version of the game was offered as a free download, identical in every way to the 'full' version with one notable exception: the elderly woman could not die. As the developer's website (Tale of Tales, 2008) states: 'It's more like an explorable painting than an actual game. An experiment with realtime poetry, with storytelling without words.'

Graveyard (2008) was inspired by the *Realtime Art Manifesto* which was first presented by its creators, Auriea Harvey and Michaël Samyn (aka Tale of Tales), in 2006 at the Mediaterra Arts and Digital Festival, Athens. According to *Videogames: Design/Play/Disrupt* (Foulston & Volsing, 2018): '*Realtime Art Manifesto* set out to characterize 3D game technology as a medium for artistic possibility. The manifesto determined a set of guidelines expressing ideas about how this technology could be used, with hopes to inspire both games designers and artists alike' (p. 88). As Harvey & Samyn state (Foulston & Volsing, 2018): 'Our intention was to encourage videogame creators to take artistic aspects of their medium more seriously, (rather than merely considering it as a form of commercial entertainment) and to inspire visual artists to take videogames seriously as a creative medium (rather than engaging with them from a conceptual / ironic distance)' (p. 90). The *Realtime Art Manifesto* (2006) consisted of ten points for videogame creators:

1. Realtime 3D is a medium for artistic expression.
2. Be an author.
3. Create a total experience.
4. Embed the user in the environment.
5. Reject dehumanisation: tell stories.
6. Interactivity wants to be free.

7. Don’t make modern art.
8. Reject conceptualism.
9. Embrace technology.
10. Develop a punk economy.

Many of these points are still benchmarks for creators within the current realm of immersive art. Some of the bold uppercase statement slides from the original 2006 presentation could be T-shirt slogans for today’s XR storytellers: ‘EMBRACE NON-LINEARITY!’, ‘REALTIME 3D IS A POETIC TECHNOLOGY!’, ‘DROP THE REQUIREMENT OF MAKING A GAME!’, ‘REJECT THE BODY-MIND DUALITY!’ and ‘MAKE THE EXPERIENCE FEEL REAL! (NOT NECESSARILY LOOK REAL)’ (Foulston & Volsing, 2018, pp. 92-3). Looking at the various pieces that have permeated VR strands of festivals and exhibitions over the past few years, it would appear that the *Realtime Art Manifesto* (2006) has impacted well beyond its original goals and, in more recent times, various curators, artists and academics have suggested a similar set of values for XR creativity expanding on the ideas of Harvey & Samyn.

As recognised experts in the curation and display of VR/AR/XR stories and artworks, Bristol-based Limina Immersive were commissioned in 2018 to produce the report *Immersive Content Formats for Future Audiences* (Allen & Tucker 2018). In the concluding pages ‘What do these formats have in common?’ they offer the following explanations and insight (pp. 84–85):

> Firstly, they all provided the material for the audience member to create their own, personal narrative. Academics and game theorists have described this style of narrative as an ‘emergent narrative’ - a format that supplies the raw material and structure for the audience member’s own ‘storification’ (Aylett 2000) process to occur. A scenario is presented to an audience in which audience members’ own individual narratives can emerge. More recently, VR industry leaders have described this user-centric approach to narrative as ‘storydoing’ (Allen 2018) or ‘storyliving’ (Maschio 2018).
>
> It may sound counterintuitive, but researchers found that experiences do not require obvious interactivity in order to foster emergent narratives from a user. Sometimes, a

> scenario or environment can be stimulating enough that it alone is enough to cause a user to have their own positive, personal experience to take away with them.

It is true that, in a great number of immersive narratives, chronology and the importance of causality are less noticeable; however, nonlinear narratives still require some form of structure. Bucher (2017) labels this as a 'linear logic' containing 'those inherent elements in our psychology that are needed to even engage an experience', insisting that 'the audience must be given *something* to orient *some* part of their experience' (Bucher 2017, p. 84).

Echoing the observations of Mark Atkin (2019), Jenova Chen – the director of *Journey* (2012) – concludes that 'Art, in the end, has to be interpreted by the audience. And depending on what the audience has experienced they will walk away with very different things' (Foulston & Volsing 2018, p. 31). This subjectivity is particularly significant in the case of immersive art, where a participant's interactions can generate a very different experience to another person using the same content. As Laurie Anderson reminds us (MIF website, 2019), this is one of the most exciting qualities of immersive art:

> I want to get lost in works of art. Of course, you can get lost in a Russian novel, lost in a pencil drawing. But getting lost in virtual reality has its own deep pleasures. I also enjoy the fact that it can confuse and confound the sense of proprioception and safety as well as convey completely different messages to your several senses.

Ferrari & Medici (2017) state: 'Different realities, simulated realities, dreamed realities, invisible reality, future or past realities represent a wide scenario where VR can find a huge field of application. A next future already became reality.' This potentially huge scope of possibility is also captured by Bucher (2017, p. 91) who claims that 'Immersive storytelling is a return to the form rather than an invention of it.' In this, Bucher is commenting on the often primitive sensory qualities of immersive content, evoking a time when stories were shared verbally with emotions and actions, as opposed to being mediated via the printed page or cinema screen. This 'campfire' approach to narrative – directly sharing stories person-to-person, like the historical telling of tales around a fire – is undoubtedly an aspect that many creatives working within immersive art seem comfortable to gravitate towards, providing a new frontier for their creative practice and an open door to the imagination of their audience.

3.6 A Collaborative Dream

As we begin to explore the possibilities of the immersive realm from the perspective of place, personhood and memory, we realise that this emerging technology provides an opportunity to go beyond the traditional boundaries of personal identity and spatial physics, with the potential to create utopias for the future. It is worth considering that a 'Utopia' is an ideal location where everything runs to perfection (More 1516) – in other words an impossible dream-like space, which seems a perfect description of many immersive VR environments. Once a group of people become accustomed to everyday experiences of virtual reality they can surely start to envision the environment that they would like to inhabit in more detail. In such a scenario, each one of them could create their own ideal place, which responds to their history and desires for living. In his 1953 manifesto entitled 'Formulary for a New Urbanism', written under the pseudonym of Gilles Ivain, Ivan Chtcheglov imagined: 'Everyone will live in his own personal "cathedral." There will be rooms more conducive to dreams than any drug, and houses where one cannot help but love' (Chtcheglov, 1953, p. 6). He wrote of a 'new vision of time and space' which would include 'new, changeable decors' (Chtcheglov, 1953, p. 2) and 'buildings charged with evocative power, symbolic edifices representing desires, forces, events past, present and to come' (Chtcheglov, 1953, p. 5). In recent years, spaces similar to those described by Chtcheglov have been realised with experiments in XR technology and – as such virtual environments become increasingly common in the everyday lives of most people – what was previously regarded as science fiction and the dreams of surreal Situationist heroes could become standard everyday escapism, available to all, regardless of their status or limits of imagination.

The malleable domestic settings envisioned by Chtcheglov are echoed and expanded in the 48th definition of VR provided by Lanier (2017): 'A shared, waking state, intentional, communicative, collaborative dream' (p. 296). In a growing ecosystem of online technology, many people and organisations have attempted to realise such a vision and instigate and organise a connected virtual community. The online virtual world of *Second Life* was launched in 2003 by Philip Rosedale on 3 servers with approximately 1,000 users. Three years later, *Second Life* ran on more than 3,000 servers with at least 1,000,000 registered

users. Rosedale humbly says: 'all we've created is a platform, an almost empty world… you came along and breathed life into it. If *Second Life* is a world at all, it's because you created it' (Rymaszewski 2007, p. iv). This sentiment seems to support the words of Gissing—'It is the mind which creates the world around us' (Gissing 1915)—in that a virtual world only acquires a sense of reality when human beings populate it with their ideas and imagination. *Second Life* was instrumental in introducing the online community to areas such as virtual land ownership, personalising their virtual appearance, engaging with virtual communities, creating new objects in virtual reality (and managing them) and even providing an opportunity to make (real) money from various activities in the virtual realm. While the graphics, resolution quality and interface of *Second Life* may seem primitive and unsophisticated by current standards, for many 'residents' in 2003 the virtual realm was reminiscent of the possibilities suggested by Gibson (1984), *The Matrix* (1999) and *Lawnmower Man* (1992) – re-enforcing the observation that each generation has their own version of immersive experiences and expectations (Judd 2016) and draw influence from cultural depictions of virtual worlds.

Along with its exclusive accompanying CD-ROM, *Second Life: The Official Guide* (Rymaszewski 2007) was relatively obsolete before the first copies were sold via Amazon; however, the publication does provide a time capsule of how the future felt in 2006, when the idea of attending a virtual nightclub dressed as a dinosaur in sunglasses seemed like a good idea. The final chapter—*The Future and Impact of Second Life*—lists some of the more novel ways in which the virtual environment was being used in 2006; we learn that Harvard Law School offered a course in 'persuasive, empathic argument in the Internet space' (p. 304) that was partially taught within *Second Life*, and that the New Hampshire city of Hanover was virtually recreated in *Second Life* to test crisis response methods. Additionally, it is claimed that *Second Life* is home to the State Department, the CIA and at least one practising psychologist (Rymaszewski 2007). Within a short space of time, *Second Life* became home to a broad and mind-boggling range of uses – mirroring the unpredictability of the real world – all created by an enthusiastic population of virtual citizens.

While some observers may be surprised that a relatively technically primitive environment such as *Second Life* became a massively appealing virtual home to so many people, the convincing quality of the environment is not always a key factor, as Popat (2015) suggests:

> New media philosophers Jeff Malpas (2009) and Mark Hansen (2006) have both independently proposed that the key factor in defining the 'real' is the lived experience rather than whether the 'reality' in question is physical or virtual. If this is the case, then the representational status of the virtual environment is less critical to the experience of the visitor than the lived experience of mixed reality. (p. 11)

Here Popat is identifying that the activity of an individual or group within a virtual environment is more important than the realism (or 'representational status') of the virtual realm itself. This argument produces further suggestions for why some XR environments—such as *The Virtual Hole in the Road* (2016) and *Memory/Place: My House* (2014–15)—had such an impact on those who explored them. While the virtual environments within these recreations were accurate and rendered to a relatively realistic standard, no participant would actually accept they were in the real space that was being represented, and only their imagination allows them to believe such a possibility. When Murray (1997) states: 'In digital environments we have new opportunities to practice this active creation of belief' (p. 137), she is underlining the idea that—if realism or 'representational status' (Popat 2015, p. 11) is not critical to the impact of immersive environments—more abstract representations of reality can be employed, providing ideal testbeds for narratives of 'masterful vagueness.'

While the virtual lands of *Second Life* were undoubtedly a beacon of social interactivity and amusement for some, it simultaneously raises questions regarding the possible negative aspects of the wide-scale adoption of similar virtual communities in the future, a concern highlighted by Caroline White (2019):

> From a civic point-of-view… there's the possibility it might make us even more isolated or more micro-grouped than we already are, where we're really only communicating with our preferences. (quote from interview with author)

As White (2019) observes, the technology that provides stronger links for a community could also segregate individuals within it. Such silos are already omnipresent in social media platforms—for example; Facebook and Twitter—and future virtual (reality) communities will face the same challenges. As highlighted by the Tech Policy Lab in their report *Augmented Reality: A Technology and Policy Primer* (2015), some XR innovations—particularly

augmented reality technology—could be used to alienate, stigmatise and, quite literally, label certain members of society:

> AR systems may also prove both empowering and disabling for a given population depending on the context. For example, AR could empower incarcerated youth providing a wider range of educational experiences, including hands-on work that would otherwise require intense investment in physical tools or spaces. But AR could also hinder these populations to the extent their arrest or incarceration records are rendered more visible to friends and neighbors, landlords, law enforcement, or prospective employers. (p. 5)

The multi-sensory aspects of XR technology, particularly those which make the difference between reality and virtuality practically indistinguishable, will hail a new era of human development, bringing with it fresh opportunities, challenges and dangers. However, as with previous technological innovations—the printing press, radio, cinema, television and the internet—society will ultimately be responsible for controlling the power of the medium. What will differentiate the regulation of XR is the multiplicity of uses and impacts on society, and our individual reliance on an everyday basis, as Greenfield (2017, p. 67) highlights when discussing the potential impact of augmented reality technology on our sensorial field:

> In essence, phone-based AR treats the handset like the transparent pane of a cockpit head-up display: you hold it before you, its forward-facing camera captures the field of view, and an overlay of information is applied on top of it... Here is one of the core premises of AR: that everything the network knows might be brought to bear on someone or -thing standing in front of us, directly there, directly accessible... This is a deeply seductive idea. It offers an aura of omnipotence positioned as a direct extension of our own senses.

This suggestion that AR could become inseparable from our everyday activities, to the extent that immersive technology becomes ‘a direct extension of our own senses’ (Greenfield 2017), becomes increasingly likely when considering the development of other, established, forms of media. Whereas cinema may only have typically featured in the lives of people once a week, or television once a day, the internet is now very much a constant companion and portal for many. XR technology, specifically augmented and mixed reality, effectively introduces the

internet into the real world around us and, for many people, will become a constant vital component of their entire daily routine. Obviously, the potential psychological, physical and civic impacts of such usage are huge and unprecedented.

The individual implications of augmented reality could go far beyond a medium for information or entertainment and into new forms of sensory provision, although such a reliance could create new dangers, as the Tech Policy Lab (2015) identifies:

> Not everyone experiences AR the same way, i.e., as 'augmenting' reality by introducing new sensory information. For some populations—notably, those living with disabilities—AR may fully or partially replace a sense. Thus, for instance, an assistive technology may vibrate as people or objects approach or convert auditory information to visual stimuli. Those living with disability may come to rely upon these signals, such that their sudden interruption could create an inconvenient or even dangerous sensory deficit. (p. 5)

While those living with particular disabilities may come to physically depend on AR within their everyday lives, equal levels of psychological dependency could also emerge for those who immerse themselves fully in virtual communities. Such individuals and groups could very quickly feel isolated when they are disconnected – even temporarily – as anyone who is dependent on email communication for their work, or Twitter or Facebook for their social connections, will know.

Virtual communities can take many forms; the participants at the Saatchi Gallery enjoying *We Live in an Ocean of Air* (2018), groups of online virtual acquaintances in *Second Life* (2003), or four friends in an arcade playing *Dactyl Nightmare* (1991). All have a sense of shared experience, involving interactions that are unique to that particular group in a specific space and time, however, some of these experiences are obviously far more physical and multi-sensory than others. Some of the more subtle, sensorial aspects of XR can often strengthen the authenticity of the experience and boost the imagination of the immersant. Murray describes the revelation of hearing a whisper in the back of her mind as 'a moment of unmediated intimacy', exuding an extreme power not due to 'gimmickry' and introducing an 'unexpected closeness' with the character. She delights how the whisper made her 'sense the potential of this technology to take us seamlessly into a character's mind', enthusing that the

experience ‘held out the possibility of a dramatic art form that can juxtapose the inner and the outer life as easily and gracefully as prose’ (Murray 1997, p. 55). Such subtle sensorial qualities—possibly employing elements within the ‘sonic hyperfield’ described by Taylor (2019)—which are beyond more traditional media, not only provide the individual or group with a higher level of immersion, but also serve as unique tools for creating immersive worlds. The impact of these emerging sensory elements informs a new space for creators to explore and exploit within their narratives, as the artist and neuroscientist Dr. Rachel Genn explains with regard to the manipulation of attention within her work (Genn 2020):

> The things that I am interested in exploring in conventional narratives are still the things that I’m interested in exploring in immersive spaces… I think a lot about how attention works in an immersive environment, and also how attention and salience appears to the reader in conventional formats. How attention is manipulated is at the core of both, but – because immersive environments are developing new ways of being immersed – I feel like they are showing us what attention can be, in a new way. (quote from interview with author)

Genn’s (2020) highlighting of the intention of the creator and how this affects the individuals or groups experiencing the work could be viewed as a further example of what Akomfrah describes as ‘the third meaning’ (TateShots 2015), as they are ‘mirrored in each other’ (Genn 2020) in a dialectical relationship. This is one aspect that is truly native to immersive technology; the imagination of the creator is combined with the actions of the participants, which are in turn translated by AI and spatial computing to create an experience which can be described as a unique and truly collaborative dream.

3.7 Mnemonic assistance and schemata

We use our imagination—often subconsciously—to augment images, sounds, smells and tastes. In 2018 I listened to a familiar piece of music playing at a medium level through average quality earphones and—in my mind—I could hear the same track pounding through huge studio speakers in 1992. The moment from the past may have seemingly been long forgotten and yet there it is – recalled in a split-second with just a few notes of music. A

similar, and even more subconscious, sensation occurs when experiencing what could be described as 'olfactive displacement'—when random or subtle odours unexpectedly transport you to another time or place, possibly one that is not instantly recognisable, effectively creating a form of time travel via the sense of smell. Such sensorial shifts of focus are products of the 'unthought known' within psychoanalysis and an opportunity for the creative exploration of 'masterful vagueness.' As I have already explored, VR/AR/XR are often platforms to facilitate such activity, however, to what extent is 'unthought known' triggered by such experiences and how does a sense of 'masterful vagueness' assist in surfacing memories? Atkin (2019) addresses this area and suggests a reason why extended reality and immersive environments can be so effective for memory:

> It's quite clear that VR is very powerful; it can leave a very lasting impression, it can have the ability to sort of 'rewire' the way that you think about things and view the world and other people – as has been discovered by psychotherapists and other types of psychologists in the way that it's been used in different types of therapy.
>
> Another thing that Chris Milk said when he was trying to account for the impact of it is 'memories are geo-tagged.' You know those people who can shuffle five packs of cards and then remember exactly what order they're in? The way they do that is they put them around spatially and then tell a story about that to themselves that allows them to relate that. VR can work in a similar kind of way because it's a spatial medium, and so you remember it as little snatches of places that you've been. Again, that's why it doesn't work so well in terms of linear storytelling, because it's those little bits and pieces that have some kind of impact. (quote from interview with author)

The sensation that Atkin describes certainly adheres to the reaction of those who experienced the non-linear narrative of *The Virtual Hole in the Road* (2016), where the spatial presence of the VR environment triggered numerous memories, thoughts and feelings for many of them. The idea that both movement and mnemonic data can be 'geo-tagged' and VR can 'rewire' such activity (Atkin 2019) suggests new possibilities for how those creating XR experiences could enhance the impact and meaning of their work. The concept of memory and perception being gained from spatial presence has been a long-standing aspect of modern art, from the

dawn of Cubism to the present day, as Gayford (2018) identifies in his mid-century study of Bacon, Freud and Hockney:

> [...] Hockney has insisted that human beings do not see geometrically or mechanically, like a camera; we see 'psychologically.' There is no such thing as an objective view of anything. Bomberg believed that vision was also physiological, that our comprehension of what we see is derived not just from the information that comes from our eyes, but informed by our experiences as three-dimensional beings moving around the world. (p.66)

The most effective VR experiences effectively update and magnify the belief that we see 'psychologically' and that our vision is not purely ocular but captured volumetrically. A similar concept was introduced by William Gibson in his debut novel *Neuromancer* (1984) when the main protagonist (Case) discusses his own mnemonic capabilities and inadequacies with an alien being known as the Finn:

> 'I don't have this good a memory,' Case said, looking around. He looked down at his hands, turning them over. He tried to remember what the lines on his palms were like, but couldn't.
> 'Everybody does,' the Finn said, dropping his cigarette and grinding it under his heel, 'but not many of you can access it. Artists can, mostly, if they're any good. If you could lay this construct over the reality, the Finn's place in lower Manhattan, you'd see a difference, but maybe not as much as you'd think. Memory's holographic, for you.' The Finn tugged at one of his small ears. 'I'm different.'
> 'How do you mean, holographic?' The word made him think of Riviera.
> 'The holographic paradigm is the closest thing you've worked out to a representation of human memory, is all. But you've never done anything about it. People, I mean.' (p. 203)

With this passage, Gibson (1984) develops the notion of spatial presence and volumetric memory to encompass holographics, suggesting that such technology could lead to the visualisation and mapping of human memory. Interestingly, he also hints that this ability could be particularly present in artists, reinforcing Hockney and Bomberg's belief that they saw the world 'psychologically' (Gayford 2018). Bucher (2017) discusses how, following VR

experiences, participants piece together their memories of the experience to make sense of the events:

> McLean suggests that rather than storytelling, we actually participate in the *memory telling* after having experiences. This memory telling causes us to create a narrative identity about ourselves. To simplify, when we have experiences, we try to take our *memories* of what has occurred and string them together to try to create a coherent story about what we experience. These memories *may or may not* have a direct connection to *what actually occurred*. Sometimes the memories actually more closely conform to narrative concepts that help us make sense of what happened. Our brains look for stories. We need them to make sense of the world. Actual memories are secondary to story in our minds. (p. 65)

While this suggests links with 'storydoing' (Allen 2018) and/or 'storyliving' (Maschio 2018), it could also explain why immersive experiences affect people in such a variety of ways, as they search for their own narratives 'to make sense of the world' (Bucher 2017) the actual events of the VR experience only serve as elements within the participant's own unique story. According to Atkin (2019): 'You remember the experience the same way as you remember a dream: little bits of it vivid, something tugging at you somewhere in a way that you struggle to properly articulate.'

While there has been much historical activity within multiple disciplines – and in particular psychoanalysis – to explore and articulate the sensation of memories, some of the most relevant work around the development of personal memory via immersive experiences can be found in the world of contemporary art. Although very little of this output currently involves the use of XR technology, I would argue that a few exemplary pieces point the way toward how we might piece together our virtual memories in the years to come. In an attempt to document, reconstruct and remember his own personal history, the British artist Mark Leckey moulded together a tangled and seemingly disparate assortment of source material for the 23-minute audio-visual work *Dream English Kid 1964-1999 AD* (2015). A large portion of the material featured in the piece is culled from YouTube; archival news clips, segments of feature films and footage of historical events. Starting in 1964—the year he was born—Leckey shares with the viewer a chronological selection of his 'found memories'; the 1969 moon landing, desolate motorway journeys, 1970s high street stores, television

programmes and adverts, punk/post-punk concerts, seminal Liverpool music venues, 1990's London Soho and the lunar eclipse in 1999. He extends and personalises the 'found memories' with animated versions of his naive childhood drawings, black and white family films featuring Leckey as a child, and a recreation of his murky student bedsit. The meticulously-crafted 5.1 immersive surround sound accompanying the video variably matches, contrasts and augments the visual material in a manner which is reminiscent of the dialectical relationship and 'the third meaning' described by Akomfrah (TateShots 2015). Leckey was inspired to make the piece after discovering a YouTube clip of a performance by Joy Division which he attended as a teenager in Liverpool. According to the archival entry for the artwork in the Tate Collection 'while acting as a form of self–portrait for the artist, the film also seeks to connect us all through shared memory and experience' (Tate 2016). There are undoubtedly parallels to *Memory/Place: My House* (2014–15), but while Rothberg's piece is formed via a virtual framing of solely genuine records of her family activity, Leckey's creation is explicitly an exploration of his own 'found memories' and imagination.

Many sequences within *Dream English Kid 1964-1999 AD* (2015) are deliberately framed as a challenge to decode the relevance to Leckey's life and/or personal development – for example; a relatively lengthy scene in which we observe a young woman repeatedly combing her hair. This mysterious element of the work is highlighted by Clarrie Wallis in her essay *Dream English Kid* (2019), from the catalogue for Leckey's retrospective at London's Tate Britain—*Leckey: O' Magic Power of Bleakness*:

> The digital age has affected how we – both as individuals and as a society – create, store and recall information. It has been widely claimed that the bringing together of time and identity is achieved through memory with criteria added to the mix – the individual, the social and the cultural. *Dream English Kid* operates on all three levels – cryptic, purely personal memories are cross-hatched with social and cultural collective memories. (p. 56)

While some of the work of Akomfrah could be described as 'cryptic', his large-scale installations are not forged from 'personal memories' but forensic investigations of the past. However, the format of *Dream English Kid 1964-1999 AD* (2015), in which visual and audio elements often appear to be telling the same story in a separate way, could be likened to many of Akomfrah's installations. Additionally, both artists work with a similar range of source

material; news reports, archive footage of urban life and scenes of community, cultural and social activity. However, it is Leckey's own explicit, personal history being recreated within *Dream English Kid 1964-1999 AD* (2015), not that of someone else – for example, a recognised political or historical figure such as Stuart Hall in *The Unfinished Conversation* (2012). What is apparent in the work of both Leckey and Akomfrah is the desire to present history within the artist's own unique terms, drawing from a diverse and inspirational range of sources and encouraging a multidimensional perspective. As with *The Virtual Hole in the Road* (Bax 2016), the apparent normality and/or mundanity of the content often contributes to the reality effect. In the case of Leckey, his iconic use of motorway bridges could also be viewed as a cultural reference to his creative predecessors, as Wallis observes: 'The shadow-filled underpass recalls novelist J.G. Ballard's descriptions of geometry and memory in the modern urban landscape, his desire to understand modernity, and his fascination with motorway flyovers, airports and hi-rises' (Wallis & Coustou, 2019, p. 52). This link to Ballard could be seen as surpassing that of a purely aesthetic or thematic obsession, with the writer's output providing the inspiration to celebrate the seemingly mundane and search below the surface of society in a cultural examination of our concrete world.

By augmenting his selected clips with reconstructed details and audio, Leckey effectively summons digital ghosts to our present reality. However, the presentation of his 'found memories' amounts to far more than just a recounting of the past, particularly his extensive use of historical popular culture which can be viewed within the hauntological terms described by Shaw (2018):

> The interconnected nature of past, present and future is central to hauntology, a critical practice that is defined by conceptual interrelation. Hauntology is not possible without ontology, in much the same way as the dead cannot exist without the living. The return highlights the significance of identifying the impact of the past on the present, and the future.

With *Dream English Kid 1964-1999 AD* (2015) Leckey not only explores his past, but uses the archival material as a conduit to investigate his cultural and personal identity. Wallis refers to the essay 'Communicative and Cultural Memory' by Jan Assman (Erll et al 2008) and how Assman 'explores the relationship between memory, time and identity' (Wallis &

Coustou, 2019, p. 57) when writing about *Dream English Kid 1964-1999 AD* (2015) in her exhibition catalogue essay for *Leckey: O' Magic Power of Bleakness*:

> At the level of the individual, memory operates in inner, subjective time and is a relationship with remembered events and objects. Social and cultural collective memory differ from individual memory in that they refer to shared objects of memory rather than being purely personal. (Wallis & Coustou, 2019, p.57)

Within this description, *Dream English Kid 1964-1999 AD* (2015) is positioned as a unique text that simultaneously spans the memory of the individual, society and culture. In order to create the work, Leckey searched the internet for events that he remembered, both as an active participant or attendee, or part of a family unit, or a member of society as a whole. What gives the visual and audio experience such remarkable resonance, as Leckey casts a high-definition lens across the fuzzy ghosts of his past, is the manner in which the various components are linked, augmented and detailed with the artist's deeply personal view of events and the effect they bestowed on him. Ultimately, due to the personal subjectivity, social/historical factors or emotional importance connected to our videos and images, it is highly unlikely that a machine or AI system could ever piece together our digital memories in the same articulate and impactful way as cultural 'specialists' (Erll et al 2008) like Leckey (2015) and Rothberg (2014–15). Artforms can capture memory and convey the passing of time in ways which are not apparent within science, and also add mystery to the process. Dr. Rachel Genn (2020) discusses Alice Oswald's lecture 'The Art of Erosion' (2019) which included a day-to-day description of changes of colour of plums on her tree:

> She could never catch the change, there's no way of doing that, but the poet aims to. I feel like VR should have that aim too. While science and technology can demystify process – like a colour change – Oswald says: 'poetry allows process its mystery.' And I feel like that's where VR's 'special stuff' is really going to come into play. Allowing process its mystery is something that we should entrust to future versions of storytelling. (quote from interview with author)

This belief that we need to 'allow process its mystery' (Oswald 2019) reflects the 'masterful vagueness' present in the work of storytellers such as Akomfrah, Lynch and Tarkovsky and follows the 'ambiguity' identified by Bordwell (1985, p. 212). If, as Genn believes, this is to

be the ‘special stuff’ of VR, those creating immersive experiences will need to familiarise themselves with the tools for executing such mystery. However, as Genn (2020) herself admits, the format of such interactions is still some way from being established:

> In pharmacology you've got first order interactions, then second and third or fourth, and I feel like – in VR – we’ve got no idea yet what the fourth and fifth level interactions are going to be with narrative elements and the constraints of the form itself. (quote from interview with author)

Regardless of the journey, will the memories of the viewer augment the stories of virtual experiences, or vice versa? When an individual views a photograph – a record of a specific time and place in their past – they effectively look at the image and augment other details from their memory, as Leckey demonstrates with his high-definition embellishments in *Dream English Kid 1964-1999 AD* (2015). If, for example, the photograph is of a party, depicting a group posing for the camera, the viewer may be prompted to remember those in the group and the relationship they held at that time. They may also recall the specifics of the event, for example; the events of the evening, before and after the photograph was taken, what they ate or drank, the music they enjoyed, etc. Even if the viewer is absent in the photograph, they may still recall the clothes they wore and how they felt at that moment in time – they may even recall conversations occurring as the photograph was taken. Compare this to another person—or an AI system—who was not present, examining the same photograph or video; they can only take from the media the facts that are presented to them and, while they may be prompted to feel happy or sad or otherwise, their memories will not provide any additional information or emotion. Returning to the source of the words from the Wakefield wall mural, a similar path of thought is revealed in the original passage from Gissing (1915, p. 98):

> It is the mind which creates the world around us, and even though we stand side by side in the same meadow, my eyes will never see what is beheld by yours, my heart will never stir to the emotions with which yours is touched.

When the media being examined is a historical virtual reality experience the same rules apply; however, there is also the physical sensation of ‘being there’ in a specific place. This goes beyond basic recollections of the occasion or environment and has the possibility to

unlock information surrounding the memories of which the viewer was previously unaware. As opposed to being presented with a flat surface (either still or moving) the visitor is immersed in an environment that engages multiple senses and feelings that many people would not normally consider when recalling a place or a time in their lives. As I will examine, this is one of the most unique aspects of virtual reality storytelling and one that provides a real opportunity for exploration.

4.0 Schema

Schema (2020) is a virtual reality artwork, a creative practice piece inspired and informed by my research and developed during the writing of this thesis. In this chapter I detail the content, conception, production and relevance of the piece which draws inspiration from the canons of cellular sci-fi, speculative fiction and the dystopian landscapes featured in the work of John Akomfrah. After outlining the creative process and different components of the artwork, I explore the numerous influences that shaped them; from multiple screen narratives and domestic memories, to mediaeval castles and brutalist housing estates. I detail the various versions that were made and explain why they were created, where the work was shown, and how *Schema* can help us to imagine future nonlinear journeys and stories through time. I also address the topic of digital simulacra—places and people—within various environments and explore how science fiction has informed the development of mixed reality immersive technologies and storytelling. Encompassing the literature of William Gibson, Stanisław Lem and Philip K. Dick, the films of Andreas Tarkovsky, Steven Soderbergh, Eirini Konstantinidou and Metahaven, recent examples of digital beings within popular culture and the work of Slater et al (2020), I will broadly outline the opposing views on 'the virtual' of Baudrillard and Lévy (Ryan 2015) and how they affect our perception of extended reality experiences. I also discuss the role of AI in recreating real people, our acceptance of such phenomena and potential future developments for virtual characters. Finally, signposting the development and potential of 'inner space time travel' by drawing on examples from literature, fine art, cinema and television, I suggest that similar virtual reconstructions could be fulfilled by artificial intelligence, using familiar places and people from our individual pasts to recreate events or make new stories.

Schema was originally conceived in 2019 as part of my ongoing PhD research and proposed as a project for the Festival of the Mind, a bi-annual city-wide series of cultural events hosted by the University of Sheffield. The project was formally commissioned in February 2020 and completed in August before finally being exhibited within the 'Futurecade' as part of the Festival of the Mind from 17-27th September 2020 (see appendix). I had originally planned for the piece to be delivered via a VR headset within a gallery setting, with the participant surrounded by the physical timepieces represented in the virtual world. Due to the impact of the Covid-19 pandemic—and the resulting health and safety concerns surrounding the sharing of headsets by the general public—I was forced to rethink the presentation of the

gallery format (see appendix). Subsequently I decided to create a multi-screen installation in which the visitor could still be immersed, in addition to sharing the full 360 experience online via YouTube. In total, *Schema* was eventually created and exhibited in four different versions:

- Full VR version (immersive / interactive): 360 3D video with ambisonic audio, experienced via VR headset (e.g: Oculus Go, Oculus Quest, HTC Vive), preferably with headphones.
- Physical gallery installation (immersive / non-interactive): 180 video file displayed across three screens, accompanied by quadraphonic audio (via 4x speakers) and exhibited with 4x plinths displaying corresponding timepieces depicted in the virtual work (see appendix).
- Single screen version (interactive): 360 YouTube video with ambisonic audio, experienced via YouTube app on a tablet or mobile device with accelerometer or via any web browser (on a tablet, mobile, laptop, or desktop computer), preferably with headphones.
- Single screen version (non-interactive): 1080 video with stereo audio, viewed via screen, computer monitor, laptop, tablet, mobile device, preferably with headphones.

With a single panoramic view divided across three large screens, the Millennium Gallery triptych installation of *Schema* echoed the multi-screen formats of *Purple* (Akomfrah 2017), *The Unfinished Conversation* (Akomfrah 2012) and *Information Skies* (Metahaven 2016), which I have discussed in previous chapters, and were arranged in an approximate 180 degree formation to effectively fill the viewer's focal range in a sensation reminiscent of an IMAX cinema experience. This, combined with the quadrophic audio emitting from four speakers, which Fell had specifically reworked for the physical exhibition space, produced an audio-visual blend reminiscent of installations such as *Dream English Kid 1964-1999 AD* (Leckey 2015). When considering how a viewer decodes and understands a film, Bordwell (1985) shows that ‘The spectator comes to a classical film very well prepared … The spectator knows the most likely stylistic figures and functions … On the basis of such schemata the viewer projects hypotheses’ (p164). What then in the case of a ‘spatial narrative’ such as *Schema*, where the sensation of spatial presence in various contrasting settings is the experience and the narrative? According to Bordwell (1985): ‘Prototype schemata and template schemata are employed by what Hastie calls procedural schemata, those operational protocols which dynamically acquire and organize information’ (p. 36). In

cases when such schemata are unfit to decode a viewing experience 'the spectator must adjust his or her expectations and posit, however tentatively, new explanations for what is presented' (Bordwell, 1985, p36). This demand of the viewer—or spectator—to create an individual explanation for what they are witnessing is a common factor within Art-Cinema and *Schema* provides an explicit example for how similar experiences could be achieved within VR, or 'Art-XR.' Film can be used to convey information, document a place, person or occasion, tell a story from one or multiple viewpoints, or simply be an abstract piece of art – and VR can be a platform for all of these with the added factor of spatial presence.

Exploring and testing ideas within this thesis – and inspired by many of the works of film and literature that I have discussed – *Schema* extends my existing creative practice within the realm of XR technology. Drawing on VR/XR pieces such as *Vestige*, *Notes on Blindness* and *Thresholds* and the multi-screen installations of Akomfrah, Leckey and Rothberg—combined with a visual language inspired by Kubrick, Pal and Tarkovsky—*Schema* falls firmly within the realm of 'Art-XR', providing an arts-based example for the emerging roadmap of extended reality storytelling. Situated in the liminal space between memory and fantasy, the immersive four minute VR journey depicts a range of specific, linked, locations from multiple time periods, suggesting a possible structure for combining inter-dimensional locations in future XR experiences.

The opening sequence displays a computer-generated 3D model of a 1980s Casio digital watch (see appendix), slowly moving toward the viewer against a blanket of solid darkness. From the opening seconds of the piece, we experience a soundtrack of lightly tapping drums sounding out a complex rhythm to a counterpoint of seemingly random low bass twangs, underscored by sustained electronic notes and drones which occasionally move into the sonic foreground. At the 30-second mark the LCD face—displaying 00:00—fills the entire peripheral vision until the blackness of the colon's upper full-stop completely engulfs the viewer. From the darkness more timepieces appear, encircling the viewer in a 360 immersive environment; two vintage Habitat LED alarm clocks – red translucent perspex blocks with an oversized display; two black Braun mid-90s bedside alarm clocks with hands moving swiftly around; two round, white modern wall clocks with black numbers and fast-moving black dials – and the Casio watch which remains vertical while spinning and orbiting its chronological cousins. As the clocks continue to turn and float—and somehow manage to cast shadows on each other despite the surrounding black void—we can inspect the top,

bottom and back of each item; battery compartments and reflective metal surfaces, green alarm-set buttons, function switches and wall-hanging notches.

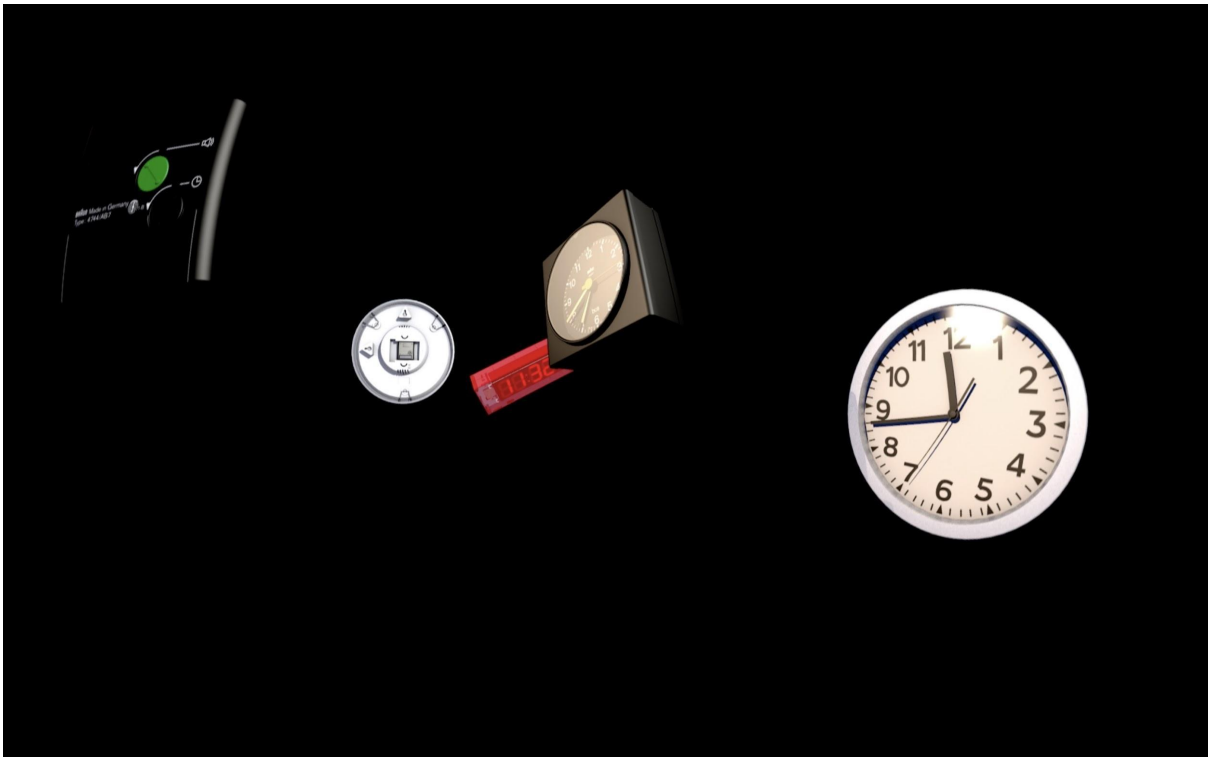

Figure 4.1 Screenshot from *Schema* (Bax 2020)

As the viewer moves their head, a tapping drum – seemingly on their right side – remains in that spatial location and they become aware that the sounds move with them due to the binaural nature of the audio. This sensation adds to the authenticity of the virtual environment, fixing the sounds in particular physical locations within the virtual sensorium, like an orchestra member positioned in a room. After sixty seconds have passed, the white face of the kitchen clock looms large, filling the front-facing 360 view, and the whole scene fades to black.

Figure 4.2 Screenshot from *Schema* (Bax 2020)

The soundtrack persists, not marking any change and—as the light quickly returns—we find ourselves standing on the deck of a modern housing estate during daylight hours, one side open to the elements, with an apparent absence of any human presence. A stairwell is directly in front and, turning 180 degrees to the right, we see that we are at the end of a long corridor or 'street' stretching-out beyond clusters of modern apartment doors and corner display windows. Large, head-height, aluminium characters form signage for residents, visitors and delivery workers, their smooth surface contrasting the brutalist concrete wall behind them, the numbers '78 ^' and '79 >' – revealing how many residencies are located on this deck. To the left—beyond the crisp, clean, concrete balustrades and smooth dark wooden handrails—evergreen trees and bushes colour a central landscaped area and, in the distance, more sections of the building are visible as it curls-in around itself, protecting the tranquil interior spaces of vegetation. We notice this is a building in transformation; a section of nearby facade wears blue construction netting with skeletal streets visible underneath, doors and windows removed, ready for regeneration. Further down the section in which we are standing, another part of the building has already been rejuvenated with anodised aluminium windows and freshly-personalised balconies revealing signs of new life. To the left, in the

distance, sits a further wing of the building in an altogether different state: a neglected piece of 1960s utopia – nine stories high, empty and waiting to be reborn.

Figure 4.3 Screenshot from *Schema* (Bax 2020)

The scene fades to black and we are returned to the temporal landscape of floating timepieces which continue to elegantly spin, flip and avoid collision – they seem intrinsically connected to the tapping—or maybe ticking—binaural audio which still encompasses our 360 sonic environment. The wristwatch and clocks dance for thirty seconds until the darkness descends again and a new scene is revealed – an urban location – a large round space with a perfect circular hole in the roof revealing a blue sky and city centre buildings above. From the angle of the surrounding structures we can surmise that the round concrete chamber is below street level with connecting corridors leading up to the streets above ground. There is a lack of human presence here which feels distinctly at odds with the obvious urban and social purpose of the hub location. A look around the space reveals several seating benches, an empty shop front, cylindrical metal refuse bins, a deserted retail stand, a discarded wine bottle – and signs of wear and tear; floor stains, wall damage and graffiti – this is not a new space or one that has been recently cared for. In the distance, a tall facade displays a large figurative sculptural artwork, evoking public art commissions of the 1950s and 60s. Returning to the circular civic space, we notice the variation and quality of the materials within the structure; mosaic tiled wall areas, a granolithic-textured concrete floor surface, long thin lights arranged around the circular roof opening like the numbers of a clock, a central area clad in green slate, strips of cedar wood panelling forming the ceiling of the corridors and—remarkably—a long

rectangular fish tank set into the far wall. The audio continues to tap a nonlinear rhythm, punctuated by metallic pangs and occasional high-pitched squeals which seem to echo and bounce around the walls of the subterranean space. The scene fades to black and darkness returns – the floating clocks and digital watch surrounding us once again, dancing to the several simultaneous rhythms alongside more electronic twangs and tones. For thirty seconds we observe the encircling clocks – an opportunity to further scrutinise their details; the wires within the translucent red LED blocks, the speedy thin seconds hand of the white wall clocks, the yellow nose on the face of the small black clocks juxtaposed with the BRAUN logotype and the words ‘quartz’, ‘bcs’ and ‘Made in Germany’ – until the blackness descends once more.

Figure 4.4 Screenshot from *Schema* (Bax 2020)

As the darkness fades, a new scene emerges with distinct components: an immediate environment of a raised area of natural land with gently swaying grass; an open sky filled with thin, warm-toned clouds, suggesting the beginning of an early evening sunset; the looming presence of two large trees, overlooking the valley below. On a raised mound in the distance, a huge mediaeval castle dominates the surrounding area, which appears to be carefully landscaped with perfectly-positioned trees and sensitively-situated hills. An absence of any other visible human-made structures within the entire 360 panorama provides the impression that this view is 400-500 years ago, and the castle sits proudly at the birth of a city. The fact that we are in the open, unencumbered by concrete structures and with no prospect of human contact or interaction occurring any time soon, provides this location a

very different sensorial qualities to the previous urban environments. As we look around—for miles in all directions—with only the castle obstructing the flow of nature, we wonder how this space will change as the mediaeval community inevitably expands to the surrounding land; how will this space develop in the future? After thirty seconds of tranquillity—accompanied by electronic drones, a low-bass hum, gently-chattering percussion and highly-strung twangs—the scene begins to dim until the whole environment becomes a black void. As the audio tones suddenly heighten we are jettisoned from the colon dot of the Casio watch face and back into the temporal landscape, questioning the scale of the timepiece and/or ourselves; is the wristwatch the size of a building, or is the viewer smaller than an ant? As the digital watch slowly moves away into the distance we notice that the clocks are now absent and we are witnessing a reversal of the introduction. The watch grows smaller until being consumed by the darkness, the electronic tones begin to reverberate and fade and—four minutes and fifteen seconds after it began—*Schema* ends.

Figure 4.5 Screenshot from *Schema* (Bax 2020)

All three outdoor location scenes within Schema are heavily linked to my creative practice and previous and ongoing research. Following the introduction to the 'temporal landscape' of *Schema*, the first 'physical location' is a 360 film taken on the corridor—or deck—of residential housing at Park Hill flats in Sheffield, where my creative studio has been based since 2013. The first inhabitants took residency on the 'Streets in the Sky' in 1961, and it proved to be a popular and much-loved home for many families, couples and individuals over the subsequent three decades, as former residents testify in *Space, Time and Streets in the Sky*

(Bax 2021). Following severe industrial decline in Sheffield in the 1980s and the launch of Margaret Thatcher's 'right-to-buy' scheme in 1980—which saw many residents leave the flats to occupy their own houses in other parts of Sheffield—much of the original community abandoned the location and it suffered from disrepair and neglect. Despite this, in December 1998, Park Hill was officially Grade II* listed by English Heritage (now Historic England) providing salvation from the inevitable wrecking-ball culture being waged on other so-called 'brutalist' structures from the same period. To the VR immersant, the architectural importance of this location may not necessarily be apparent, however, you soon become aware of the unique spatial quality of the deck—a space which is effectively 'within' a building while simultaneously 'out in the open'—and appreciate the the crisp concrete balustrades, smooth wooden handrails, bright aluminium signage and clean, restored concrete surfaces and views of urban parkland. When contrasting Park Hill with the two following locations we can contemplate why it still exists —and can consequently be filmed with a 360 camera—and the other two have been virtually recreated in computer-generated imagery. Ultimately, Park Hill was recognised as being worthy of saving and conserved accordingly, unlike the other two structures which were treated far less kindly.

The second 'physical location' in *Schema*, after the abstract temporal landscape and the 'Street in the Sky' at Park Hill, is a virtual recreation of a real structure that has now been demolished and removed, the former Castle Square underground hub in Sheffield, better known as the 'Hole in the Road.' The computer generated model for this location was reworked from my project *The Virtual Hole in the Road* (2016), which sought to reconstruct the former civic circle using a realistic virtual reality environment augmented by the stories of those who remembered it. The original version of *The Virtual Hole in the Road* (2016) was imagined to exist in a parallel dimension, where the original structure had not been allowed to fall into a state of disrepair until it became an intimidating place to avoid and, alternatively, was still well-maintained by the local council and cherished by the city's inhabitants. The version of the VR location in *Schema* reverts back to the actual physical location towards the end of its life in the early 1990's – unloved and dishevelled, showing increasing signs of wear, damage, grime and graffiti. This is in direct contrast to the Park Hill 'Street in the Sky' scene which displays an architectural utopian dream from the same decade (1960's) that has transcended a period of neglect and has subsequently been restored and reimagined for the 21st century. There is deliberate juxtaposition of a 'real' building—which has been noticeably cleaned and restored and is consequently of a condition beyond that expected of a

structure of its time—and a virtual location which has been faithfully reproduced but not to its original, crisp, state and consequently feels more 'real', questioning if a virtual environment could eventually feel more 'real' than a physical one. The status of these two locations also provokes thought on the topic of how we should revive and represent buildings and places from history; it is not always appropriate or effective to portray them as idyllic architectural renders – they often offer greater value and potential as memory catalysts when depicted in a more realistic form.

The final 'outdoor' scene, high on a hill overlooking a green valley, is a recreation of an area from four hundred years ago, seemingly devoid of any trace of human life apart from a dominant mediaeval castle in the distance. Around this time—at the end of the sixteenth century—the castle had held captive its most famous prisoner, Mary Queen of Scots, from 1570 to 1584 (Moreland & Hadley 2020). The origins of Sheffield Castle date back to 1270 when Thomas de Furnival received a royal charter from King Henry III to build a castle in Sheffield, and the huge fortress was gradually expanded and stood for nearly 400 years until being finally demolished in 1648 on the orders of Oliver Cromwell during the English Civil War (1642–1651). The scene in *Schema* depicts the castle toward the end of the sixteenth century when it would have been at its most magnificent – although the area near the castle moat and drawbridge at this time would have been inhabited with some early streets and housing—the genesis of Sheffield city centre—whereas the landscape in *Schema* is based on how the undeveloped surrounding area would have looked when the castle was first constructed some centuries before. The mediaeval structure in *Schema* is an existing model of Sheffield Castle from an earlier project, *Experience Castlegate* (Bax, 2018), an augmented reality installation commissioned for the University of Sheffield's 'Festival of the Mind' which was a collaboration between University of Sheffield academics and staff in the departments of Archaeology and Architecture and the team at Human, the creative studio in Sheffield (led by myself), which expanded on work from *Digital Engagement for Heritage-led Urban Regeneration* (Hadley et al, 2017). As I outlined in a paper for *Shanghai Art Review* in 2019:

> The castle has been effectively removed from not only the landscape but also the collective memory of the population of Sheffield (UK). *Digital Engagement for Heritage-led Urban Regeneration* attempted to restore the castle to the city via immersive technology, which was further established via the AR recreation exhibited

> at the ‘Futurecade’ (Millennium Gallery, Sheffield) in September 2018 and the National Videogame Museum, July–September 2019. In addition to the AR exhibit, a ‘fly-through’ of the virtual model was projected at a large scale onto a modern building on the site of the former castle, effectively restoring the mediaeval structure to the physical space it had occupied 400 years ago. (Bax 2019)

The vantage point for the scene is set on a former deer park, part of the Castle grounds which were landscaped at considerable costs by the owners (Moreland & Hadley 2020) and later became the site of multiple buildings, including the Park Hill housing estate. The actual spot is roughly calculated to be the current site of Human’s design studio at 27 Gilbert Street, Park Hill, with the castle visible in the distance towards the north of the city. The precise location of the Park Hill ‘Street in the Sky’ scene in *Schema* is nearby, at the end of Hague Street, five floors above ground level and very near to the spot where the Sheffield Castle scene from four centuries earlier is based. While the three places in *Schema* display varying states of existence, condition and time, this relatively small area unites them; the locations of Park Hill, Castle Square and Sheffield Castle are all within a central zone of approximately half a mile, which also encapsulates my creative studio, Human, and the Millennium Gallery, where *Schema* was eventually shared with the Sheffield public. These virtual visions of concrete and castles, particularly the Park Hill scene, formed the basis for a follow-on XR Stories research project ‘Space, Time and Streets in the Sky’ (Bax & Hadley 2021).

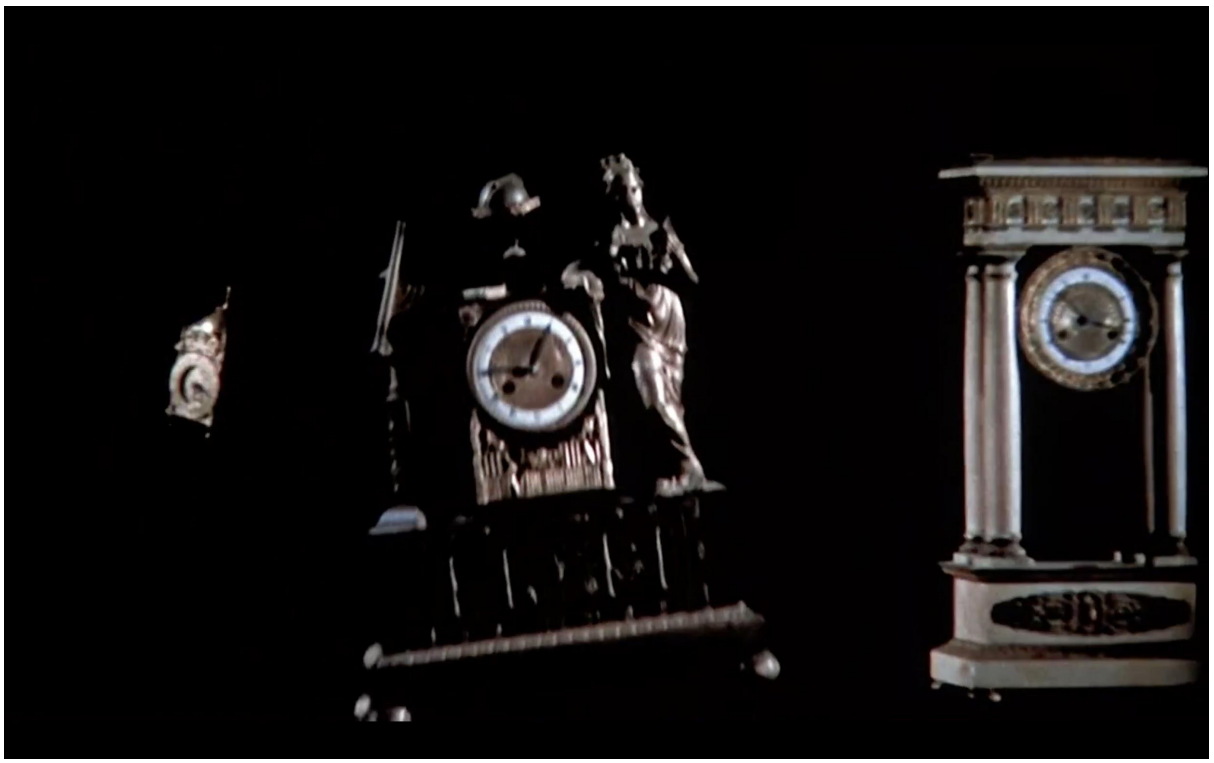

Figure 4.6 Screenshot from opening titles of *The Time Machine* (Pal 1960)

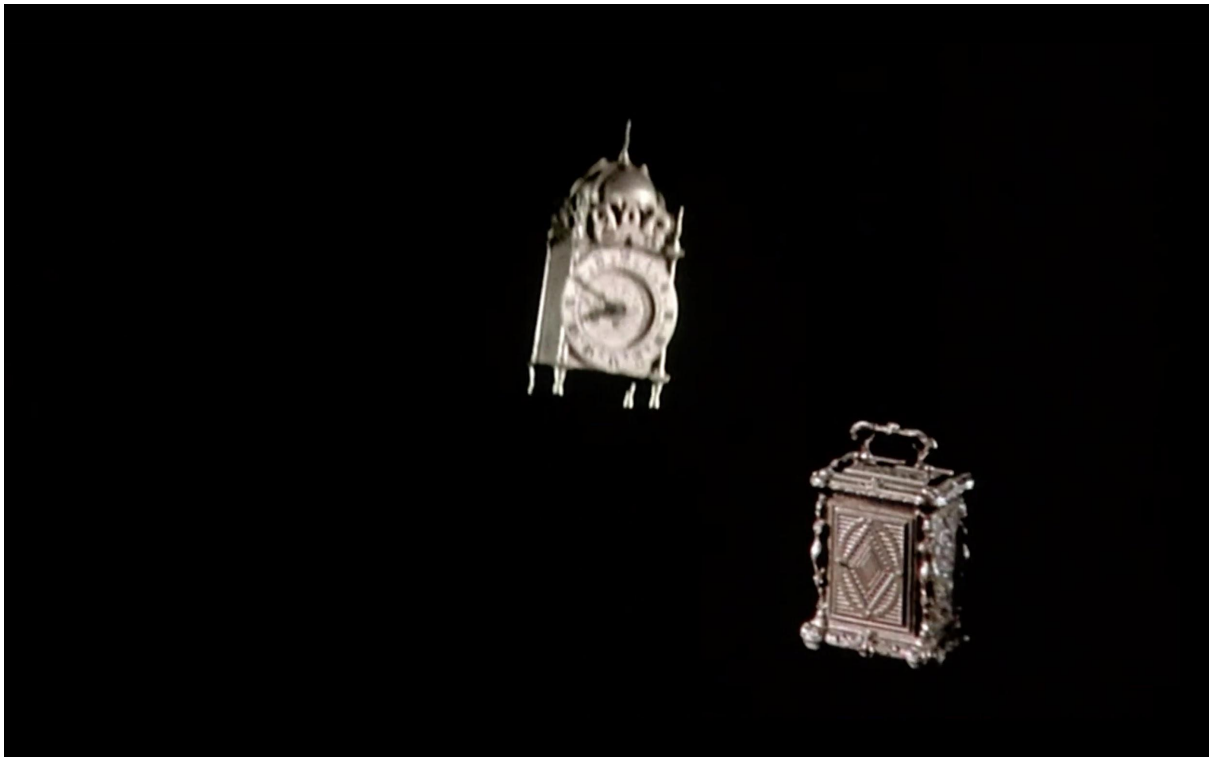

Figure 4.7 Screenshot from opening titles of *The Time Machine* (Pal 1960)

Figure 4.8 Screenshot from *Schema* (Bax 2020)

The creative direction for *Schema* takes inspiration from multiple sources, many of which I have listed and described in earlier chapters; the opening sequence of Pal's *The Time Machine* (1960) provided specific reference for the floating timepieces or 'temporal landscape' that recurs throughout *Schema*. The Casio digital wristwatch featured in *Schema* represents an identical model that I wore for several years and, similarly, all the clocks are based on items within my home—a Braun bedside alarm clock purchased in 1994 (see appendix), a Habitat LED block from the late 1990s (see appendix)—mirroring the exposing of personal history and revealing of domestic life in the work of Leckey and Rothberg, which I have detailed in previous chapters. The vertical positioning of the Casio watch mirrors Kubrick's use of the mysterious black monoliths in *2001*, creating an iconic motif for *Schema*, while deliberately sparse and motionless 360 locational scenes—with a total lack of human presence—echo the photography within the work of Akomfrah and Kubrick, effectively embodying the viewer in a similar way to the isolated individuals in works such as Akomfrah's *Purple* (2017).

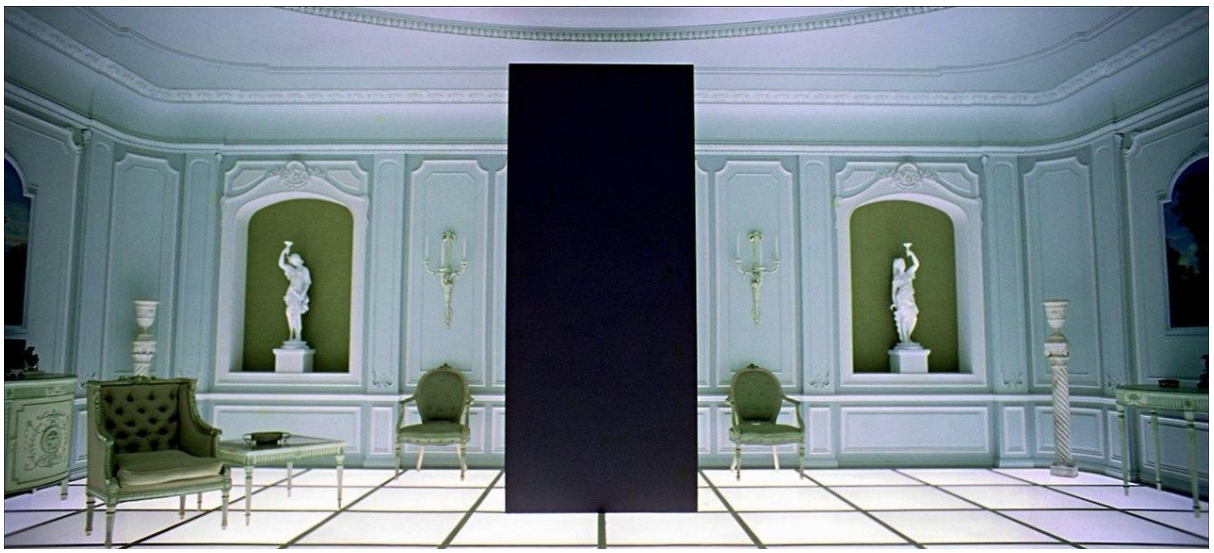

Figure 4.10 Screenshot from *2001: A Space Odyssey* (Kubrick 1968)

Figure 4.11 Screenshot from *Schema* (Bax 2020)

Figure 4.12 Screenshot from *Purple* (Akomfrah 2017)

Figure 4.13 Screenshot from *Purple* (Akomfrah 2017)

Figure 4.14 Screenshot from *Purple* (Akomfrah 2017)

The inclusion of the castle also serves as a reference to the mediaeval fortress in Christopher Priest's *A Dream of Wessex* (1977), highlighting the idea that our past can become our future, building on events within Priest's novel which see the 'cosmonauts of inner space' developing new lives in another dimension and becoming members of a community 'within a collective, virtual, reality' (Bax 2019). In featuring the development of a specific local geographical area over several centuries—linking a mediaeval castle with a concrete utopia within the propagation of a city— *Schema* shows that VR artworks do not necessarily need to be inherently abstract such as the experiments described by Lanier (2017). *Schema* demonstrates that VR can be utilised as a genuine, unique, platform for art within its own right and not solely as an extension of television, cinema, videogames or forms of 'immersive documentary.'

4.1 Virtual locality and non-diegetic sound

The overall artistic direction of *Schema* is informed by my professional experience as creative director of Human; within this role I have been responsible for overseeing the production of animated visuals for various performances, events and exhibitions since 2007. Following my creative direction, the visual elements of *Schema* were produced by Abby

Hambleton and Michaela White, both members of my creative team Human (aka Humanstudio and HumanVR). Michaela worked intensively on creating the 3D CGI models of the digital watch and clocks, having previously produced the virtual environment for *The Virtual Hole in the Road* (2016) and worked on the Sheffield Castle model (2018) with Dan Fleetwood (Lead Designer at Human). For *Schema*, Michaela also revisited *The Virtual Hole in the Road* (2016) under my creative direction and aged the urban environment, adding signs of wear and grime, so that it was no longer a carefully restored parallel dimension but more a true representation of the neglected civic structure towards the end of its life. Abby orchestrated the animation within the 'temporal landscape' sequences, including creating the large kitchen clock, and made the final CGI scene incorporating the distant view of Sheffield Castle. It was also Abby's role to work with myself as an editor, piecing together the various elements of 360 film and CGI animation to construct the nonlinear narrative whilst taking into consideration Tarkovsky's (1988, p. 117) comments on timing:

> Although the assembly of the shots is responsible for the structure of a film, it does not, as it is generally assumed, create its rhythm. The distinctive time running through the shots makes the rhythm of the picture; and rhythm is determined not by the length of the edited pieces, but by the pressure of the time that runs through them. The pieces that 'won't edit', that can't be properly joined, are those which record a radically different kind of time.

This is particularly pertinent to the editing of 360 VR sequences as, when a viewer is immersed in a 360 degree environment with no outside distractions, a period of sixty seconds—such as the location scenes in *Schema*—can seem a considerable amount of time, particularly when there is no discernable 'action' taking place and, consequently, the rhythm and 'pressure of time' (Tarkovsky 1988) is much slower. Equally, the viewer is effectively forced to notice details at a relatively frantic pace when items encircle them in an immersive space—as in 'temporal landscape' sequences within *Schema*—and a duration of thirty seconds can be more than enough. When considering the viewer's perception of stylistic tendencies within film, Bordwell (1985) notes: 'Film style may usually go unnoticed, but that does not entail that the spectator has no stylistic schemata' (p. 36). Due to the nonlinear nature and deliberate 'ambiguity' (Bordwell, 1985, p. 212) of *Schema*, the viewer is encouraged to take note of the very strong visual aesthetic that is employed throughout the piece, particularly the 'temporal landscape' sections. In this way, *Schema* is much more of a

soundtracked visual artwork than a film work conforming to what Bordwell (1985) would term as a 'Hollywood' narrative tradition.

While the team at Human could originate all the required visual components of the immersive experience for *Schema*, I needed to think separately about the audio format for the piece, how it would align with the visual content, and also assess the possibility of sounds reinforcing the sci-fi narrative. There were two main reasons for this; my personal expertise is within the visual arts—although I have extensive experience in working with musicians in my capacity as a designer, packaging their release and visuals for performances—and I am a strong advocate in the belief that the sound should function separately to the visuals, creating an additional and unique facet to the combined overall experience. Musician and sound artist Brian Eno states that a soundtrack should not be used to directly guide the viewer through visual events, as creating music that reacts to what is happening on-screen undermines the skill of the director and the intelligence of the audience (*Sound and Vision* 2020). This belief that a more nonlinear soundtrack should contribute another element to the experience – and not just describe or underline what is already there – is echoed in the work of Kubrick and Tarkovsky, particularly in *2001* and *Solaris* respectively and, accordingly, their application of music is within carefully constructed boundaries, as Bould (2014, p. 47) observes:

> Kubrick's *2001* is composed of sequences in which there is either music or speech, but never both. Tarkovsky also eschewed musical accompaniment, favouring a soundscape in which dialogue unfolds 'free of musical investment', and in which 'sound episodes' appear as 'extraordinary events' (Shpinitskaya 2006). He felt that 'the world as transformed by cinema and the world as transformed by music are parallel and in conflict with each other', and that instrumental music thus possessed too much autonomy, resisting dissolution 'into the film to the point where it becomes an organic part of it' (Shpinitskaya 2006).

With this in mind I chose to collaborate on the audio for *Schema* with Mark Fell, who created a unique soundtrack for the piece. The visual component of *Schema* was completed in full prior to Fell beginning work and remained subsequently unchanged. We had several discussions about the nature of the piece and the overarching concepts that I was attempting to convey, such as nonlinear time consciousness—a common recurring element within Fell's own work—and the recreation of memory. Fell is internationally recognised for his

innovative immersive sound installations in galleries and cultural venues around the world, such as BALTIC 39, Newcastle (2013); Trouw, Amsterdam (2013); Sage, Gateshead (2018); V&A Museum, London (2019) and Boston City Hall (2019), and yet this was his first attempt to create responsive binaural audio for a VR project, inspired by the panoramic nature of the visuals, effectively creating matching 360 audio to heighten the virtual sensorium. While originally conceptualising how the audio for *Schema* could work, I was inspired by Bould's (2014) description of the soundtrack in Tarkovsky's *Solaris*:

> Sometimes it sounds as if heavy plant machinery is starting up, sometimes as if a jet is taking off. There is a constant roar, noisy and grubby and industrial. It is impossible to distinguish between naturalistic sounds, sound effects and score. (p. 47)

This links directly to Bordwell (1985) on Pudovkin's theory of the 'invisible witness' or 'invisible observer' when he states how Pudovkin expands his theory of the camera being the eyes of the observer into sound, 'well, with the microphone taking the place of the observer's ears' (p. 9). This resonated with the type of non-direct, non-diegetic and deliberately evasive sounds that I felt would suit the visuals of *Schema*, creating a nonlinear soundtrack that does not necessarily guide viewers through the visual events they are experiencing (Eno 2020). During our ongoing discussions, I shared a short playlist of musical pieces that seemed to resonate with the visual element while expressing to Fell that he should interpret the environments in his own unique way and supplying a very sparse written brief:

> electronic sounds, <u>not</u> music
> no drums; possibly a pulse?
> recreating / representing nature

Fell used the clocks sequence as inspiration for the audio—the nature of their gears resonating with the use of nonlinear patterns—and devised a binaural experience using the physics of their movement as a mathematical base for the sound. While this did not have the traditional effect of the ticking of a clock, particularly as the overall rhythmic timing appears to be relatively nonlinear, the sounds subconsciously relate to the timepieces onscreen and the resulting audio-visual combination feels intuitively synchronised. The connection between the visual and sonic elements continues beyond the 'temporal landscape' sequences, which is partly due to a technique Fell utilised where the 'sense of space' is shared within the binaural

environment via subtle acoustic elements; for example, on the Park Hill housing deck, the noises within the soundtrack—echoes and drones—seem to bounce from the nearby surrounding wall and then dissipate where there is an absence of structure. Within the 'Hole in the Road' section, a high-pitched tone seems to resonate around the space – providing a 'sonic footprint' for the encircling curved walls, effectively a reversal of the process where a sign language interpreter visually describes a sentence. I spoke with Fell prior to his work on the soundtrack for *Schema* and he outlined his thoughts on the editing of sound and image within virtual environments (2020):

> I think a lot of the rules of editing in cinema and the way sound and image work are similar in a virtual environment. If you take two images and composite them together, and you don't do that very carefully, it's clear that there are two images composited together and it looks unconvincing … when you edit sound, you can create these layers and have lots of things happening at once… You can do all these things with different levels of reality and diegesis and play around with them...' (quote from interview with author)

Fell's comments regarding non-diegetic sound bring to mind Bould (2014, p. 47) describing the soundtrack to Tarkovsky's *Solaris* (1972): 'The motorway's 'permanent drone of traffic' (Fairweather 2012) is enhanced by Eduard Artemev's cacophonous score, which uses 'synthetic rather than acoustic sounds' (Fairweather 2012).' This also resonates as a description of the sonic assemblage in *Schema*, particularly where Fell uses an array of synthetic devices to illuminate the space that the viewer is experiencing, effectively augmenting the immersive environment. The nonlinear high-paced rhythm of Fell's non-diegetic soundtrack fills the void of inactivity in the 360-degree spaces and alters the sense of temporal awareness within them, as our ears search for signals of life in the desolate locations. When this additional element is brought to the experience, the immersant subconsciously connects the sounds to the imagery they are viewing and unplanned synergies – such as a clock sharply spinning in synchronicity with a high-pitched reverb – are perceived as highly-coordinated audio-visual moments when, in fact, they are more accurately described as 'planned coincidences.' With the use of clock gears and the physics of their movement as a mathematical base for the dominant rhythmic channel of *Schema* – the viewer may be unaware of the mathematics at play, but the overall sensory impact of the 'spatial synthesis' is no less powerful as a consequence. Players of videogames are accustomed to

experiencing realistic sounds within virtual environments in order to enhance the sense of 'reality', however, *Schema* demonstrates that more ambiguous 'Art-XR' pieces do not seek to emulate reality and, consequently, diegetic sounds are not expected or particularly reassuring – the environment is equally 'believable' with non-diegetic sound.

4.2 Recognising the past and connecting to the future

Throughout *Schema* the viewer is a virtual entity, in that they do not possess a typical human shape or any form resembling legs, arms or body; they are simply 'there', as a presence, in the environment, observing. The sensation of passing into and out of the watch face provokes the question of our scale within the virtual environment and underlines the fact that—even when we are effectively 'invisible'—we automatically assume that our 'virtual self' is still a human form of average size and not a presence the size of a photon. This assumption is probably based on the sensation that the surrounding virtual environment feels a familiar scale to our virtual selves and, for all three 'external' locations featured in *Schema*, the 'camera position' is the approximate head height of an average human. The one exception to this is the 'temporal landscape' sequences where the viewer is unable to gauge their physical form in any way; they can only assume that the objects being presented—six clocks and a watch—are at the scale we would encounter in our everyday lives although, as we are drawn into and out from the watch, we are forced to wonder if this is actually the case. It was my intention to demonstrate with *Schema* that, in order to have 'presence' within a virtual reality experience, the viewer does not necessarily need to see their 'virtual body' or adhere to the standard rules of physics. We may not be able to see our body or legs, but we still very much feel we are standing within a 'place.' We may be the size of an ant rather than a human, but the illusion of 'being there' persists, and the experience remains intact regardless of how physically impossible or difficult to believe it may be.

All three interactive versions of *Schema* managed to generate a sense of virtual presence and immersion as defined by Weinel (2018, p. 138) when outlining the properties of interactivity within non-linear media, such as video games, which 'may offer kinaesthetic, spatial, shared, narrative, affective, and lucid forms of 'player involvement' … According to Cajella, these six forms of involvement allow the player to build up a mental representation of a given virtual environment, and gain a sense of habitation within it' (p. 138). Not all of these 'six

forms of involvement' (Cajella 2011) were employed in *Schema*, but the experience imbued sufficient levels of immersion and presence which, as Weinel (2018, p. 139) suggests, are markedly different properties: ''Immersion' describes the capabilities of technology for submerging an individual into a virtual environment, while 'presence' describes the feeling of 'being there' that such experiences may produce (Slater and Wilbur, 1997).' Weinel (2018, p. 139) concludes that 'being immersed in these electronic environments may lead to feelings of 'presence', as the user feels like there are 'really there.' Within this context, the devices used for viewing *Schema*—a VR headset, or a mobile device or a tablet—may have been responsible for the sense of 'immersion', but the feeling of 'presence' or 'being there' was produced by the scenes displayed within them (Slater and Wilbur, 1997). When considering the use of the term 'presence' within such virtual experiences, Weinel (2018, p. 139) states: 'The term "presence" originated from Minsky's (1980) discussions of "telepresence" systems for industrial applications that require remote operation, such as may be encountered in nuclear power plants or space stations, which present situations otherwise inaccessible to humans.' The relatively mundane and industrial background of the term seems incongruous to the contemporary use, which many people possibly assume comes from a more spiritual or psychological origin.

To curate the contents of the Futurecade, which eventually amounted to 21 unique exhibits, the University of Sheffield appointed immersive media experts Mark Atkin and Tom Millen from Crossover Labs, a company with extensive experience in the curation and production of innovative storytelling. I met with Mark and Tom several times, in person and online, to explain the concept and content of *Schema* and to discuss the format of the piece for the Millennium Gallery. I was keen to add an additional element to the gallery installation and create the extra-sensory experience of seeing physical items in the gallery space—the digital watch and three clocks—transformed into virtual entities as part of the multi-screen artwork. This advantage of a physical 'gallery space' provided an opportunity to introduce the audience to the concept of solid 'real life' objects being transformed to virtual entities and also proved that the clocks were genuine artefacts, not purely digital creations. It was agreed to include four identical plinths within the installation space, each just over a metre high and exhibiting a different timepiece, along with the addition of a two metre high banner displaying a photograph of the original Casio wristwatch—an image which was also used for *Schema* on the Festival of the Mind project webpage and all online publicity material—as an iconic 'totem' for the installation experience. The central location of the Millennium Gallery,

Sheffield, was a considerable factor when selecting the virtual environments within *Schema*: both *The Virtual Hole in the Road* (2016) and the augmented reality model of Sheffield Castle (2018) had been exhibited as part of the Futurecade in previous iterations of the Festival of the Mind (2016, 2018). Additionally, the prominent landmark of Park Hill – Europe's largest Grade II listed building – is visible from the gallery location and an established architectural, historic and cultural icon within the city, heightening the poignancy and impact for local people viewing the piece, particularly for those who visited the installation at the Millennium Gallery – a short walk from where all three virtual locations previously physically existed or currently remain. Equally, many of those visiting the exhibition may have been unaware of the significance of the virtual places featured within *Schema* and this was firmly in my mind when creating the piece; the locality adds extra internal layers of resonance, but it is not essential to the purpose or narrative of the work. However, for many of those experiencing the piece, *Schema* creates multiple meanings via the visitors' own interpretive resources and knowledge of place and history, effectively becoming a catalyst for memory and imagination.

The full VR experience could be accessed by viewing the YouTube version via a VR headset, although I was well aware that a relatively small number of people would have the facilities to do this. Interest in *Schema*—within academia and from the general public—was fuelled by a University of Sheffield news feature on 14 September 2020 (*Public invited to step into new virtual reality world at Festival of the Mind*, 2020) regarding the Futurecade and the 'new virtual reality world' it presented, highlighting *Schema* and including quotes from myself reflecting on the project and my research in general. Despite very restrictive circumstances due to the Covid-19 pandemic, 1,707 people visited the Futurecade in the Millennium Gallery during the 11 days of Festival of the Mind from 17-27th September; however, I was conscious that the *Schema* would mainly be viewed by 'virtual visitors' via their own mobile phones, tablets, laptops or desktop computers. With this in mind, I produced an online offering for the Festival of the Mind website that could be viewed directly in YouTube, utilising the accelerometer inside mobiles and tablets, effectively allowing participants to move the device around in their own physical space to see the 360 surroundings in the virtual space. A 360 view could also be gained on laptops or desktops—or mobile devices without the YouTube app—but this required direct interaction such as dragging a finger or clicking a mouse, and was consequently not as intuitive or effective as the YouTube 360 experience.

Through the various planned and enforced formats; myself, the curators and the extended team involved in the project learned much regarding 'format flexibility' within XR projects, with *Schema* effectively transforming into a creative practice pilot for exhibiting in a non-restrictive (physical or temporal) form. It was my primary intention for *Schema* to provide a suggestion of how a range of specific, linked, locations from multiple time periods could all be linked within an immersive experience, using the 'temporal landscape' as a narrative device. The past was represented by the former structures of Sheffield Castle (1270–1648) and the nearby destination of Castle Square (1967–1994) which existed in different centuries, and also the reference to Pal's opening sequence for *The Time Machine* (1960), with the present being formed by the 'deck' location of Sheffield's Park Hill estate, which could also arguably be in the near future or recent past. A sense of 'things to come' is also encapsulated by the inclusion of re-evaluated and rejuvenated 1960s brutalist structures and a hint of the 'memory contamination' that the XR recreation of former places might provoke, particularly if such activity becomes a common occurrence in our future society. The mixing of 360 film and realistic and surreal computer generated sequences also highlights the comments of Palermos (2017, p. 134) in previous chapters, envisaging a time where it is 'impossible to distance ourselves from this added dimension of future society' and, despite immeasurable numerous benefits, there remains a 'serious danger of being unable to tell reality and Augmented Reality apart.' The deliberate blurring of past and current dimensions within *Schema* envisages a scenario outlined by Slater et al (2020, pp. 5-6), which I have previously discussed, where 'Participants remember virtual events as if they had been real, and fail to distinguish over time events that really happened and those that happened in XR … After spending some time in a scenario people forget the device-gap and become unsure about whether they are experiencing reality or virtual reality.' Ultimately, as Atkin (2019) summarised when discussing the adoption of spatial computing: 'these technologies will become the operating system through which we navigate our worlds' and it may become increasingly difficult to differentiate the past from the present, or visualisations of the future. With this in mind, on multiple levels, *Schema* reinforces Fell's comments that 'landscape is just a different place in time' (Fell 2020) and, within this context, the VR artwork was conceived and executed as a potential roadmap for future augmented and mixed reality experiences.

4.3 Digital Simulacra and Psychic Vivisection

The narrative language of *Schema* is heavily indebted to multiple outputs of science fiction, or 'sci-fi', or 'speculative fiction', from various sources that I have outlined. Via literature or screen, such stories often serve as a laboratory for ideas and a testing ground for what kind of future we may or may not want to inhibit, as Neil Gaiman (2016, p. X) articulates in his introduction to the Penguin Galaxy Series of science fiction classics:

> Speculative fiction serves a different purpose from other branches of fiction. Most fields of literature aim to illuminate the world we live in by depicting it as accurately and completely as possible. SF, on the other hand, normally aims to illuminate the world by depicting something quite different from the quotidian and day-to-day reality; instead, it shows us our world reflected, our lives extrapolated.

Although Stuart Gordon's 1986 film *From Beyond* (1986) may traditionally be overlooked as a source of futuristic inspiration, it depicts a unique form of mixed reality as the main protagonists experience a parallel dimension overlaid on their real world. Adapted from H.P. Lovecraft's short story *From Beyond* (1920, published 1934), two scientists – Dr. Edward Pretorius and his assistant Dr. Crawford Tillinghast – run a series of experiments to stimulate the pineal gland with their invention called 'The Resonator' which produces the ability to see into another dimension. However, events expand beyond their control and they are soon consumed by a psychic presence and attacked by vicious creatures from the alternate reality. It is worth noting that—in some amphibian and reptile species—the pineal gland is connected to a light-sensing organ called the parietal eye, also known as the pineal eye or 'third eye', a term that could be used to describe current technological developments in extended reality. The scenes from Gordon's film in which the scientists interact with elements from another dimension within their laboratory could be viewed as AR concept development.

Other science fiction authors—Arthur C. Clarke, William Gibson and Philip K. Dick, for example—seem to equally capture an essence of the future in stories written decades previously and, subsequently, their work is often hailed as prophetic. In his debut novel *Neuromancer* (1984), William Gibson imagined a future Earth where boundaries between human and digital are blurred in 'The Matrix', via tangled narratives of simulated realities,

mainframe hacking, AI entities and body upgrades. I would argue that—rather than these iconic authors magically guessing the future—in reality the future is actually directed to resemble their fiction. For example, the communication devices from *Star Trek*—which first appeared in 1966—influenced a generation of technologists developing the mobile phone. As Mark Atkin argues when discussing the influence of *Star Trek* on the evolution of technology: 'It's incredibly important that this type of science-fiction allows us to imagine futures... If we don't have progressive visions of the future, then that technology will be dystopian' (Atkin 2020). With this, Atkin is alluding to the idea that dystopian stories cultivate a similarly dystopian outlook and that—in order to fashion a more positive 'protopian' future—we need hope and the positivity to create 'progressive visions' (Atkin 2019). According to Merchant (2018), the operating interface for the original iPhone was directly influenced by the hand gesture interface depicted in Spielberg's film *Minority Report* (2002), which was based on Philip K. Dick's 1956 short story of the same name. Before production began, Spielberg held a three-day summit with a think-tank of fifteen protopian experts from academia, industry and creative circles—including Jaron Lanier and author Douglas Copeland, alongside architects, scientists and journalists—to help him shape a convincing environment for the 2054 setting. One by-product of this collective was, according to Merchant (2018), '*Minority Report* produced a hundred patents and helped rapidly mainstream the concept of gesture-based computing—not just the iPhone but all touchscreen tablets, the Kinect, the Wii—and became cultural shorthand for anyone looking to point their ventures toward the future.' This fascinating cycle of technology following fiction is observed by Bryant & Pollock (2010) in their reference to Gibson's *Neuromancer* (1984):

> In an afterword to the twentieth anniversary of the novel (*Neuromancer)* in 2004, fellow science-fiction author Jack Womack suggested the possibility that the imagined worlds of fiction that Gibson named influenced the way in which cybercultures and their technologies were themselves subsequently elaborated. (Bryant & Pollock, 2010, p. 11)

Gibson's subsequent novels in what became known as the 'Sprawl Trilogy'—*Count Zero* and *Mona Lisa Overdrive*—expanded the world of *Neuromancer* and sealed his reputation as a unique sci-fi visionary. Much of Gibson's later work drifted toward the present as he seemed increasingly disinterested in writing about the future, however, as Gaiman (2016) observes: 'If, these days, his novels are set in the here and now, perhaps it is because the here and now

is science-fiction.' In this quote Gaiman underlines the unique symbiotic nature of the relationship between fictional stories and the advance of technology.

The impact of science fiction stories transcends the shaping of 'hardware'—buildings, vehicles and communication interfaces—it also imagines new 'software'; redefining relationships, memory and virtual lives. The main character in Stanisław Lem's best-known novel *Solaris* (1961) is Dr. Kris Kelvin, a psychologist tasked with visiting a space station orbiting the planet of Solaris after a series of mysterious events. Kelvin arrives to find the facility and crew in a state of disarray and is soon confronted by a woman with an identical likeness to his deceased wife, Harey (renamed Rheya in the Kilmartin-Cox English translation – an anagram of Harey). He discovers that the other human passengers all have similar 'impossible companions' from their history on Earth, seemingly somehow generated by a form of intelligence emitting from the mysterious planet below. The book was the basis of Andrei Tarkovsky's critically-acclaimed 1972 film of the same name, helping to seal Lem's global reputation as a master of modern science fiction. While much of the public focus of Tarkovsky's film may have rested on the stunning visual effects—the gigantic interstellar craft, a convincingly neglected space station and the beautiful depiction of the mysterious planet Solaris—it also brought to life Lem's concept of human simulacra, as we see someone replicated perfectly in every way. The only visible flaw in the planet's 'copy' of Harey is the incorrect formatting of the cord fastening on her dress, which results in the couple having to cut the garment with a pair of scissors in order to release her from it. As Kelvin and Harey spend more time together it becomes clear that there are more serious issues to address than a faulty garment as Harey's state of mind becomes an increasing cause for concern. With this relationship Lem and—subsequently—Tarkovsky were starting to imagine the issues that could arise from intelligent human simulacra being unleashed on society.

The idea of beings leaping from our minds into physical space may have seemed pure science fiction in 1961, but recent developments in virtual reality are making such a proposal increasingly realistic. In the latter stages of Lem's novel, when Kelvin is discussing with Snaut (renamed Snow in the Kilmartin-Cox English translation) how their respective 'visitors' have come to be, he speculates that the planet (Solaris) has taken information from them and somehow delved into their individual personal memories:

> It has performed a series of... experiments on us. Psychic vivisection. It has used knowledge which it stole from our minds without our consent. (Lem, 1961, p. 201)

This sense of a mysterious entity taking our memories—which are effectively data—and using them without consent, is now very often a part of modern day life which can help, entertain, or comfort us. When the algorithms of digital platforms such as Facebook survey our digital memories—personal photographs and videos—and then present them back to us as 'highlights of the year', we experience a data form of the 'psychic vivisection' described by Lem (1961). The software has no idea how relevant or poignant each picture is to the user, or if it might prompt a significant psychological or emotional response, the only way it can gauge reaction is via popularity – the number of views or 'likes.' Similarly, when the intelligent planet of *Solaris* selects figures to revive from the minds of the orbiting space station crew, it chooses the individuals that are most deeply-etched into the memory of the humans, with the circumstances of their original relationships neither considered or understood. This is another example of a fictional narrative—in this case Lem (1961)—anticipating technological advances, specifically the way in which certain technologies embed themselves in the experiences and lives of human users.

This brings to mind Caroline White's previous quote when discussing immersive technology and using social media to explore time and place: 'Facebook are doing it very badly... with loads of really insensitive things like: 'here you are having a party' — and your mum died the next day and they never mention that, and they don't know that' (White 2019). As I have already outlined when discussing Rothberg's *Memory/Place: My House* (2014–15), machines organising and presenting our personal memories can understand and decode when or where an image was taken or video recorded, but they are unaware of the personal implications, historical importance, or emotional impact that are inherently connected to them. This is the case with the individuals that are revived in *Solaris* (Lem 1961) and potentially the same issues will occur if and when an AI-driven system creates virtual entities from our past.

At the end of Steven Soderbergh's version of *Solaris* (2002)—which more closely adheres to Lem's original text—Kelvin (George Clooney) touches the hand offered by Gibrarian's simulacrum son and is forever reunited with a copy of his wife Rheya (Natasha McElhone) on a representation of Earth. Similarly, at the finale of Spielberg's *A.I.* (2001), the android David is discovered entombed in ice by an extraterrestrial race who then reunite him with his

human mother in their apartment. The filmmaker and critic Jamie Stuart suggests that this family activity is purely a memory implant, an alien act of kindness to an autonomous being in the closing stages of existence and, taking the *Solaris* example into account, this could well be the case. Certainly, in Soderbergh's *Solaris* (2002) we are left in no doubt that Kelvin remains on the space station and his return to Earth is purely a journey of the mind, and this willingness to succumb to a virtual existence is echoed by Roger Ebert (2003) in his review of Tarkovsky's *Solaris* (1972):

> Some years before virtual reality became a byword, Tarkovsky was exploring its implications. Although other persons no doubt exist in independent physical space, our entire relationship with them exists in our minds. When we touch them, it is not the touch we experience, but our consciousness of the touch.

This specific element of virtual reality that Ebert highlights, of experiencing the 'consciousness of the touch', is a key factor in the future planning of sensorial technology, particularly haptic research – when people see something in virtual reality, how can we help them feel it too? This question is currently firmly in the realm of immersive technologists, however, once they have created the software and hardware to access such sensory factors, it will open a whole new palette for artists to work with, as suggested by pieces such as *Notes On Blindness: Into Darkness* (2016) and *We Live in an Ocean of Air* (2018), which I have already examined.

The visionary work of Lem, Tarkovsky, Gibson et al continues to influence the development of current visual artists, particularly those concerned with the human implications of virtual reality. Dutch artists, filmmakers and designers Metahaven (Vinca Kruk and Daniel van der Velden) engrain the spirit of Tarkovsky and Sprawl-era Gibson in much of their output, often explicitly in pieces such as *Digital Tarkovsky: Rolling Titles* (2018), sometimes in reference with work such as *The Sprawl* (2016), or in more subtle visual ways as in *Information Skies* (2016) which, according to the creators, 'questions how deep immersion in digital augmentation, combined with our persisting emotional limits as humans, is altering our capacity to decide on what constitutes 'reality'' (Metahaven 2016). A 24-minute fusion of live action, graphic overlays and animated sequences, *Information Skies* (2016) features a young man and woman in a forest setting, seemingly on the outskirts of a built environment, in an area not dissimilar to The Zone in Tarkovsky's *Stalker* (1979). The two figures, who are

initially deeply immersed within VR headsets, eventually remove the technology from their faces and discover that the visions from their digital dreams persist, blurring the boundary between reality and their virtual world. Curator and writer Karen Archey (2018) observes: 'Metahaven's films engage fictive, factual and poetic forms of narration – they extend out from investigations into mythmaking and branding, the increasingly fragmentary narrative effects of cloud platforms, and the epic linguistic and visual textures of the cinematic.' The formal features of *Information Skies* (2016)—long takes of landscape, flowing streams, close studies of moss and fauna—are consciously reminiscent of Tarkovsky's work, particularly the Earth scenes from *Solaris* (1972), with the natural setting deliberately contrasting the ongoing otherworldliness, as in Tarkovsky's film. Beyond the Tarkovsky-esque 'visual textures' (Archey 2018), *Information Skies* (2016) is also one of the first films since *The Lawnmower Man* (1992) to hypothesize on the effects of VR immersion and suggest that a sense of 'other' may persist long after the headset has been removed.

The liminal space between the virtual and the real, and the idea that some people may prefer to live in the virtual at the expense of the real, is explored by writer/futurist Charlie Brooker in *San Junipero* (2016), an episode from the third series of his technology-centred tales *Black Mirror*. *San Junipero* (2016) tells the story of two women—Yorkie and Kelly—who meet and fall in love in the beach town of San Junipero, a utopia which is eventually revealed to be a simulated VR environment inhabited by elderly and deceased people. As the story progresses we learn that the two athletic twenty-somethings who constantly party in San Junipero's 1980s bars and clubs as they time-travel through the 1980s, are actually senior citizens – one of whom is nearing the end of her life. Hailed by critics as one of the television highlights of 2016, *San Junipero* won two Primetime Emmy Awards for its groundbreaking depiction of a virtual reality love affair. The final scene depicts rows of generic computer banks juxtaposed with Belinda Carlisle's song *Heaven is a Place on Earth* (1987), highlighting that the couple's chosen heaven is actually a place on Earth (in a computer bank). I would suggest that the rolling views of the mesmerising planet surface in *Solaris* (1972) are a precursor to the mysterious and endless rows of servers in *San Junipero* (2016), where the intelligence generating the simulacra is finally revealed; cosmic wonder or technological singularity.

One unique quality of *San Junipero* (2016) was a positive portrayal of extended reality technology which eventually produces a happy ending. So often in science fiction stories,

technology is portrayed in a dangerous or problematic form, as the artist Mark Fell (2020) observes:

> What is interesting about how technology is represented in science fiction is that it tends to be looked on as something threatening to humanity ... like the 'Terminator' films, for example … I think that narrative is really deep through the history of Western culture, that technology is viewed as something a little bit worrying. If you go back through Western thought, making and doing are seen as subservient to thinking … So this hostility towards the mechanics of the world runs deep in our society and our thinking, so I think science fiction expresses that. (quote from interview with author)

A deep mistrust of technology is certainly present in a great deal of science fiction, sometimes as the main narrative of the story, with positive glimpses of future-tech only occasionally appearing from the sidelines, reminding us that the setting is not the present. *San Junipero* (2016) did not contain any such threat, the only fearful element in the story being the decision whether or not to commit to a fully virtual existence when our time on Earth comes to an end. Many futuristic stories can effectively be perceived as laboratories for testing ideas and conceptual thinking, as Fell (2020) summarises: 'Science fiction – it's a place where we can collectively imagine what might be and make moral judgements. Science-fiction is a place to process fears, ambitions.' This statement connects strongly with the alternative title for sci-fi – 'speculative fiction' – and links back to the quote from Gaiman (2016) that 'Speculative fiction serves a different purpose from other branches of fiction.' According to Archey (2018) 'Science fiction dares to imagine life under fantastical conditions that, with a twist of the kaleidoscope, lay bare the truths of our own' – and stories such as *From Beyond* (1920), *The Minority Report* (1956), *Solaris* (1961), *Neuromancer* (1984), *Information Skies* (2016) and *San Junipero* (2016) certainly seem to achieve that, both in terms of holding a critical lens to our current position and helping to navigate the future. Inspired by the title sequence of *The Time Machine* by George Pal, a model of special effects cinematic technology in 1960, *Schema* further tests and expands Pudovkin's theory of the 'invisible witness' placing the viewer in a space where it is impossible to gauge one's physical scale or location. Pimentel & Teixeira (1993) claimed that 'Virtual art can be used as a new kind of mirror to explore and challenge ideas, experiences, and states of mind in the real world' (p. 232) and my intention was for *Schema* to underline and substantiate this claim.

Emerging and future XR landscapes blur the boundaries between digital and real-world content; *Schema* predicts and tests this by combining real 360 footage with different aspects of CGI imagery containing varying levels of realism. Taking inspiration from Kubrick, Pal and Tarkovsky, *Schema* also proposes a structure for how a range of specific, linked, locations from multiple time periods could all be linked within an immersive experience, using the 'temporal landscape' as a narrative device.

4.4 'Are you real?'/'Does it matter?'

Fuelled by the rise of digital humans and virtual characters we see ongoing academic and public debate surrounding the legitimacy, importance and status of such entities, described by Pauline Oliveros (2022/2010, p. 43) as 'grappling with who we are as extended humans – hybrid computer/humans and computer beings.' Amongst this emerging landscape of immersive technology, we see the science fiction of *Solaris* becoming science fact, with people from the past or present—or maybe even the future—existing as digital simulacra that, through mixed reality technology, seem real. Before examining our perception of virtual reality or XR experiences, I would suggest it is worth briefly considering the meaning of simulacra and how it relates to 'the virtual.' In Latin, 'simulacrum' is a term for likeness or similarity – in the modern sense 'simulacrum' is usually taken to mean a representation of something or someone and, generally, when we describe something or someone as 'simulacral', we mean a copy or representation. In their respective publications about simulacra, Jean Baudrillard and Pierre Lévy both wrote about 'the virtual' and had seemingly opposing views on that which is not 'real' (Ryan 2015, p. 19-29). For Baudrillard, modern human experience is a simulation of reality, with symbols and signs replacing all reality and meaning, as he states in *The Precession of Simulacra* (1983):

> This would be the successive phases of the image:
> - it is the reflection of a basic reality
> - it masks and perverts a basic reality
> - it masks the absence of a basic reality
> - it bears no relation to any reality whatever: it is its own pure simulacrum.

> In the first case, the image is a good appearance - the representation is of the order of sacrament. In the second, it is an evil appearance - of the order of malefice. In the third, it plays at being an appearance - it is of the order of sorcery. In the fourth, it is no longer in the order of appearance at all, but of simulation. (p. 412)

Baudrillard (1983) states there is either real or not real, genuine or fake, and he perceives a simulacrum as being a fake or an illusion. His mistrust and repulsion of simulacra can be seen to reflect science fiction's hostility toward technology highlighted by Fell (2020) but, at the same time, there is admittedly something in Baudrillard's description of simulacrum formation that echoes how a virtual reality 'mirrorworld' could be created. Lévy, however, views 'the virtual' as being a predecessor to 'the real' and it is worth noting that, within philosophy, 'actual/virtual' are not binary either/or – 'virtual' is something that has the potential to be 'actual', as Lévy (1998) articulates:

> The virtual is by no means opposite of the real. On the contrary, it is a fecund and powerful mode of being that expands the process of creation, opens up the future, injects a core of meaning beneath the platitude of immediate physical presence. (p. 16)

In the current emerging digital environment the term 'simulacra' is regularly used to describe something that is artificial or fake. However, I would argue that this is entirely biased toward Baudrillard's definition of the virtual and does not take into account Lévy's more positive stance. The definition suggested by Lévy is certainly more suitable when framing the experience of Kelvin in Lem's *Solaris* (1961), in that he is clearly aware that his companion on the space station cannot be real and yet, ultimately, he chooses not to care. For him, her existence is 'virtual' in the sense that she has the potential to become real—to form her own opinions and personality separate from the individual that she simulates—and become her own person. While she may not be human, she is neither purely just a fake copy or counterfeit version of his former wife. This potential to be 'actual' in the context of our current world environment has come into being through recent advances in immersive technology—the magic that Lem (1961) imagined being performed by a mystical planet now being digitally simulated by a series of complex softwares—creating non-human beings with which we can interact and cohabitate. In our real world, we naturally grant young children or

animals the space to grow and learn, and we will have to extend a similar level of patience to virtual beings so that they may fulfil their potential, albeit at an inherently increased pace.

> ‘Are you real?’
> ‘Does it matter?’
> *Westworld* (Season 1, 2016)

Based on the 1973 film written and directed by Michael Crichton, the television series *Westworld* (2016-18) created by Jonathan Nolan and Lisa Joy is a prime-time examination of simulacra and what it means to be real. The simulacrum entities in *Westworld* (2016-18) are not virtual beings in a mixed reality sense, but sophisticated physical robots that—to anyone but experts—are indistinguishable from humans. However, as their consciousness is driven by AI and they are essentially cybernetic organisms with electronic components, each ‘robot’ can be viewed as the physical form of a digital being. The robots—who only dwell within the large leisure resort of Westworld and not in the outside world—are given the term ‘hosts’ by their creators to differentiate them from ‘visitors’ to the amusement park. The hosts are given the memories of real people, attributed roles within a series of scenarios and stories within various areas of the park, and go about their duties on a daily basis, unaware that they are robots with ‘fake’ memories. Eventually, and inevitably, many of the visitors—and some of the creators—develop emotional and physical relationships with the hosts and, in some cases, help them come to terms with the fact that they are simulacra, mirroring the discussions between Harey and Kelvin in *Solaris* (1961).

While the blistering pace of current AI research may point toward the eventual emergence of fully-autonomous digital beings, *Westworld* shows us that there is a long way to go before convincing physical human simulacra can be perfected. Apart from purely physical likeness and body movement, in order to totally simulate human contact we will need to create sensory devices to simulate smell and temperature. Feeling the warmth of another’s hand or capturing the faint distinctive odour of someone’s perfume, cologne or hair may seem like relatively insignificant details, but surely such sensory information would contribute greatly to the detail and perceived reality of a virtual encounter. There are obvious advantages of being able to (re)create people in this way and, in certain situations, the use of such virtual beings could be invaluable and/or irreplaceable. In *Human Assets: The Promise and Dread of Digitising Humans* (Atkin 2018), documentary curator and filmmaker Mark Atkin enthuses

the emerging possibilities surrounding the creation of virtual historical figures, 'since it opens up a world of opportunity to engage audiences in history, science, and archaeology in new and exciting ways.' However, as Atkin examines the pros and cons of such technologies he arrives at a dramatic conclusion:

> We need a new definition of human value in media and a new definition of what a documentary is. We are being presented with one of the greatest challenges to journalism and documentary that we have yet faced: How can we redefine our craft when we can no longer tell truth from fiction?

In this statement, Atkin (2018) raises the fears highlighted by Baudrillard (1983) surrounding the 'fake' being viewed as 'fact.' The view of Lévy that 'the virtual' can become 'the real' is not an aspect that Atkin or any of his peers would welcome within documentary film or journalistic reporting and, for these areas, the line between truth and fiction needs to be firmly established. The ongoing debate surrounding virtual beings is not solely limited to fictional or historical characters; in his 2019 article for *The Guardian*, 'Celebrity Holograms', Owen Myers addresses some of the ethical issues of digitally resurrecting deceased actors and musicians, including insights from Professor Robin James who claims: 'Long-dead people who couldn't imagine that this sort of tech would ever exist would likely have never consented to this specific use of their work and image' (Myers 2019). In the same article, music critic and author Simon Reynolds questions the validity of hologram tours by deceased musicians:

> A performance – whether showbiz entertainment or performance art – is by definition live, involving the unmediated presence of living performers, whereas the hologram tours are 'un-live' and involve non-presence. On an ethical and economic level, I would liken it to a form of 'ghost slavery', that applies certainly when done without the consent of the star, (but rather) by the artist's estate in collusion with the record company or tour promoter.

Reynold's words were brought into sharp focus in 2020 when the singer Whitney Houston, who died in 2012, was resurrected in holographic form for *An Evening With Whitney: The Whitney Houston Hologram Tour* (2020) which visited London, Birmingham, Manchester, Sheffield, Glasgow, Dublin, Cardiff and other UK venues – and was followed by a planned

residency at the Flamingo Showroom in Las Vegas. One advantage of this kind of event is that the performance could potentially take place in several venues simultaneously, although this further demonstrates how unauthentic and reproduced the audience experience is – you are not watching an exclusive live performance that is solely happening in your space and time, but one of many 'un-live' performances by what Reynolds (2019) would label a 'ghost-slave.' The resurrection of the dead and rise of digital simulacra is not only limited to historical characters or famous singers, but also has huge ramifications for the film industry. In a 2018 article from *The Telegraph*—'How Hollywood actors are writing wills to control their CGI selves from beyond the grave'—special effects expert Tim Webber is quoted as saying that 'the technological barriers preventing a digital recreation so perfect as to be undetectable have already been passed. The actual world and the imagined world are coming together, visual effects have merged with the real.' In the same piece Mike McGee—co-founder of visual effects company Framestore—says: 'they [dead people] can begin to have new consciousness. It's only a small step to interactive conversations with holographic versions of dead celebrities or historical figures.' This proved to be the case when, 20 months later, the same newspaper reported that James Dean had been cast in a new film, 64 years after his death. According to the article, *Finding Jack*, which is described as 'an action film about 10,000 military dogs that were abandoned at the end of the Vietnam War' (*The Telegraph* 2019), features the actor in the supporting role of Rogan, with archive footage and photographs used to reconstruct Dean's visual presence and another actor providing his voice. Speaking of the approval the producers had gained from the deceased star's family, director Anton Ernst declared: 'We feel very honoured that his family supports us… The family views this as his fourth movie, a movie he never got to make.'

In a 2019 article for *The Guardian*, Luke Kemp consults a range of experts within the film industry on the likelihood of 'aesthetically convincing digital humans combined with AI-driven virtual humans to produce entirely artificial actors', ultimately claiming that the current level of progress 'could lead to performances without the need for human actors at all' (Kemp 2019). This form of virtual reanimation is not solely reserved for actors, musicians and famous people. *Meeting You* (2020), a television documentary shown in February 2020 by South Korean broadcaster MBC depicted how a team of VR, AI and VFX experts worked together to digitally resurrect a seven-year old girl, Nayeon, and reunite her with her mother, Ji-sung. By analysing family video footage the team harnessed various facial expressions, speech, unique gestures and combined them with photogrammetry, motion

capture technology and CGI to create a virtual being with Nayeon's appearance, movement and voice. The goal of the VR team was to provide an opportunity for Ji-sung to say one last goodbye to her daughter who had died quickly and unexpectedly from hemophagocytic lymphohistiocytosis (HLH). In *Meeting You*, Ji-sung wears a HTC Vive VR headset and haptic VR gloves in a green screen studio and has a meticulously-created rendezvous with her virtual daughter in a park. During the initial conversation, in which the simulacrum Nayeon and her mother ask each other questions, Ji-sung becomes increasingly emotional as the little girl replies to her voice as she gently strokes her hair. Following this, they move around the virtual park setting, play games, share a birthday memory by lighting candles on a cake and eat some of Nayeon's favourite party snacks. As journalist Scott Hayden (2020) reflects in his review of the programme for the *Road to VR* website:

> Putting aside the obvious exploitation factor of reuniting a mother with her deceased child for television viewers … recreating a deceased loved one in such high-fidelity raises some ethical concerns, and they're ones we simply don't have clear answers to yet. Whether conjuring virtual doppelgangers of lost loved ones may one day be considered an unnecessary re-traumatization, or a valid coping mechanism to help overcome tragedy, we just can't say for now.

Trauma is certainly one worrying outcome of potential danger of liaisons with virtual entities, but such encounters also raise many other questions, as Higgs (2019) discusses when discussing possible future issues:

> Who will be the first person to demand the right to marry their digital companion? Will sufferers from the schizophrenic family of illnesses be comfortable with, or distressed by, these unreal entities? Could such creations be legally compelled to share your secrets with the police, or your employer? (p. 234)

Such questions may seem like pure science fiction to some, but – as we become increasingly accustomed and dependent on the company of virtual beings – the potential for psychological harm and negative impacts on society and individuals will need to be examined carefully. In their paper *The Ethics of Realism in Virtual and Augmented Reality* (Slater et al 2020), Professor Mel Slater and co-authors call for the creation of a 'code of conduct' with content determined by those working with XR technology; researchers, creators and distributors.

After highlighting potential areas that Slater and his team propose for further examination and experimentation, they suggest the following questions:

> Do people trust virtual characters more if they are more realistic?
> Does greater realism lead to greater confusion between the real and the virtual?
> Does greater realism lead to greater behavioral and emotional impact?
> Does greater realism lead to a greater chance of negative after-effects?
> Can people already today be confused between reality and virtual reality?
> Will there be greater plausibility (illusion that the events are really happening) in interactions with super-realistic characters?
> What, if any, are public perceptions of these issues today?
> How can there be longer term follow-ups of the effects of a virtual experience?
> What are the long-term cultural effects of superreal XR usage?
> (Slater et al, 2020, pp. 11)

As Slater and his team are aware, any one of these questions warrants a huge amount of research and debate within the industry and academia, with any answers helping to shape a mixed reality world that increasingly becomes our everyday environment.

When discussing the implications of virtual beings, Higgs (2019) asserts: 'We can be dismissive of such technology simply by saying that virtual entities aren't real and we shouldn't treat them as such … but if they become a larger and more integrated part of our lives, that distinction will seem less important' (p. 235). The reaction of the mother featured in *Meeting You* (2020) would suggest that this process has already begun and the kind of complex psychological relationships with virtual people as suggested by Lem (1961) are beginning to form around us. A typically philosophical conversation between two characters in *Westworld* (2018)—the simulacra 'host' Dolores and her 'creator' Bernard—circumnavigates Baudrillard and Lévy, providing a suggestion for how digital simulacra could be defined within our future society:

> Dolores: 'What is 'real'?'
> Bernard: 'That which is irreplaceable.'
> *Westworld* (Season 2, Episode 1, 2018)

This further raises the argument that to be 'real', or 'irreplaceable', something does not necessarily have to be original or human. This argument can be very simply and powerfully illustrated when we consider the complex relationship between some human beings and their canine companions. Dogs are not human and, to many people, they are not particularly original – a dog in 2020 is intrinsically the same as a dog of the same breed in 1920. However, what makes an animal an irreplaceable part of a family unit or—in some cases—a substitute for a family or partner, is the bond between humans and their canine counterparts, the history that develops between them, and the humanity that we endow the animal which consequently becomes embedded into the relationship. As humans and dogs cohabitate, the understanding between them becomes unique – replacing the dog (or human) with another of exactly the same breed and age will not replicate the relationship, a new one will always be formed. If animals can become such an intrinsic and irreplaceable part of our lives, worthy of our unconditional love and care, then I would argue that—with equal patience and understanding—virtual beings could also fulfil a similar potential.

When discussing how we communicate with others through the digital window of obscurity, White (2019) suggests there will always be an intrinsic desire to deal with other humans, regardless of how seemingly remote the portal for such a conversation may be:

> At the same time you still know that's a human, and the minute it's a chatbot we don't want it anymore. Even though it's really very removed it's still a human, and there's something in that for us that meets a need – and the minute it isn't anymore, at what point do we accept that's ok? Personally I don't think we ever will, because there's something about human–human you can't really replace.

While this will be the case for many people, *Solaris* (1961), *Westworld* (2016-18) and *Meeting You* (2020) all demonstrate variations of a potential future where simulacra transcend their imitative origins and take on a life of their own to become irreplaceable. While science fiction may have provided a blueprint for the existence of virtual beings, the stories within the genre also suggest pathways for how we interact with such simulacra and, increasingly, 'real life' examples of this behaviour are now beginning to emerge from science fact.

4.5 Mixed reality memory contamination

A prime factor in the potential impacts of mixed reality and other immersive technologies in relation to memory is how we remember people, objects, environments, events and our experience of the world around us. According to Pimentel & Teixeira (1993) 'by drawing us into art worlds, the computer's ability to store and retrieve events becomes a way for us to explore our notions of time, space, and memory' (p. 232) and such qualities are particularly resonant when considering the impact of VR and mixed reality experiences. Looking to the future in 1993, Pimentel & Teixeira predicted that 'after spending a certain period in a world, the virtual traveller could be confronted by virtual memories of his own virtual experiences' (p. 232), suggesting that virtual experiences could become solid memories with similar schemata structures as those formed by 'real world' activity. Some of these memories may be triggered accidentally—'key incidents and phrases seen and heard could come tumbling back' (Pimentel & Teixeira, 1985, p. 232)—and, at some point, the immersant 'might even be able to re-experience episodes from his own life' (p. 232). Mark Atkin (2019) summarises how the adoption of spatial computing across society is leading to new forms of viewing and experiencing life and work:

> Immersive technologies – much more quickly than any other media-sort of technology – have become incredibly widespread across engineering, architecture, real estate commerce, every branch of entertainment, medicine – even video didn't happen that quickly on all those things. In the end, these technologies will become the operating system through which we navigate our worlds. (quote from interview with author)

In a society that is now deeply invested in technology, particularly with mobile devices, Atkin makes the point that this landscape provides a very easy setting for spatial computing to flourish. However, such activity goes beyond solely being a pastime or hobby—or even another way of delivering stories—but the actual framework through which we conduct our lives. This vision of immersive technology becoming an integral part of our everyday activities is mirrored by Palermos (2017), along with a warning of the potential consequences:

> As Augmented Reality will become ubiquitous, it will likely take over most aspects of our daily interactions with surrounding objects and human beings, making it practically impossible to distance ourselves from this added dimension of future society, much in the same way that most people can no more leave their house without making sure they have their mobile phones on them. There is, no doubt, a great potential in this emerging technology, which promises to enrich our lives beyond imagination. But its users may also be exposed to the serious danger of being unable to tell reality and Augmented Reality apart. (p. 134)

A key part of creating a virtual world which interacts with our own—seamlessly or otherwise—is first capturing the physical world that exists around us. Volumetric capture via 360 scanning on a mass scale, combined with AI and algorithms that recognise forms and functions are all key technologies that will enable us to form a virtual replica of our environments which we can then inhabit and/or change. Kelly (2019) describes how a 'mirrorworld' is being constructed – 'everything connected to the internet will be connected to the mirrorworld' – and that we 'will interact with it, manipulate it, and experience it like we do the real world' (Kelly 2019). The 'mirrorworld'—which, according to Kelly (2019), was popularised by Yale computer scientist David Gelernter—will not only look like the world around us but behave in the same way too, as a perfect simulacrum mirroring the scenario outlined by Baudrillard. Citing the 1:1 map described by Borges in *The Garden of Forking Paths* (1941), and echoing the 'operating system' described by Atkin (2019), Kelly says: 'Someday soon, every place and thing in the real world—every street, lamppost, building, and room—will have its full-size digital twin in the mirrorworld … Piece by piece, these virtual fragments are being stitched together to form a shared, persistent place that will parallel the real world.'

For many years, cosmetic and toiletries companies have used CGI pack shots for promotional images and campaigns, not only because they can be digitally produced using bespoke software for 'perfect' results, but also because they appear more 'real' than actual photographed objects. The majority of people are unaware that these CGI creations which surround us have seamlessly merged into the fabric of their daily lives. Kelly (2019) describes how the home goods retailer Wayfair has adopted this process to display items online: 'You have to look very closely at an image of a kitchen mixer on Wayfair's site to

discern its actual virtualness. When you flick through the company's website today, you are getting a peek into the mirrorworld.' As AI is gradually embedded within this world of simulacra, a further contextual structure of time and space is formed, as Kelly (2019) explains: 'cameras only capture sheets of pixels … But artificial intelligence … will make sense of those pixels; it will pinpoint where you are in a place, at the very same time that it's assessing what is in that place' – known as SLAM (simultaneous localization and mapping), this form of technology may further blur our ability to identify simulacra. The potential outcomes of no longer being able to differentiate 'virtual' from 'real' in our everyday environment are vast and numerous, and potentially impact the most unlikely of scenarios. For example, substantial amounts of property are valued according to their immediate surroundings and the view outside – potentially every modern dwelling could soon boast an amazing (virtual) view, hence reducing the need for households to be constructed with impressive or picturesque vistas in the physical world. Eventually, the virtual view of your window could look identical to the real one, but with better weather. A feature such as this could eventually reach a standard where the inhabitants and their visitors neither know the difference, or concern themselves with authenticity.

Slater et al (2020) begin to unpick questions surrounding 'false memory' within AR and immersive VR, specifically in the section 'Is It Real?' in which they examine the phenomenon of 'place illusion' and outline three conditions which help to establish a believable experience within VR:

> A VR system may support (i) credible responses to the actions of the participant, (ii) contingent events that are directed specifically and personally toward the participant (for example a virtual human character smiles at the participant), and (iii) scenarios that are faithful to expectations when they simulate events that could occur in reality in a domain in which the participant has expertise. To the extent that these three are supported, the VR experience may become a plausible one, where participants have the illusion that the depicted events are really happening (to them). These two illusions, place illusion and plausibility, provide the basis for people responding realistically in virtual environments. (Slater et al, 2020, pp. 5-6)

Slater et al (2020) then progress to suggest possible outcomes of repeated exposures to XR with strong place illusion and plausibility, leading to 'uncertainty of past and current events':

> Participants remember virtual events as if they had been real, and fail to distinguish over time events that really happened and those that happened in XR. This could also lead to mistrust of events that are actually occurring in reality. After spending some time in a scenario people forget the device-gap and become unsure about whether they are experiencing reality or virtual reality. (pp. 5-6)

Slater et al (2020) also warn of other potential negative impacts, such as falsely attributing characteristics onto specific groups of people, dangerous activities and misjudgements within immersive environments leading to actual physical harm, and difficult transitions back into the real world (pp. 5-6).

If granted access to our thoughts and memories, the web—when combined with powerful AI—could potentially deliver experiences similar to the intelligent planet in Lem's *Solaris*. In some ways, *Solaris* can be viewed as an allegory for the potential of the web and AI, and how we may come to perceive the mirrorworld. As we often rely on photographs of events to support our fading memories, could we become accustomed to depending on immersive recreations of events within our own personal histories, effectively relying on expositions of simulacra to supplement the missing links of memory? For his 2018 film *They Shall Not Grow Old*—marking 100 years since the end of the conflicts of WW1—director Peter Jackson and his team spent thousands of hours painstakingly restoring, digitising and enhancing original footage in an attempt to 'reach through the fog of time and pull those men into the modern world' (Jackson 2018). Jackson utilised the latest technology to scan the aging celluloid and add missing components – including detail, depth of field and colour. Many viewers were astonished by how 'real' the soldiers now appeared, and yet they were effectively looking at CGI recreations, augmented by AI facial recognition and 3D software. As Atkin (2018) says in his article 'Human Assets: The Promise and Dread of Digitising Humans':

> Some years ago there was a debate in the documentary industry about whether colourising black-and-white film was acceptable, since that was modifying the source and to do that would be to challenge the very nature of what constitutes a documentary. Increased ratings meant the colourisers won that argument. Nonetheless, it's still controversial enough that Peter Jackson hit the headlines when

> he used Hollywood techniques developed in *Lord of the Rings* to create 2D and 3D colourised renditions of World War I from archive sources. He justified this approach in a January 18 interview in BBC's *Today* show: 'They didn't fight the war in black and white…. It gives a true reflection of what the soldiers saw.'

Mark Kermode salutes the power of Jackson's process and vision in his review of the film for *The Guardian*: 'It's as if the technology had somehow pierced the surface of the film, causing (virtual?) memories to come pouring out' (Kermode 2018). This method of channeling technology to make history more accessible, and the resulting haziness of the boundary between the virtual and the real, is a factor articulated by Kermode (2018):

> Stepping through the looking glass, we find ourselves right there in the trenches, surrounded by young men whose faces are as close and clear as those of people we would pass in the street. I've often argued that cinema is a time machine, but rarely has that seemed so true.

If certain events or details within a convincing immersive recreation from our own personal history are not accurate, but we perceive it as a factual document, such experiences could effectively become a form of memory contamination. Within psychology, schemas are informed by a range of life experiences and situations which we store in our memory (McVee et al 2005). If these mental frameworks can be constructed from simulations or recreations of actual events, there is a possibility that our memories of a particular event could be contaminated, particularly if elements of the experience have been changed deliberately. This is potentially akin to retouching a family photo album – removing objects or people, or digitally adding new ones – altering minor details or major aspects of the experience. Obviously the possible personal, emotional and civic impacts of this are considerable and—in scenarios that depend on certain memory, such as an eyewitness testimony in a legal case—potentially calamitous. Arguably the same could be achieved with film, however, due to the unique sense of spatial presence within VR the effect is potentially more extreme.

The 2019 independent feature film *Mnemophrenia* is a sci-fi drama in which a new form of psychosis, caused by use of VR technology, renders those affected unable to separate real and artificial memories. As director Eirini Konstantinidou explains on the website for *Mnemophrenia* (2019), perceptions surrounding the condition become subject to a

generational change; ‘The story explores how attitudes to Mnemophrenia would differ from person to person and across generations, going from resistance and fear, through acceptance and eventually even using it to our benefit, pushing humanity towards a new evolutionary step.’ *Mnemophrenia* (2019) may be a work of science fiction, but academic research into the effects of virtual reality on memory is very much real. In their paper ‘Virtually True: Children's Acquisition of False Memories in Virtual Reality’, Segovia & Bailenson (2009) outline their methods for assessing the effects of Immersive Virtual Environment Technology (IVET) on the memories of children:

> Using this tool, we examined how memory was affected by viewing dynamic simulations of avatars performing novel actions. In the study, 55 preschool and elementary children were randomly assigned to 1 of 4 memory prompt conditions (idle, mental imagery, IVET simulation of another child, or IVET simulation of self) … Results showed that preschool children were equally likely to develop false memories regardless of memory prompt condition. But, for elementary children, the mental imagery and IVET self conditions caused significantly more false memories than the idle condition.

It may seem surprising that the memories of older children were more affected by the VR content, however—compared to the preschool participants—they have an increased capacity to augment and reconstruct their recollections with the content of the immersive environments they experienced. In Atkin’s article ‘Human Assets’ (2018), Nicolas Roy—Creative Director of Dpt.—observes: ‘There is something unique about AR in that it writes itself into your environment. Long after the experience you still remember these people as having inhabited that space – their presence lingers there.’ Chris Milk references this aspect in his interview with Bucher (2017) when predicting where mixed reality narratives may lead: ‘The story that happens will be a memory rather than just a piece of media that you consumed.’ (Bucher 2017, p. 104). This ability to influence and form memory—combined with a willingness to embrace a ‘mirrorworld’ mixed reality environment on an individual and societal level—provides a tangible form to the possibility of science-fiction visions of the future becoming part of our everyday existence. At the end of *Schema*, the viewer is left with a feeling of spatial presence from four very different environments; one of which could be described as relatively abstract and ‘surreal’, the other

three being instantly recognisable as ‘places’ in which one feels a different, more solid, sense of presence within a location. The spatial sensation gained in all four environments could be perceived as extensions of the ‘invisible witness’ view described by Pudovkin (Bordwell 1985) which are unique to VR in which the memory of ‘being there’ persists long after the headset has been removed.

4.6 Inner space time travel

For over a century, arguably since the publication of *The Time Machine* (Wells 1895), our perception of time travel has involved a craft or device that physically transports the ‘time tourist’ to another dimension, as Gleick (2016, p. 295) describes how ‘Wells's *Time Machine* revealed a turning in the road, an alteration in the human relationship with time’ and that, as a result of his novel ‘scientists and philosophers were primed to understand time in a new way. And so were we all’ (p. 295). With the convergent emerging technologies of extended reality—AI and high-speed data transfer—I would argue that we now have the tools to re-evaluate the possibilities of ‘understanding time in a new way’ (Gleick, 2016, p. 295) and to rethink ‘time travel’ on a personal and civic level. The ability to knit together archival or reconstructed material from the past in the same physical location in the present—or visions of the future—creates an emerging form of immersive storytelling. Such experiences can now be facilitated via a scenario where GPS technology combines with cloud-based databanks of geo-tagged location imagery and/or video footage, together with CGI recreations or artist impressions, at speed and with precision. In their 2018 report *Immersive Content Formats for Future Audiences*, Allen & Tucker conclude with a ‘Future Formats’ focus which includes a section specifically on the possibilities of VR ‘time travel’:

> Volumetric capture and photogrammetry has become an increasingly more viable way for creators to realistically capture a real environment in high resolution. Imagine capturing a busy Oxford Street in London on a Saturday afternoon. Imagine that you can capture that moment in time so that it can be relived again and again, realistically via virtual reality. If you were to come back to that moment in VR ten years after it was captured, it could feel a bit like travelling back in time.

> There likely wouldn't be any interactivity, however there could be a lot of presence. Akin to the golden record or a time capsule, there is the potential to create and capture our current times for visitors of the future to experience and gain insight into what life was like in the 21st century. (p. 83)

This recording of experiences and subsequent re-coding of time is examined by Lanier (2017): 'Nothing will be forgotten, so the present and the past will become less distinct. Time will become less linear and more diffuse, spread out like a map instead of a string' (p. 65). While this brings to mind the 'mirrorworld' maps from *The Garden of Forking Paths* (Borges 1941) it also positions time as a more tangible and potentially malleable entity. The ability to permeate the past in a nonlinear fashion—where the entry point is unfixed and movement fluid—is articulated by Kelly (2019) when writing of the 'mirrorworld':

> With a swipe of your hand, you will be able to go back in time, at any location, and see what came before. You will be able to lay a reconstructed 19th-century view right over the present reality. To visit an earlier time at a location, you simply revert to a previous version kept in the log. The entire mirrorworld will be like a Word or Photoshop file that you can keep 'undoing.' Or you'll scroll in the other direction: forward. Artists might create future versions of a place, in place … These scroll-forward scenarios will have the heft of reality because they will be derived from a full-scale present world. In this way, the mirrorworld may be best referred to as a 4D world.

This vision of a constantly shifting virtual environment which responds and reacts to the commands and desires of those within it is effectively conceptualising our surroundings as an 'operating system'—similar to those which many people already seamlessly use on a daily basis—treating time as an endless 'Google doc' which is constantly being updated, deleted and restored. Kelly's description of a virtual 'mirrorworld' as a '4D world' brings to mind the interdimensional tesseract portal graphically demonstrated in *Interstellar* (Nolan 2014) and the fluidity with which Cooper (Matthew McConaughey) moves between different time frames within the same physical space. The potential relationship between a physical location someone is occupying and a historic or projected future of that specific place creates a very unique and powerful dynamic 'fourth element' that is not present in more traditional media such as literature, photography or film. A historic narrative text, a set of archive photographs, a film or audio recording may be required in order to create an immersive experience, however, the sum of

those parts—combined with spatial presence—can create an unparalleled unique experience; a '4D world' (Kelly 2019). Much of this specifically relates to virtually recreating environments via the 360 video capture or CGI recreation of a location – however, as Allen & Tucker (2018) remind us, time travel is not solely related to place but also those who inhabit that particular time:

> Another way that immersive media could elicit the feeling of time travel is through the capturing of people and their personalities. People can be 3D scanned, and then AI versions of their personalities can be built. This means that generations to come may be able to interact with their ancestors, learning from them and potentially even building relationships with them. People can spend time with these ancestors via AR glasses or VR headsets. (p. 83)

In 2000, inspired by the 'Holodeck' in the science-fiction series *Star Trek*, Cavazza et al (2000) examined the theory and conditions required within a scenario in order for a participant to interact with virtual (or 'artificial') characters and influence the way that they behave and the consequential story being told. Nearly two decades later, The Shoah Foundation's *New Dimensions in Testimony* (2017) provided audiences with the opportunity to meet and interact with a virtual representation of holocaust survivor Pinchaus Gutter. Constructed from a week of in-depth interviews, the team utilised volumetric video capture, natural language processing and advanced chatbot technology (Allen & Tucker, 2018, p. 83) in order to create a virtual Gutter capable of responding to questions from the audience. If we think back to Collishaw's mixed reality exhibit *Thresholds* (2017)—which recreates a convincing museum environment from 1839 where participants have a simulated physical presence and the ability to examine and handle historical artifacts—and combine this with the levels of interpersonal interaction as demonstrated by The Shoah Foundation (2017), then a roadmap for 'inner space time travel' begins to form.

In Nicolas Roeg's *The Man Who Fell To Earth* (1976) the main protagonist—alien visitor Thomas Jerome Newton (David Bowie)—is driven through the dusty wastelands of 1970s New Mexico and perceives flashbacks of the early settlers, or frontier/colonist community, working their crops centuries ago. The vision is reciprocated and the settlers become animated as they watch the unbelievable speeding metal vehicle and its occupants. A similar sensation could be easily created using AR, with the obvious difference that those in the past

would not be able to see and respond to those in the present, but a suitable reaction could be simulated via AI to increase the mutual feeling of presence and inter-dimensional connectivity. As Caroline White reminds us when discussing *The Time Machine* (Wells 1895) and multiple science-fiction storylines: 'A lot of the time it's not really about time travel, it's more about the past' (2019), meaning that many sci-fi stories are actually historical tales packaged within a multidimensional journey. The potential impact of such interactions reflects Higgs' (2010) comments regarding the assimilation of virtual entities in that they 'aren't real and we shouldn't treat them as such … but if they become a larger and more integrated part of our lives, that distinction will seem less important' (p. 235). We only have to consider the interactions between the mother and virtual daughter in *Meeting You* (2020) to appreciate that, while such relationships may not be 'real', they are nonetheless important. In terms of 'reality', the success of immersion is often dependent on discovering the level of interaction required in order to make the experience feel real – for example, it may not be necessary to engage in conversation with any characters encountered within a virtual world (Darnell & Hutchinson 2016), in the same way that it is perfectly normal for an individual to travel through a contemporary, bustling metropolis and not speak to a single soul (Allen & Tucker 2018). Equally, it is not always necessary to have multiple interactions with the virtual environment around us in order to feel a believable presence and—as I have already shown—sometimes just 'being there' 'can be enough' (Darnell & Hutchinson 2016). This is a factor also highlighted in Allen & Tucker's influential report *Immersive Content Formats for Future Audiences* (2018):

> It may sound counterintuitive, but researchers found that experiences do not require obvious interactivity in order to foster emergent narratives from a user. Sometimes, a scenario or environment can be stimulating enough that it alone is enough to cause a user to have their own positive, personal experience to take away with them. (p. 84)

What is particularly pertinent about this statement is that—for those working within creative immersive technology—it was assumed that increased amounts of interactivity within a virtual environment would naturally raise the level of immersion for any participants. While concentrating on improving the believability within immersive environments, many researchers, developers and creatives—particularly those involved or interested with the production of videogames—overlooked the power of imagination in those experiencing virtual realms, which, according to Allen & Tucker (2018) deemed 'total believability' to

actually be unnecessary in order for users to develop their own 'emergent narratives.' The storyline that was presented, or the virtual environment forming the setting, was sufficient for many to stimulate their own imaginations and narratives. This certainly seemed to be the case for the 'time tourists' who experienced *The Virtual Hole in the Road* (2016) as detailed in Chapter 3, particularly as many of them augmented their VR journey with their own real-life experiences, using their minds and memories to (re)create a time and a place. None of the 'immersants' mentioned that they were unable to converse with other virtual occupants, or restricted from moving objects and opening doors – the 'fixed-route' journey through the space was adequate for them to satisfactorily achieve a sense of place and, in some cases, immense familiarity (Bax 2020).

Not all augmented reality experiences necessarily involve visual objects appearing in the real world or graphic displays overlaid on our physical environment. Mark Fell's audio artwork *A Stitch Outside Time* (2019) is a site specific experience for the duration of the train journey between London Fenchurch Street and Shoeburyness via Basildon. Conceived as a permanent sound work that is only accessible on that particular journey and commissioned as part of a major exhibition of Fell's work at Focal Point Gallery, Southend-on-Sea, the piece 'uses digital sound synthesis and GPS technology to create musical structures and sounds that respond to the train's location' (Focal Point Gallery 2019). Fell's generative rhythmic patterns form an integral part of the travel experience and become synonymous with each location on the journey, which lasts for approximately 75 minutes. Different sections of the piece are triggered at specific points en-route, creating a sensory symbiosis with the ever-changing landscapes; from concrete tower blocks to woodland, seashores to scrap yards. According to Fell, the bespoke sound piece is effectively an exercise in 'augmenting the experience of sitting on a train, and often the emotional resonances that might lead to' (Fell 2020). What is particularly fascinating is that the multi-location 'installation' is effectively permanent and yet rests invisibly on another plane, or, as Fell articulates: 'all that landscape is just a different place in time' (Fell 2020). The audio experience is a nonlinear soundtrack which has varying length and different sounds depending on when the train arrives and leaves, as the specific audio created for each location only emerges when the train occupies that particular space or 'landscape.' Residing concurrently with the physical location of the participant, the audio effectively becomes 'a different place in time' (Fell 2020). *A Stitch Outside Time* (2019) was conceived by Fell as an audio artwork triggered by time and place,

and is a truly innovative example of augmented reality; a virtual creative entity that interacts with our environment, as he reflects (2020):

> There is the physical world that we inhabit and then there is a kind of virtual space laid over it, and this permanent thing will always be there until the end of the universe. Even if iPhones stop being made and every iPhone or Android phone in existence suddenly breaks, it's still there. From a phenomenological point of view, that's what it felt like. (quote from interview with author)

With this comment Fell is reflecting on the task of making virtual content appear tangible within a conceptual framework that is understood by the general public and equal to how they generally accept cloud computing and understand that the entry point for their data is a physical device—such as a laptop, mobile phone, tablet or desktop computer—the physical location of which they can clearly identify. However, as Fell observes, even if the physical device is broken or lost and access effectively removed, the virtual content will still remain in place, occupying a 'parallel landscape' (Fell 2020). We are still at a very early stage in the development of immersive storytelling—particularly that which utilises spatial computing—however, as Allen & Tucker (2018) concludes: 'There is a great deal of potential to create something that has parallels with a time machine – something culture has held in its shared imagination for many years' (p. 83). As technology becomes smarter, faster and increasingly records the world and those within it, a new immersive form of storytelling is emerging, which will evoke experiences similar to those imagined by Wells (1895) and his peers, with the result that a journey to another time and place could become a regular, seamless, pastime; as unusual as making a phone call.

4.7 Cosmonauts of inner space

In his introduction to the poetry collection *Man At Leisure* (Trocchi 1972), William S. Burroughs describes first hearing Scottish writer Alexander Trocchi proclaim himself a 'cosmonaut of inner space' at the 1962 Writer's Conference in Edinburgh (pp. vii). Although Trocchi probably intended the term to reflect his standing as an exponent of existential philosophy in 1960's counter-culture, it could be applied to those who now explore the virtual space within their own minds via spatial computing. In a 1968 interview for *Munich Round*

Up, J.G. Ballard defines 'inner space' as 'an imaginary realm in which on the one hand the outer world of reality, and on the other the inner world of the mind, meet and merge' and—although Ballard's 'inner space' was not one powered by technology—this sentence serves as a very fitting description for the emerging mixed reality landscape. Following early science fiction works such as *The Crystal World* (1966), Ballard moved away from the genre and created dystopian narratives that were set in the present or not too distant future. However, during his initial 'pure sci-fi' phase Ballard wrote numerous short stories for magazines and publications from 1956 to 1964, including 'Zone of Terror' (1960) in which Larsen, an electronics company executive, is sent to a secluded scenic retreat with his psychologist Bayliss. Over the course of the story Larsen experiences nonlinear time consciousness and feels increasingly threatened by a mysterious figure who is eventually revealed to be himself in the same space but at a different time. Such tales of 'inner space time travel' may have seemed extraordinary in 1960, but the ability to see figures—including yourself—in different places and dimensions is now increasingly possible given recent advances in immersive technology, as I have previously highlighted in works such as *Outrospectre* (Kolkman 2017) which uses VR 'out-of-body' experiences as a method of overcoming the fear of death. I would argue that the ideas and stories from writers such as Ballard concerning similarly fluid concepts of time and space contribute to our understanding of how mixed reality environments could function, providing inspiration while simultaneously highlighting the potential psychological dangers of such experiences.

The sensation of seeing one's self and feeling challenged by such presence can take many forms. In 1996 Psygnosis/SCE Studio Liverpool included the addition of 'ghost ships' in their futuristic anti-gravity racing game sequel *WipeOut 2097*, as players were challenged by the spectres of their own craft performing previous laps. Mirroring Larsen's visions of his 'other self' in Ballard's 'Zone of Terror' (1960), competitors are effectively harassed and threatened by their own previous actions as they speed around the track. While *WipeOut 2097* was not the first game to use 'ghost ships'—Atari's *Hard Drivin'* (1988) introduced a similar concept—the Psygnosis racer refined the idea by rendering the aerodynamic racers in a translucent 'ghost-like' aesthetic. *WipeOut* players quickly adapted to this new form of nonlinear time consciousness and assimilated the feature into their learning in order to improve their knowledge of each track and, subsequently, 'ghost ships' have become a seamless central tenet of the solo racing experience. Following this innovation, it is not difficult to envisage a technology-embracing populace using augmented reality technology to

view virtual 'ghost' versions of themselves performing, dancing or competing in order to perfect their movement and timing – in other words, the experience of Larsen in 'Zone of Terror' (Ballard 1960) but without the fear, utilising their respective digital simulacra for personal improvement and positive change as 'cosmonauts of inner space.'

While considering various individual virtual environments as an 'inner space', we can begin to look at similar constructs which we know are not 'real' but are believable, extending to the most familiar of experiences such as looking at one's self in a mirror and the surrounding space, as described by Foucault (1967):

> The mirror is, after all, a utopia, since it is a placeless place. In the mirror, I see myself there where I am not, in an unreal, virtual space that opens up behind the surface; I am over there, there where I am not, a sort of shadow that gives my own visibility to myself, that enables me to see myself there where I am absent: such is the utopia of the mirror. (p. 47)

With this Foucault highlights the sensation of being aware that the spaces we see in mirrors are effectively a trick of the light and are not there, and yet we undeniably believe them and trust in their existence. We can imagine that this was not always the case, and those seeing their reflections for the first time may have reacted differently to the representation of their selves and the space surrounding them but, with time, the experience has become commonplace and we have learned to accommodate and utilise mirrors to improve our daily lives – as we may come to do with immersive technology. The sense of utopia, or 'placeless place', that Foucault (1967, p. 47) describes could equally be applied to immersive environments—such as *Thresholds* (Collishaw 2017) or *The Virtual Hole in the Road* (Bax 2016)—which may not be 'real' but possess the potential to be utterly believable. In this way, our perception of future immersive experiences may be no more complicated or challenging than simply looking in a mirror. Once such environments become commonplace, they provide further potential for archival images or film to be added via spatial computing and become a virtual portal to the past, as Greenfield (2017) enthuses: 'An augmented view returning the layered past to the present, in such a way as to color our understanding of the things all around us, might well prove to be more emotionally resonant than any conventional monument' (p. 69). This powerful emotional resonance created by layering the past is undeniably and explicitly present in the works of Akomfrah, Leckey and Rothberg.

Throughout *The Unfinished Conversation* (2012) Akomfrah masterfully conducts an audio/visual smorgasbord of archive material, sometimes dramatic and often relatively mundane, to fashion a unique narrative of twentieth century events which resonates with the viewer on an emotional level, far beyond that of the newsreel footage he often employs. Likewise, as Leckey virtually reconstructs the events and places of his lifetime in *Dream English Kid 1964-1999 AD* (2015), his multiple layering of film, animation and illustration—YouTube videos and childhood scribbles—adds to the emotional impact of a deeply personal work. As Rothberg lays bare the roots of her past in *Memory/Place: My House* (2014–15) we inevitably think of the people, places and events that formed our own childhood and how they manifest within ourselves and those around us today. What unites all of these works is a temporal fluidity; a blurring of the past and the present, and a knowledge that the future will become part of the same plan, as time becomes 'less linear and more diffuse, spread out like a map instead of a string' (Lanier, 2017, p. 65).

Rejecting more formal time structures, the audio patterns in Fell's augmented reality sound piece *A Stitch Outside Time* (2019) are based upon the Tala system from Indian classical music which, as the artist explains, utilises an ancient approach to time:

> … there is a linearity in written fiction that reinforces a view in a very basic sense that you read the story from the beginning to the end – there's a cursor that you are always at. If you look at music systems, the western musical score for example, basically is a way of ordering time that is very different to an Indian musical score. Not that Indian people think somehow that time is different to us – that's quite a patronising view – but the view of time embedded in the musical score is of a certain kind. That's what I try to do. (Fell 2020, quote from interview with author)

This view of challenging a more traditional (Western) concept of time is central to Fell's work and is particularly resonant within *A Stitch Outside Time* (2019) as the timestamps of Indian music accompany the traveller on their journey from London to the South coast. Fell is essentially expressing that, if we are to challenge the constraints of space and time, we must first be prepared to accept another form of 'ordering time' within music and the other media in which he is active as an artist. Within Fell's work, the inseparable connection between time and location, in which he claims 'landscape is just a different place in time' (Fell 2020), demonstrates not only alternative formats for 'ordering time' but new ways of ordering place

in terms of the way certain locations are experienced by the immersant. In this sense, Fell's exploration of nonlinear time can be grouped with the work of Akomfrah, Leckey and Rothberg, and this is underlined when he articulates his fascination with temporal landscapes:

> Exploring time is really about exploring what time feels like. So there's exploring what time feels like and how we exist within time and how we understand time. We all have thoughts about what time is that is very different to the way a physicist would describe what time is … My exploration of time is: how do we understand time, how does the description of time fit with what we experienced and how do we experience time, and how do the objects and processes, technologies and cultural forms and formats – what role do they have in how we experience and understand time? (Fell 2020, quote from interview with author)

This concern with the understanding and experience of time differs from Genn's exploration and interest in how the inherent message is conveyed, as she explains (Genn 2020): 'What I'm very interested in is how the timelessness and endurance of the creative act has a value that can be transmitted to the person who is experiencing what the creator has made.' In this we can see that Genn is more concerned with conveying the experience of an individual (the artist) to the viewer, encapsulating a moment in time and sharing it, whereas Fell prefers to create unique 'real-time' artworks as shared simultaneous and, if possible, collaborative experiences for both himself and the viewer.

When assessing immersive experiences—particularly those where time is an essential element—it is important to remember that virtual interactions in our everyday lives occur on multiple levels; some may be brief moments, others could encompass a digital entity that is painstakingly formed over several years, as Kerby (1991) echoes when outlining the landscape of experience:

> Experience is *at once* part and whole. The concept of experience can be used to cover the whole of a life ('There is nothing but experience'), and also the parts of a life ('I just had a strange experience'). Another way of saying this is that experiences come to one not in discrete instances but as part of an ongoing life, *my* life. Experience gains its density and elusiveness precisely through a continuous contextualising or meshing of part to changing whole; the relating of itself to itself. (p. 16)

With this Kerby is highlighting both the duality of the word—an 'experience' can be a single, one-off, 'happening' or the knowledge gained from a collection of multiple events—and, in the case of the latter, is reminding us that 'experience' is an evolving entity which can be unique to an individual or common to a whole group. This framing of experience is particularly resonant when viewing the work of Akomfrah, Leckey and Rothberg – artists who utilise a range of sources to craft their narratives, which gain 'density' as they develop with multiple layers of micro-experiences and via 'continuous contextualising' (Kerby, 1991, p. 16). How these three artists present the stories of their lives and others with carefully curated moments from time echoes Kerby's description of ongoing human existence and psychological self-awareness. According to Kerby (1991, p. 16), *Phenomenology of Perception* (Merleau-Ponty 1978) demonstrated how the use of 'now' is 'not atomistic but variable, depending on one's perspective, one's interest.' In a sentence mirroring how experience can be '*at once* part and whole', Kerby (1991) reminds us that '..."Now" can be "this moment", "this day", "this year", or "this life"...' (p. 16). This observation that even 'now' does not have a fixed or definitive meaning highlights the possibility for temporal ambiguity which immersive 'inner space' experiences often solicit and exploit, encouraging non-linearity and the exploration of 'what time feels like' (Fell 2020). Understanding, comprehending and appreciating the various components which form both experience and the memory of an experience is key to creating significant immersive artworks and augmented reality experiences, with time—and our perception of time—being a central tenet. In the same way that Fell chooses to use a different timestamp for his musical output, spatial computing and extended reality devices provide an opportunity to creatively explore time and temporal ambiguity and challenge the constraints of space and time beyond the possibilities of traditional media.

Greenfield (2017) comments on the exploration of time and non-linearity when discussing the potential of mobile devices as portals for cultural heritage: 'by superimposing images or other vestiges of the past of a place directly over its present, AR effectively endows its users with the ability to see through time' (p. 69). While this is currently the focus of multiple ongoing XR research projects—for example *Space, Time and Streets in the Sky* (Bax & Hadley 2020)—the concept for such activity lies within *The Time Machine* (Wells 1895) and subsequent science fiction. 'Cosmonauts of inner space' have been present in works of literary fiction long before mutli-dimensional experiences could be simulated with a VR

headset; in his psychological time travel novel *A Dream of Wessex* (1977) Christopher Priest imagines a secure government facility in 1985 in which participants in a psychic experiment travel into the future to uncover solutions to current and imminent environmental disasters. Without ever leaving the drawers of their mortuary-like environment these 'cosmonauts of inner space' embrace the 'dreams' of their occupation and 'develop new lives in the future, becoming active community members and citizens within a collective, virtual, reality' (Bax 2019) which, ultimately, becomes more appealing than their existence in the real world. Like Ballard, Priest's vision of the future does not require immersive technology to facilitate the 'inner space time travel' which takes place in his novel, but many of the inter-dimensional journeys in and around the mediaeval castle within *A Dream of Wessex* (1977) echo Fell's comment that 'landscape is just a different place in time' (2020), as the various protagonists occupy the same location within Dorchester in dramatically different timeframes: 1985 and 2135. While the extended stays of the time-travellers in *A Dream of Wessex* (1977) result in physical consequences such as severe muscular wastage, which may be more in line with the symptoms of someone in a coma than that of a casual VR user, Priest's intuition that virtual worlds could become far more appealing than reality is authenticated by the long-term inhabitants of *Second Life* (Rymaszewski 2007) and the growing community of online video-gamers around the world. Future XR landscapes will blur the boundaries between the virtual and the physical world; *Schema* both recognises and tests this by combining real 360 footage with CGI recreations of historic places that have been removed from the physical environment, providing a suggestion of how a range of specific locations from multiple time periods could all be linked within an immersive experience, using the 'temporal landscape' as a narrative device. As we spend increasing amounts of time immersed in online social media portals, congregating in omnipresent virtual meeting places and environments for both leisure and work, the boundary between our 'inner space' and real world grows increasingly narrow. We may soon no longer regard our 'electronic lives' as separate and distinctly technological moments of everyday reality, but purely as another facet of being human.

Throughout the short history of immersive technology, if one concept has captured the imagination of artists and developers more than any other, it is the promise of a mixed-reality environment—essentially an empty room—that can be activated via spatial computing to simulate any time or situation. A mainstay of virtual reality depiction and ambition, the Holodeck first featured in *The Practical Joker*, a 1974 episode of the *Star Trek* animated series and subsequently often appeared in the television series *Star Trek: The Next*

Generation (1987-94) and also featured in the film *Star Trek: First Contact* (1996). According to Heim (1993, p. 122), the Holodeck is 'a virtual room that transforms spoken commands into realistic landscapes populated with walking, talking humanoids and detailed artefacts appearing so life-like that they are indistinguishable from reality.' Zambetta (2017) describes the Holodeck as 'a recreation room containing a simulated, alternative version of reality', a place for generating scenarios strikingly similar to the 'narrative-driven' action that currently dominates 'cinematic videogames' which populate the entertainment spectrum today (Zambetta 2017). Another aspect of the Holodeck that we see mirrored in similar videogame 'virtual worlds' is the ability to momentarily engage with a story and for activity within the scenario to continue regardless of the player's presence, subsequently on their return the environment has changed and/or the story has developed, just like 'real life.' Essentially, the Holodeck provided the writers of *Star Trek* with a narrative device 'to experiment with philosophical questions in settings not available in a typical sci-fi context' (Zambetta (2017) and place their characters within multiple settings—known as 'Holoprograms'—from human history such as Leonardo Da Vinci's workshop, Victorian London, or a mid-20th century New Orleans jazz club.

The promise and potential of the Holodeck transcended the imagination of science fiction fans and the general entertainment audience and inspired 'several generations of computer scientists who spearheaded research in artificial intelligence, computer graphics and human-computer interaction' (Zambetta 2017). One of these was MIT research scientist Janet H. Murray, who subsequently created her seminal work *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (1997) in which she argues that the computer is a capable platform for the development of a unique expressive narrative format, matching the rise of the novel powered by the invention of the printing press and the creation of motion pictures with the development of cellular film stock. As one of the first academics to claim that the outputs of such a platform could be as culturally important as the works of Shakespeare, Murray draws on prevalent computer games of the era and links the experience of playing them with existing media in an exploration of immersion, agency and transformation. By exploring the potential role of artificial intelligence in the creation of narratives, Murray points toward a direction involving emerging forms of storytelling that would be impossible to realise within traditional media such as cinema, television, radio or literature.

While a convincing working model of the Holodeck is yet to be realised, the quest for such a virtual platform is ongoing and, as Zambetta (2017) asserts: 'The convergence of these research areas has given rise to other forms of reality on the path to the construction of a real Holodeck.' The conditions required to build a real-life Holodeck were explored by Cavazza et al (2000) in their research project which aimed at 'developing an immersive story generation system supported by an Intelligent Virtual Environment' (Cavazza et al, 2000). While the virtual environment they created was relatively primitive by current standards, it allowed them to explore several factors in the 'believability' of virtual worlds such as story-telling which they found to be an essential ingredient and 'more than an entertaining add-on, it is an important requirement in order to create a believable (virtual) world, in order to allow a human to be socially immersed and be able to understand this world' (Cavazza et al, 2000). This factor connects to the ideas of Kerby (1991, p. 16) when he highlights: 'Experience gains it's density and elusiveness precisely through a continuous contextualising or meshing of part to changing whole; the relating of itself to itself.' The research team also found that a degree of social interaction was important and 'Believable virtual environments need to be social environments in order to support a user's social presence' (Cavazza et al, 2000), supporting the theory that when other people are included in a virtual environment the experience becomes more believable. Bricken (1991) underlines this with a condensed definition of his extensive experience of VR design:

> Psychology is the physics of VR.
>
> Our body is our interface.
>
> Knowledge is in experience.
>
> Data is in the environment.
>
> Scale and time are explorable dimensions.
>
> One experience is worth a trillion bits.
>
> Realism is not necessary.

In recent years, much effort within VR research has been concentrated on achieving reality, however, as industry veteran Ken Perlin attests: 'effective virtual reality isn't just about

verisimilitude. As with the way we experience reality itself, it's also about the way we lie to ourselves' (Vanderbilt 2019). Aylett & Louchart (2003) also identify that 'A narrative theory for VR must encompass the emotional contribution to believability, which contributes towards providing the user with a unique immersive experience.' Based on my own experiences of imaginative ground-breaking XR content such as *ManicVR* (2018), *We Live in an Ocean of Air* (2018) and *Notes On Blindness – Into Darkness* (2016), I would argue that until we focus on the 'believability' of virtual worlds and less on the 'reality' within them—such as the likeness to the 'physical' world around us—convincing immersive experiences such as those provided by the Holodeck will continue to elude us.

As we see in Priest's *A Dream of Wessex* (1977), an immersant may be fully aware that a virtual environment is not 'real', but that does not mean that the experience cannot be believable and, consequently, something that resonates with the senses. Equally, in order to assemble a convincing immersive environment an artist does not necessarily have to conform to the specifics of reality. For *Schema* (2017), the creation of a sonic environment not based on 'reality' aligns with other VR artworks—such as *Notes On Blindness – Into Darkness* (2016)—which attempt to form a sense of place, or 'spatial experience', by non-traditional means. In most cases this involves using the senses in a way that would be impossible with traditional media—such as photography or film—and utilising technology such as a VR headset. Many levels of believability require some degree of audience participation, and this is often aided by the liminal space between memory and imagination, as Kerby (1991, p. 25) writes: 'Imagination is difficult to separate from memory because it shares a similar phenomenal structure. Their difference, where it is discernible, lies especially in the belief accompanying each presentation.' The distinction of memory from imagination is further blurred by time, and our recollection of an event is shaped by many factors, not all of which are in the past. The potential for imagination to unlock the possibilities of virtual reality is further explored by Harper (2017), who describes VR as 'a substantive product of the human imagination' and 'a non-reality made real by humans', while enthusiastically asking: 'Has there ever been a greater opportunity, a more spectacular platform for invention, a less restricted portal for possibility?' Also, within such experiences, we are not restricted by the traditional limitations of gravity and solid walls, as William Bricken reminds us when he says: 'psychology is the physics of virtual reality' (Markley 1995). Harper (2017) decodes the uses and possibilities of augmented reality technology within cultural and industrial settings

before providing a definition of AR and ‘non-reality’ which effectively forms a solid description of XR artworks such as *We Live in an Ocean of Air* (2018): ‘take what is real and explore it, add to it, record it, place it in a network which you control, delving in, adding to, reflecting on, and ultimately responding. Augmentation in this sense means reality creation and re-creation, by us’ (Harper 2017). Taking into account that the success of any extended reality experience is reliant on the essential cognitive ingredients of believability and imagination—and possibly memory—we can begin to understand how virtual realms could be constructed to provide portals to other times and places, as demonstrated in *Schema*. These qualities would also be required in the reconstruction of past events, much in the same way as they are essential within the viewing of other screen-based media, however, with spatial presence and the sense of ‘being there’ serving as an added catalyst for imagination and memory.

5.0 Conclusion

At the turn of the 21st-century it would have been difficult to convince the majority of the general public that, within twenty years, they would carry a small device in their pockets or bags and be able to access the kind of information that traditionally would involve a visit to their local library. By touching onto a piece of glass or simply speaking, we can now obtain in seconds the average rainfall of a particular country, the attributes of a certain species of bird, an image of a specific national flag, or the name of the main protagonist in a novel. Immersive technology has the potential to further deliver such instantaneous data and knowledge onto the world around us, and the ability to display images and moving imagery, in isolation or overlaid onto the surrounding environment. As we enter an age of convergence, factors leading to Extended Reality (XR) experiences in everyday life primarily involve three elements: technology—both hardware and software—together with the method of delivery and the technical competence of the population. Devices and the components within them continue to evolve and become increasingly smaller, faster and more robust; the cameras now integral to mobile devices gain further precision; integration with both GPS location mapping and advanced AI software allows computers to recognise physical surroundings and place virtual content within them. In order to deliver such experiences, 5G signals and superfast broadband wi-fi networks transport data-heavy XR content to a society with a rising knowledge of technology, accustomed to mobile devices and increasingly reliant upon them.

The virtual reality continuum offers another level of 'being' not possible with film, audio or literature; an opportunity to exist, individually and collectively, in a different place previously unexplored and uninhabited. This will inevitably lead to various digital social layers which will in turn be engaging, enlightening and empowering for many. However, this will be invisible and unavailable to those of lower socio-economic standing until universally-compatible, globally-affordable, devices are widespread. Ultimately, the immersive realm will become an additional platform of existence that can only be accessed with a sufficient (wearable) device that creates and mediates the experience. As Greenfield (2017, p. 84) concedes: 'It is hard to argue against a technology that glimmers with the promise of transcendence' – and yet we need to carefully consider how to govern such a seductive proposition fairly and account for those not able to access the virtual space. In a world where 43% of the population are not online (Internet Usage Statistics, March 2019) and

a whole range of services are beyond their grasp, there is a danger that this technology could effectively lead to a new form of 'virtual poverty.' For humanity to embrace and optimise the potential of this new digital opportunity, a consideration of inclusivity is essential to create an essential 'virtual layer' of society which is accessible to all, avoiding the divisions which currently exist in society.

Following Aylett & Louchart's claim in 2003 that 'VR should be considered as a specific narrative medium alongside other narrative forms such as theatre, literature or cinema', the immersive technology platforms of Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR)—collectively known as Extended Reality (XR)—have grown to provide exciting new possibilities for storytelling and the creative practice of artists. XR offers a new way for us to experience space and time. A similar claim could be made for a book, a play, or a film, however, the immersive qualities of XR generate a unique sensation of spatial presence or 'being there' which provides new and exciting possibilities for artists and those working within the arts and humanities. Additionally, XR experiences are impacted by the viewer's own interactivity and, in some cases, may include their own previous experiences and memories. As mixed reality environments do not need to follow traditional temporal and spatial boundaries, they are particularly open to the exploration of nonlinear narratives. It is not difficult to envisage how the work of an artist such as Akomfrah could be translated within a mixed reality environment: a green site augmented with black and white footage of an industrial past; a deserted shipyard brought to life with crowds of virtual passengers departing ships seventy-five years ago; images and audio testimonies, peeling away the layers of gentrified neighbourhoods to reveal the lives of previous inhabitants. In the course of my research, I have drawn on literature, screen work—both two dimensional and 3D—and examples of immersive audio. Within this, I have discussed more recent examples of XR (VR/AR/MR) artworks and highlighted established artists—such as John Akomfrah and Mark Leckey—who do not currently work with immersive technology but whose practice can be seen as a roadmap for the display of audio and visual material in mixed reality environments and the organisation of the sensorial tableaux within future XR creations.

Building on the claim that ''Being there' … is the defining characteristic of VR' (Aylett & Louchart 2003) I have highlighted more recent developments within XR technology and the arts. I have demonstrated that the 'ambiguity' highlighted in Bordwell's theory for 'Art-Cinema Narration' (1985) is present and magnified in many pieces of 'art-based' XR

or—as I label such works—'Art-XR.' Also, I have shown how other 'ambiguous' artworks that are not within the XR category—such as those I have discussed by Akomfrah, Ballard, Tarkovsky and Leckey—can be seen as roadmaps and inspiration for future explorations in extended reality art. Additionally, the nature of immersive artworks, where 'being there' is often a viewer experience in its own right, lends itself to increased opportunities for 'ambiguity' beyond those of cinema and other, more traditional, artforms.

Throughout this thesis I have argued that extended reality (XR) is an emerging artform with unique qualities including the ability to convey a sense of spatial presence. The unique properties of emerging VR, AR and MR artworks are significant enough for XR to be viewed as a distinct new form of artistic expression—such as literature, photography, cinema, radio or television—and not purely an extension of film or video games. Extended reality (XR) displays unique spatial attributes that do not collectively appear in existing media and has the capacity to alter our perception of space and time via experiences involving people, places and memory. With both my creative practice work and written thesis I have demonstrated how the sense of spatial presence or 'being there'—identified by Aylett & Louchart (2003) as 'the defining characteristic of VR'—is a unique element of VR, AR and MR creations and an aspect which is being increasingly exploited by artists and creative communities. Such activity is being empowered and driven by the convergence of several factors including GPS location services, high-bandwidth digital connectivity (5G), the growth of AI systems and improved camera lens in mobile devices. Combined with an increasingly digitally-literate population, these factors are proving to be ideal conditions for XR creations and spatial narratives, including location-based historical experiences, 'Art-XR' and the development of 'mirroworlds' and/or 'metaverses.'

As immersive technology continues to develop – together with the digital and social networks supporting and surrounding it – we are entering an era where virtual elements seamlessly interact with real places and people, influencing each other and creating unique experiences that are unattainable with previous existing media or artforms. Throughout the thesis, I have built on the structural framework and 'dynamic systems view of narrative' suggested by Aylett & Louchart (2003) and, in particular, their argument that ''Being there' is … the defining characteristic of VR' by highlighting more recent developments within XR technology and the arts. Drawing from key texts by Pimentel & Teixeira (1993), Ryan (2015) and Lanier (2017) and analysing VR works including *Memory/Place: My House* (Rothberg

2014–15), *Thresholds* (Collishaw 2017), *We Live in an Ocean of Air* (MLF 2018), *To The Moon* (Anderson & Huang 2019) and my own VR journey *The Virtual Hole in the Road* (2016), I have demonstrated how extended reality (XR) offers a new way for us to experience space and time. A similar claim could be made for a book, play, or film – however, the immersive qualities of XR generate a sensation of spatial presence or 'being there' (Aylett & Louchart 2003). Additionally, XR experiences are impacted by the viewer's own interactivity and, in some cases, may include their own previous experiences and memories. My own creative practice piece, *Schema*, suggests a possible structure for combining inter-dimensional locations in future arts-based XR experiences. *Schema* also demonstrates a mix of visual techniques and sources—'real' 360 filming and 'non-real' virtual surroundings; an artistic recreation of a location based on historical accounts and archaeological research; a 'factual' recreation based on photographs and films—foregrounding the ability of a mixed reality experience to position such recreations accurately in the actual physical spaces.

5.1 Summary of findings

I have reviewed existing theorisations of VR and extended reality (XR) in various contexts, evaluating and considering them in relation to applications of spatial computing and XR within the arts and humanities. In doing this, I have highlighted the difference between the creative potential of XR and the unique emotional and/or psychological qualities which are unachievable with more traditional media or art forms. While assessing such aspects, I have outlined some potential routes for mediating the sci-fi promise of this emergent artform and some potential civic impacts—both positive and negative—of the resulting experiences. After discussing Aylett & Louchart's (2003) claim that 'VR should be considered as a specific narrative medium alongside other narrative forms such as theatre, literature or cinema' and arguing that first-person video games use a similar narrative theory model, I have examined VR experiences via the 'invisible observer' lens of Bordwell (1985), showing that even exclusively computer-generated experiences adhere to this point-of-view in order to promote more aesthetic reality and an increased sense of presence within virtual settings. After considering this, I have highlighted that even the most basic 360 VR films provide the viewer with the freedom to choose where to look. This is another unique aspect of VR and other 360 experiences: the viewer does not directly follow the director's gaze and, subsequently, the director must find alternative ways of leading the narrative, possibly via characters, objects, graphic alerts or sound.

When discussing the virtuality continuum (Milgram & Kishino 1994) and development of VR/AR/MR technology I have signposted early pioneers of XR art, such as Myron Kruger, Dan Sandin and Scott Fisher, and also considered the work of technology pioneer and VR evangelist Jaron Lanier and his numerous attempts to describe and define the essence of virtual reality. Building on this work and insights – and my own personal experience as a creative practitioner – I have outlined the unique qualities which distinguish VR from other artforms making it a powerful tool for artists and future creativity and 'spatially oriented entertainment' (Schilowitz in Bucher 2017, p. ix). These include the ability to place the viewer in the skin of another, potentially creating a more empathic perspective via 'body tourism'; the direct sensory impact of VR which does not require the visitor to know a specific written or spoken language, or understand a predetermined set of symbols (Pimentel & Teixera, 1993, p. 17), much in the same way as instrumental music or field recordings; the

sensation of ‘being there’ – ‘the defining characteristic of VR’ (Aylett & Louchart 2003) – which I have linked with the feeling of ‘being with’ (Forrest 2020) and, expanding on Heater (1992), I have argued that ‘being there’ is an essential ingredient of ‘believability’ – a more important factor than ‘reality’ in VR experiences (Heater 1992, Lanier 2017, Ryan 2015). After highlighting the invisibility of XR technology (Weiser 1991) and examining the challenges of invisible systems of mediation (Murray 1997, Dow 2008) I have shown that the inability to distinguish between the virtual and the real—a much used trope within science-fiction narratives—is fast becoming a genuine possibility with a mixture of danger and exciting creative potentialities.

In order to address the research questions I have discussed various XR experiences—including a detailed description and reflections on my own creative practice work *The Virtual Hole in the Road* (2016)—and conducted interviews with other professionals working in the realm of immersive storytelling. This process has helped me to examine place and its relationship with subjectivity within immersive storytelling, particularly when contrasted and compared with other XR environments in works such as *Second Life* (2003), *Memory/Place: My House* (Rothberg 2014–15) and *Thresholds* (Collishaw 2017), with the sensation of spatial presence, or ‘being there’, leading to cognitive sensations such as ‘unthought known’ (Genn 2020).

My interview with musician Richard H. Kirk detailed his unique experience of ‘time travel’ simulacra with the creation of his own personal ‘holodeck’, as he observed the recreation of a specific life event in a physical environment with himself portrayed by an actor. I have described how such a phenomenon could become a common occurrence via XR storytelling, simulating personal journeys through time and space very similar to those suggested by Wells (1895) and numerous other science fiction writers exploring the possibilities of non-linear time. Such experiences draw on multiple aspects outlined and examined within the thesis but, specifically, personal and collective memory and the ability of convergent XR systems to generate and sustain environments that are sufficiently realistic to create ‘believability.’ Within such scenarios, there is the possibility that we may not necessarily be fully in command of the experiences, including any virtual places or beings that we encounter.

I have aligned the work of maverick storytellers—Akomfrah, Ballard, Borges, Lynch, Tarkovsky and Wells—in order to show how they effectively form a roadmap for current and

future XR creativity via frequently nonlinear and 'ambiguous' narratives (Bordwell 1985). My claim that the work of John Akomfrah is particularly pertinent to future XR narratives is underlined by his simultaneous nonlinear use of numerous dimensions in time and space, viewing 'the past and present simultaneously' (Alter et al, 2016, p. 3) to present a unified story. I have argued that, over the course of his career, Akomfrah has effectively invented his own form of 'time travel'; mixing a potential future with the historical past and skilfully blurring temporal boundaries – his large-scale multi-screen presentations expanding on Bordwell's theory for 'Art-Cinema Narration' (1985) with his signature handling of 'ambiguity' or 'masterful vagueness' (Genn 2020) providing an exemplary guide for the use of XR within the arts and humanities.

Inspiration for nonlinear narratives is also present in the early work of J.G. Ballard. I have drawn parallels between *The Atrocity Exhibition* (Ballard 1970) and Akomfrah's dialectical approach to montage in order to facilitate a 'third meaning' (Akomfrah, TateShots 2015). Using Borge's *The Garden of Forking Paths* (1941) and *Interstellar* (Nolan 2014) as literary and cinematic examples, I argued that spatial computing will combine with AI to create the possibility of endless branching narratives within XR storytelling. Within the same chapter, I also highlighted that immersive art and mixed reality narratives are still waiting for their 'spiritual need' (Tarkovsky) to be expressed and identified, as was the case with literature, film and other past and present art forms. Following on from Bordwell's (1985) theory for 'Art-Cinema Narration', I have identified non-documentary XR artworks that display 'ambiguity' and do not adhere to traditional narrative formats, as belonging to a unique group which I labelled 'Art-XR.' Drawing on 'Art-XR' and 'proto-XR' artworks—such as Rothberg (2014–15) and Leckey (2015)—I have also argued that, as humans, we already effectively augment various media with our own memories, thoughts and experiences and, consequently, extended reality is essentially a natural extension of this cognition.

Using examples of digitally-native multiform stories and XR works from a documentary background—such as *ManicVR* (2018), *Notes On Blindness – Into Darkness* (2016), I have shown how VR/AR/MR is an ideal tool for future nonlinear narratives. Detailing the mixed reality exhibit *Thresholds* (2017), I examined how artist Matt Collishaw took a blank white space and overlaid a virtual layer from nearly two hundred years ago in order to create a believable portal to the past. I also described unique features within the immersive installation *We Live in an Ocean of Air* (2018) which allowed participants to see real-time

representations of others within the same physical gallery space within the virtual world. Linking to the multi-stranded branching narratives suggested by Borges (1941) and *Interstellar* (2014) and Murray's vision where 'We can play all the parts, exhaust all the possible outcomes' (Murray 1997, p. 223), I highlighted the nonlinear 'shifting states' (Anderson 2016) of *To the Moon* (2019) and Karen Palmer's 'neurogame' *RIOT* (2016) in which decisions are made via AI detection of the participant's facial expressions, in a combination of storytelling and neuroscience. Outlining the goals *Realtime Art Manifesto* (2006) I have defined the main points of the manifesto as being benchmarks for current XR creators and emerging narratives for 'storification' (Aylett 2000) and a user-centric approach to narrative: 'storydoing' (Allen 2018) or 'storyliving' (Maschio 2018).

Linking VR environments to the ideals of 'Utopia' (More 1516), I have shown how the online virtual world of *Second Life* (2003)—a realisation of *Snow Crash* (Stephenson 1992) and numerous works from 1984 onwards by Willam Gibson—acquires a sense of reality when human beings populate it with their ideas and imagination, mirroring Gissing (1915): 'It is the mind which creates the world around us.' Subsequently, I have discussed how virtual environments require our imagination, or an 'active creation of belief' (Murray, 1997/2017, p. 137), in order to be believable. Following this, I have outlined the benefits and possibilities of augmented reality experiences, and argue that AR could become inseparable from our everyday activities, to the extent that immersive technology becomes 'a direct extension of our own senses' (Greenfield 2017) which, beyond the sensory aspects, may be potentially hazardous for those with particular disabilities who come to physically depend on AR within their everyday lives. In order to further understand the potential to create 'believable' virtual experiences within the arts and humanities, I have discussed emerging subtle sensorial aspects of XR which augment and enhance the visual and aural environments.

Addressing the topic of spatial presence, I have linked ideas of volumetric memory (Gibson 1984) to the belief of some artists that they saw the world 'psychologically' (Gayford 2018) and argue that the idea that both movement and mnemonic data can be 'geo-tagged' and VR can 'rewire' such activity (Atkin 2019) suggests new possibilities for how XR creators could enhance the impact and meaning of their work. As an example of this, the spatial presence of the VR environment in my own creative practice piece *The Virtual Hole in the Road* (2016), triggered numerous memories, thoughts and feelings for many of those who experienced the

non-linear narrative. In order to approach a structure for how memories could be articulated within a VR environment, I detailed a non-VR work by the artist Mark Leckey, the 23-minute audio-visual work *Dream English Kid 1964-1999 AD* (2015). While generating an experience where 'cryptic, purely personal memories are cross-hatched with social and cultural collective memories' (Wallis, 2019, p. 56) Leckey attempts to document, reconstruct and remember his personal history via his own unique artistic and hauntological lens.

To further address the research questions and test the subsequent theory and arguments within this thesis, I made the creative practice piece *Schema* (2020) which I have described in detail, highlighting science fiction tropes inspired by Akomfrah, Kubrick, Pal and Tarkovsky. Film can be used to convey information, document a place, person or occasion, tell a story from one or multiple viewpoints, or simply be an abstract piece of art – and VR can be a platform for all of these with the added factor of spatial presence. *Schema* follows Bordwell's theory for 'Art-Cinema Narration' (1985) with the additional factor of spatial presence and, subsequently, can be labelled a work of 'Art-XR', suggesting a possible structure for combining inter-dimensional locations in future arts-based XR experiences via a nonlinear narrative featuring a range of specific, linked, locations from multiple time periods.

I have rigorously outlined the production process for *Schema*, including the timing and rhythm (Tarkovsky, 1988, p. 117) within VR artworks and 'stylistic schemata' (Bordwell, 1985, p. 36). Detailing the specially constructed soundtrack for *Schema* by Mark Fell, I outlined the benefits of non-diegetic sound within VR artworks and compared this to the audio employed by Kubrick and Tarkovsky (Bould 2014, Shpinitskaya 2006) in their respective works of science-fiction cinema. Directly addressing the term 'presence' within a context of spatial presence and immersion (Weinel 2018) and returning to Pudovkin's theory of the 'invisible witness' or 'invisible observer' via Boardwell (1985), I have examined how VR artworks such as *Schema* can challenge our perception of the 'virtual self' in terms of scale and create a sense of 'being there' without including a virtual body.

Following an explanation of how *Schema* is indebted to multiple outputs of science fiction—or 'sci-fi', or 'speculative fiction'—in terms of narrative and aesthetic quality, I have outlined how science fiction has played an important role in the development of XR technology and the ongoing imagining of how XR experiences could be formed and shared. Specifically, I have drawn on the novel *Solaris* (Lem 1961) and Tarkovsky's subsequent

critically-acclaimed cinematic telling (1971) for two main purposes. Firstly, to highlight that the virtual characters featured in Solaris are no longer a distant possibility, using the South Korean television programme *Meeting You* (2020) as an example of realistic and believable virtual beings interacting with people within a mixed reality environment. Secondly, that the entertainment sector is increasingly recreating virtual versions of real people, particularly within cinema and live music, some of whom are deceased and others being younger versions of those still alive. A combination of these two factors leads to the conclusion that, eventually, we will have the option to welcome 'digital ghosts' into our lives—some of whom may be from our own past—and, like Kelvin in *Solaris* and the grieving mother in *Meeting You*, we may choose to respect and interact with such characters as though they were 'real' human beings. I have followed this claim with a discussion on the ethics of virtual beings (Higgs 2019, Slater 2020) and the recreation of the deceased, which sometimes prompts accusations of exploitive 'ghost-slavery' (Reynolds 2020). Finally I questioned if, like Rheya in *Solaris*, virtual beings—or simulacra—will transcend their imitative origins and take on a life of their own to become irreplaceable.

Looking at 'mixed reality memory contamination', I examined our ability to 'explore our notions of time, space, and memory' (Pimentel & Teixeira 1993) via VR artworks. As experiences within virtual realities are stored within our minds, they could become solid memories with similar schemata structures as those formed by 'real world' activity. As emerging XR technology is rapidly integrated and embraced by society, it will quickly 'become the operating system through which we navigate our worlds' (Atkin 2019). Citing the 1:1 map described by Borges in *The Garden of Forking Paths* (1941) as inspiration, I outlined how virtual objects and environments will be overlayed onto and into our physical world, in a 'mirrorworld' where it will become an increasingly difficult—and pointless—exercise to distinguish between the two.

In discussing 'inner space time travel', I began to examine the conditions that may be required in order to recreate events or make new stories featuring familiar places and people from our individual pasts. Much of the work involves the participants being prepared to 'understand time in a new way' (Gleick, 2016, p. 295) and the possibilities of this have been discussed by numerous others (Allen & Tucker 2018, Darnell & Hutchinson 2016, Kelly 2019). Key to such 'believability' can be the power of imagination within the virtual realms; often the storyline or the virtual environment is sufficient for many to stimulate their own

imaginations and narratives. This was certainly the case with my own creative practice piece *The Virtual Hole in the Road* (2016), a 'fixed-route' VR journey which was adequate to satisfactorily achieve a sense of place and, in some cases, immense familiarity. Highlighting Fell's *A Stitch Outside Time* (2019), I have shown that not all virtual environments and landscapes include a visual element and that 'all that landscape is just a different place in time' (Fell 2020).

Using the term 'cosmonauts of inner space' (Trocchi 1962) – which I argue is an appropriate term for those now exploring virtual space within their own minds via spatial computing – I have examined previous examples of 'out-of-body' experiences (Ballard 1960, Kolkman 2017) and 'digital ghosts' and how they prepare us for life within an 'inner space.' Spaces which are not 'real' but are undeniably believable—such as looking at one's self in a mirror and the surrounding space (Foucault 1967)—become commonplace with time and integrated into our daily lives. The sense of utopia, or 'placeless place' (Foucault 1967) describes could equally be applied to immersive environments such as *Thresholds* (Collishaw 2017) or *The Virtual Hole in the Road* (Bax 2016), which may not be 'real' but possess the potential to be utterly believable. As spatial narratives and virtual places and beings absorb into our physical surroundings, time becomes 'less linear and more diffuse, spread out like a map instead of a string' (Lanier, 2017, p. 65) and we will experience a temporal fluidity, a nonlinear blurring of the past and the present, and a knowledge that the future will become part of the same plan.

As certain virtual experiences become inherently tied to specific physical places, visitors to those locations will expect to see the augmented content as regularly as the existing buildings or landscape; this leads to a scenario where the virtual material within the 'mixed reality environment' forms as much a part of their 'memory of place' as the surrounding trees, concrete, bricks or stone. Consequently, mixed reality environments provide exciting and innovative possibilities for creative presentations and experiences that extend beyond the capacity of existing media formats.

5.2 Digital death tech and virtual resurrection

In an emerging era of deep fakes and doublespeak, the question of what makes us human and unique becomes increasingly urgent. Simultaneously, as the boundary between the real and the virtual begins to blur (Ng 2019), the ability or desire of our society to recognise and realign to the shrinking of such liminal space, as highlighted in *Solaris* (Lem 1961), *Westworld* (2016-18) and *San Junipero* (2016), increasingly means the technology becomes invisible (Murray 1997, Dow 2008) and our focus is concentrated not on the mode of delivery but on the story being told. Inevitably, some people will marvel at the spectacle of seeing old photographs of their deceased elderly relatives brought to life – revived and smiling via AI algorithms – while others will be horrified at what they perceive as 'puppeteering the dead', mirroring the opposing views of Baudrillard and Lévy. Such technology, employed to great effect by director Peter Jackson in his film *They Shall Not Grow Old* (2018), once solely a precious asset of Hollywood film studios, is now available to all via a device in the palm of our hand. The possibilities for the application of such technology within the world around us generates as many problems as it does possibilities and we have yet to formulate the rules of engagement for such experiences (Pesce 2020). Over the coming years, as immersive technology grows increasingly omnipresent, this is one area that will be scrutinised and debated in governments and courtrooms alike.

During the COVID-19 pandemic many meetings for work and personal purposes were forced online and some continue to be conducted in such a way, often with people only ever seeing colleagues on screens and never meeting them in person. With the proliferation of augmented reality and increased placement of virtual beings within our physical environment, we are encountering a situation where virtual beings become more present in our 'real' world than some real people. Slater et al (2020) attempted to formulate early ethical guidelines with their paper 'The Ethics of Realism in Virtual and Augmented Reality' and, in doing so, appealed for the creation of a 'code of conduct' with content determined by those working with XR technology: researchers, creators and distributors. The concerns of Slater and his team were brought into sharp focus within months of their paper being published, as news outlets around the world reported the holographic resurrection of the American attorney and businessman Robert Kardashian on the occasion of the 40th birthday of his daughter Kim on 29 October

2020. As *The Guardian* reported (Gorman 2020): 'Robert Kardashian is not the only departed celebrity to be resurrected in holograph form. Tupac Shakur, Amy Winehouse and Ronald Reagan have all received similar treatments – albeit for live performances and museum exhibitions rather than as birthday gifts' – however, much of the controversy surrounding the hologram of Kardashian was the 'birthday speech' written for him by his son-in-law, Kanye West, who funded the experience as a gift for his wife. In the eyes of many, by literally putting words into the mouth of his deceased father-in-law, West breached many of the ethical concerns I have previously discussed, particularly those outlined by Simon Reynolds when discussing 'ghost slaves' (Myers 2019) and his actions also mirrored the indignation caused by *Meeting You* (2020) and the *Whitney Houston Hologram Tour* (2020). Strictly speaking, Kardashian's spectre was not actually a hologram, as *The Guardian* (Gorman 2020) also affirmed: 'These projections are not technically holograms but instead rely on an optical illusion, first discovered in the 19th century called Pepper's Ghost to create the appearance of a three-dimensional image. True hologram technology is still far from any commercial application.' As augmented reality hardware develops, we may well find that the elusive holographic technology which has featured in science fiction for decades may actually be realised via AR eyewear and not require any beams of light or hi-tech refinements of 'Pepper's Ghost' in the physical environment; the crisp, ultra-realistic, 'holograms' will literally appear in our mind's eye.

The symbiotic relationship between the virtual world and the physical realm is evaluated by Higgs (2019) who suggests: 'We once thought the computers were things we would enter, but it may be that we had that the wrong way around. It is the digital spirits who will enter the real world, and enchant it, as the line between the physical and the digital becomes increasingly blurred' (p. 235). This idea that distinctively separating the two realms could become notably difficult as immersive technology gains prevalence is also recognised by Ng (2019): 'How we identify and interrogate what belongs to the worlds of actual reality and fiction, respectively, will become an increasingly complex task.' In some instances—legal or criminal cases, for example—the ability to differentiate the two will be essential, however, in more creative scenarios, we can expect that the capacity to separate the virtual from the physical will be actively discouraged by creators and viewers alike, giving rise to multiple instances of 'masterful vagueness' and innovative outlets for imagination.

5.3 A roadmap for future XR experiences

As I have outlined in earlier chapters, maverick storytellers such as Akomfrah, Ballard, Borges, Lynch, Tarkovsky and Wells, with their respective individual approaches to nonlinear narrative, effectively form an artistic roadmap for future work in extended reality and immersive creativity. When viewed collectively, their joint output—literature, film, art installations—can be summarised by Lanier (2017): 'What unites all of these works is a temporal fluidity; a blurring of the past and the present, and a knowledge that the future will become part of the same plan, as time becomes less linear and more diffuse, spread out like a map instead of a string' (p. 65). The 'fluidity' Lanier describes can be perceived as a reworking of temporal cognition, where writers and artists demand that we rethink linear narrative and open our minds and imagination to an uprooting of traditional perception – and, in doing so, they prepare us for mixed reality environments where our everyday activities—work and leisure; shopping and sport; placefinding and parking; eating and education—will be seamlessly attached to the transformational qualities of immersive technology. As we explore the creative content and their implications from the writers and artists I have highlighted—plus the innovative and important works that I have detailed such as the *Realtime Art Manifesto* (2006), *Notes On Blindness – Into Darkness* (2016), *Thresholds* (2017), *Outrospectre* (2017), *ManicVR* (2018), *We Live in an Ocean of Air* (2018) and *To the Moon* (2019)—a potential route for the future directions within arts-based mixed reality storytelling begins to emerge. Akomfrah's delicate handling of multiple video sources within his multi-screen presentations with a blend of diegetic and non-diegetic sound, combined with the interweaving of seemingly disparate dimensions and locations in time, is a particularly powerful and inspirational roadmap for the display of audio and visual material within mixed reality experiences and the management of the sensorial tableaux that they produce.

We are currently in a development stage of the immersive ecosystem where extended reality provides a new opportunity, as I have already discussed, to step outside of our traditional comfort zones and see the world through the eyes of others via forms of VR 'body tourism', while also creating a natural environment for the forms of branching narratives imagined by Borges and graphically depicted in *Interstellar* (Nolan 2014). Equally, while the amalgamation of such technology provides countless opportunities to improve our lives in

numerous ways, we need to mitigate the circumstances by which some people could be excluded and inadvertently placed in a state of 'virtual poverty.' *Dream English Kid 1964-1999 AD* (Leckey 2015) and *Memory/Place: My House* (Rothberg 2014–15) both suggest a personal introspective direction for our digital memories and deeply personal data; bending time and space in emotive and inventive forms, 'a non-reality made real by humans' Harper (2017). If we place immersive technology in the hands of artists such as Leckey and Rothberg, they will eventually transform the way we perceive the world around us and force us to re-examine existing traditional temporal and spatial boundaries. Spatial narratives such as *The Virtual Hole in the Road* (2016) form the beginning of our understanding of how places and stories, particularly those which are important to a community, can be (re)constructed within the virtual realm.

I have distilled and demonstrated many of the findings within the thesis via my creative practice piece *Schema* (2020), an immersive artwork which could be described as 'Art-VR', which is both the product and proof of my scholarly investigation. *Schema* (2020) provides a snapshot of how a nonlinear journey through space and time could feel, exposing the viewer to multiple dimensions and parallel places within different virtual environments that are connected on numerous levels. As with some of the other examples of arts-based VR I have discussed—*Notes On Blindness: Into Darkness* (2016), *The Virtual Hole in the Road* (2016) and *To The Moon* (Anderson & Huang 2019)—*Schema* further proves that you do not need to have control within an environment, for example the ability to move around—other than controlling your head movement and gaze—in order to establish a sense of spatial presence or 'being there' (Aylett & Louchart 2003). Also, in terms of 'presence', environments do not necessarily seem less plausible, real or 'believable' because they are CGI recreations or physically impossible – for example the sparse vector landscapes of *Notes On Blindness: Into Darkness* (2016), the psychedelic scenes from *To The Moon* (Anderson & Huang 2019) and the 'temporal landscape' section of *Schema* which was inspired by George Pal's surrealist title sequence for *The Time Machine* (1960).

Within 360 VR it is difficult to direct the viewer's gaze in order to lead a narrative—as one would in cinema (Bordwell)—however, the opening view of each 'scene' within a VR experience can be used to orient the immersant as an entry point to which they return. For example, the second scene of *Schema* begins with the viewer looking directly down a corridor, not at a nearby doorway or out toward the distant landscape. Equally, if the initial

orientation points are subsequently moved, as in the 'temporal landscape' sequences in *Schema*, orientation within a virtual environment can be made intentionally difficult or impossible, with a sensation of floating unanchored in space. These are unique characteristics of immersion within extended reality experiences that are not present in traditional, existing, artforms.

Schema demonstrates that virtual reality can be used to construct self-contained, individual, artworks that are not solely extensions of television or cinema, or forms of 'immersive documentary.' Like many other visual artworks – paintings, sculpture and photographs – *Schema* can be enjoyed on a purely aesthetic and sensorial level, but further information about the piece and the places depicted can enhance the richness of the experience and reading of the artwork. Equally, virtual reality artworks—or works of 'Art-VR'—do not need to be purely abstract such as the experiments described by Lanier (2017), and *Schema* highlights the development of a specific local geographical area over several centuries, linking a mediaeval castle and concrete utopias within the propagation of a city. *Schema* utilises the 'temporal landscape' as a narrative device in order to connect these seemingly disparate locations.

VR experiences offer the creator an opportunity to provide the sensation of 'being there' via spatial presence (Aylett & Louchart 2003), even if the environment is not 'realistic.' In more abstract or ambiguous settings, such as the 'temporal landscape' in *Schema*, the viewer still has a sense of place, even though the location is not based on a typical narrative setting or 'realistic' location. This could be likened to the sensation that arises with unrealistic surroundings in our dreams which we know are not real but still feel 'believable'; we are able to draw a sense of presence and 'being there' (Aylett & Louchart 2003) and, in some cases, vividly recall the environment afterwards. In terms of sound and 'believability', while video game players may be accustomed to experiencing realistic sounds within virtual environments in order to enhance the sense of 'reality', *Schema* shows that more ambiguous 'Art-XR' pieces do not necessarily seek to emulate reality and, consequently, diegetic sounds are not expected or particularly reassuring – the environment is equally 'believable' with non-diegetic sound.

Schema further tests and expands Pudovkin's theory of the 'invisible observer' (Bordwell 1985) placing the viewer in a space where it is impossible to gauge one's physical scale or

location. *Schema* demonstrates that, in order to have 'presence' within a virtual reality experience, the viewer does not necessarily need to see their 'virtual body' or adhere to the standard rules of physics. We may not be able to see our body or legs, but we still very much feel we are standing within a 'place.' It is unclear, or ambiguous, whether the viewer is the size of an ant or that of a human, but the illusion of 'being there' (Aylett & Louchart 2003) persists, and the experience remains intact regardless of how physically impossible or incredible it may be. This is an extension of Pudovkin's theory of the 'invisible observer' (Bordwell 1985) that is unique to VR.

The convergence of emerging XR technologies creates a platform on which immersive experiences could occur in real time without the direct action of the viewer. Within such a scenario, the immersant does not willingly open a book, turn on a radio or television, or enter a cinema or art gallery – the artwork has the ability to materialise around them. The same could be claimed for some audio artworks, but even they tend to be site-specific, an innovative exception to this being Fell's *A Stitch Outside Time* (2019). As XR technology gradually places the internet within the physical world around us via wearable devices—for example AR glasses—such experiences can potentially happen at any time in any location, possibly without the permission of the immersant. This is a truly unique aspect of extended reality experiences, requiring further academic and industrial research and investigation within artistic practices. *Schema* aims to begin the conversation of how XR technology could facilitate experiences such as returning a mediaeval castle to the landscape or restoring an urban landmark to the fabric of a city within a nonlinear narrative.

As with traditional cinema, VR and AR experiences can combine various visual formats—filmed sequences, animation and computer generated imagery—in order to deliver different parts of the same narrative. Emerging and future XR landscapes blur the boundaries between digital and real-world content; *Schema* both predicts and tests this by combining real 360 footage with different aspects of CGI imagery containing varying levels of realism. *Schema* draws attention to the idea that, as XR technology develops, the hybrid presentation of CGI elements within our own natural environment will become increasingly commonplace, in terms of graphic information and overlays, augmented reality landscapes and virtual beings. The various sensations that *Schema* provokes—some of which are relatively intangible—point towards a virtual 'mirrorworld' becoming more prevalent in our society, with increasing amounts of our own personal data and digital content embedded

within it. We can expect such experiences to harness the connectivity of physical and virtual elements – with varying levels of emotionally seductive content – as ghosts from our past are placed in the present, guiding us to the future. Once we have the ability to create our own virtual environments and the responsive and life-like characters inhabiting it, within a mixed reality which seamlessly interacts with our physical environment, then many of the ideas and concepts from speculative fiction will materialise into the world around us and finally take form, providing an opportunity to 'see-through' time and view our everyday experiences as nonlinear journeys through space.

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Dream English Kid 1964-1999 AD., (2015). [Film]. Directed by Mark Leckey. London: Tate.

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From Life., (2017). [Exhibition]. Artist: Anthony Gormley. At: Royal Academy, London.

The Graveyard., (2008). [Videogame]. Directed by Auriea Harvey & Michael Samyn. Tale of Tales. USA.

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https://wakefieldartspartnership.org/it-is-the-mind-which-creates-the-world-around-us
https://www.parex.co.uk/Case_Studies/Renders/Public_Art_Wakefield_Kirkgate_Station.aspx

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Journey., (2012). [Videogame]. Directed by Jenova Chen. thatgamecompany, Santa Monica, USA.

ManicVR., (2018). [Virtual reality installation]. Created by Kalina Bertin, Sandra Rodriguez, Fred Casia & Nicolas S. Roy. Canada.

Marshmallow Laser Feast., (2018). *We Live in an Ocean of Air* [online]. Published 2018. [Viewed 22 October 2019]. Available from:
https://www.marshmallowlaserfeast.com/experiences/ocean-of-air

Memory/Place: My House., (2014–15). [Virtual reality installation]. Created by Sarah Rothberg. USA.

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Notes On Blindness – Into Darkness., (2016). [Virtual reality experience]. Ex Nihilo, ARTE France, AudioGaming, Archer's Mark.

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Purple., (2017). [Film]. Directed by John Akomfrah. London: Barbican.

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Thresholds., (2017). [Mixed reality experience]. Artist: Mat Collishaw. London: Somerset House.

To the Moon., (2019). [Virtual reality installation]. Artists: Laurie Anderson and Hsin-Chien Huang. UK, Manchester International Festival.

The Unfinished Conversation., (2012). [Film]. Directed by John Akomfrah. London: Smoking Dogs Films.

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The Virtual Hole in the Road., (2016). [Virtual reality installation]. Director: Nick Bax. UK, HumanVR.

We Live in an Ocean of Air., (2018). [Mixed reality experience]. Artist: Marshmallow Laser Feast. London: Saatchi Gallery.

Films / Television / Radio

24 Hour Party People., (2002). [Film]. Directed by Michael Winterbottom. London: Film4.

2001: A Space Odyssey., (1968). [Film]. Directed by Stanley Kubrick. USA: MGM.

From Beyond., (1986). [Film]. Directed by Stuart Gordon. USA: Empire Pictures.

Interstellar., (2014). [Film]. Directed by Christopher Nolan. London: Syncopy.

The Lawnmower Man., (1992). [Film]. Directed by Brett Leonard. Los Angeles: New Line Cinema.

The Man Who Fell to Earth., (1976). [Film]. Directed by Nicolas Roeg. London: British Lion Films.

The Matrix., (1999). [Film]. Directed by The Wachowski Brothers. USA: Warner Bros.

Meeting You., (2020). [Documentary]. MBC (South Korea). 6 February 2020, 22:05. [Viewed 23 July 2020]. Available (with English subtitles) from: https://youtu.be/uflTK8c4w0c

Minority Report., (2002). [Film]. Directed by Stephen Spielberg. Based on *The Minority Report* (1956) by Philip K. Dick. Los Angeles: 20th Century Fox.

Mnemophrenia., (2019). [Film]. Directed by Eirini Konstantinidou. USA: Indie Rights.

The Nine Muses., (2010). [Film]. Directed by John Akomfrah. London: Smoking Dogs Films.

Royal Academy: Painting the Future (2017). [Television programme]. Sky Arts. 13 December 2017, 21:00. [Viewed 10 November 2018]. Available from: Sky Catch Up.

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Solaris., (1972). [Film]. Directed by Andrei Tarkovsky. Moscow: Mosfilm.

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Stalker., (1979). [Film]. Directed by Andrei Tarkovsky. Moscow: Mosfilm.

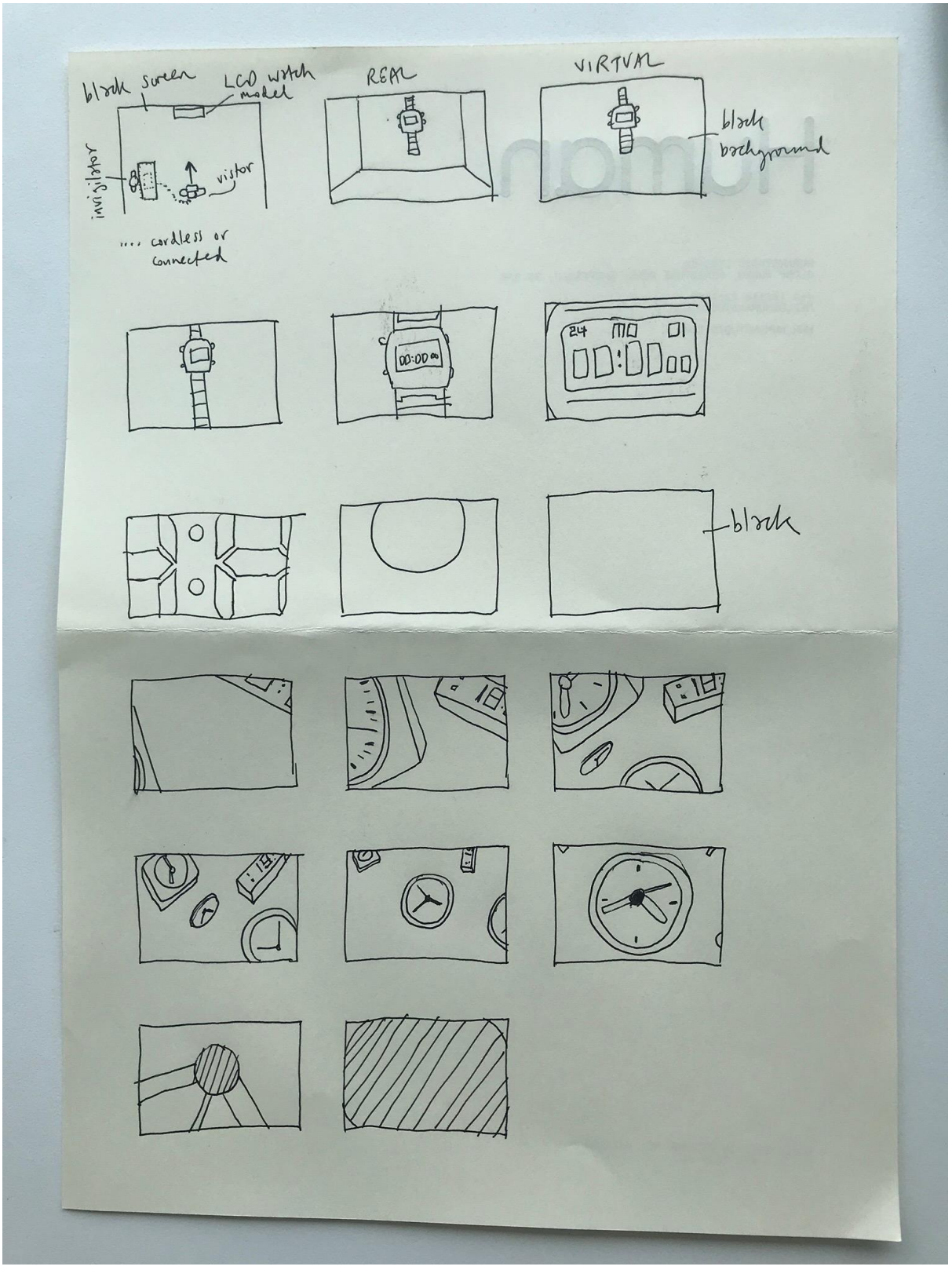
TateShots: John Akomfrah – Why History Matters., (2015). [Online]. Tate, UK. [Viewed 1 September 2019]. Available from: https://youtu.be/jDJYyG7jKV0

They Shall Not Grow Old., (2018). [Film]. Directed by Peter Jackson. London: WingNut Films.

The Time Machine., (1960). [Film]. Directed by George Pal. USA: Metro-Goldwyn-Mayer.

Westworld., (2016-18). [TV series]. Created by Jonathan Nolan and Lisa Joy, based on *Westworld* (1973). [Film] Directed by Michael Crichton.

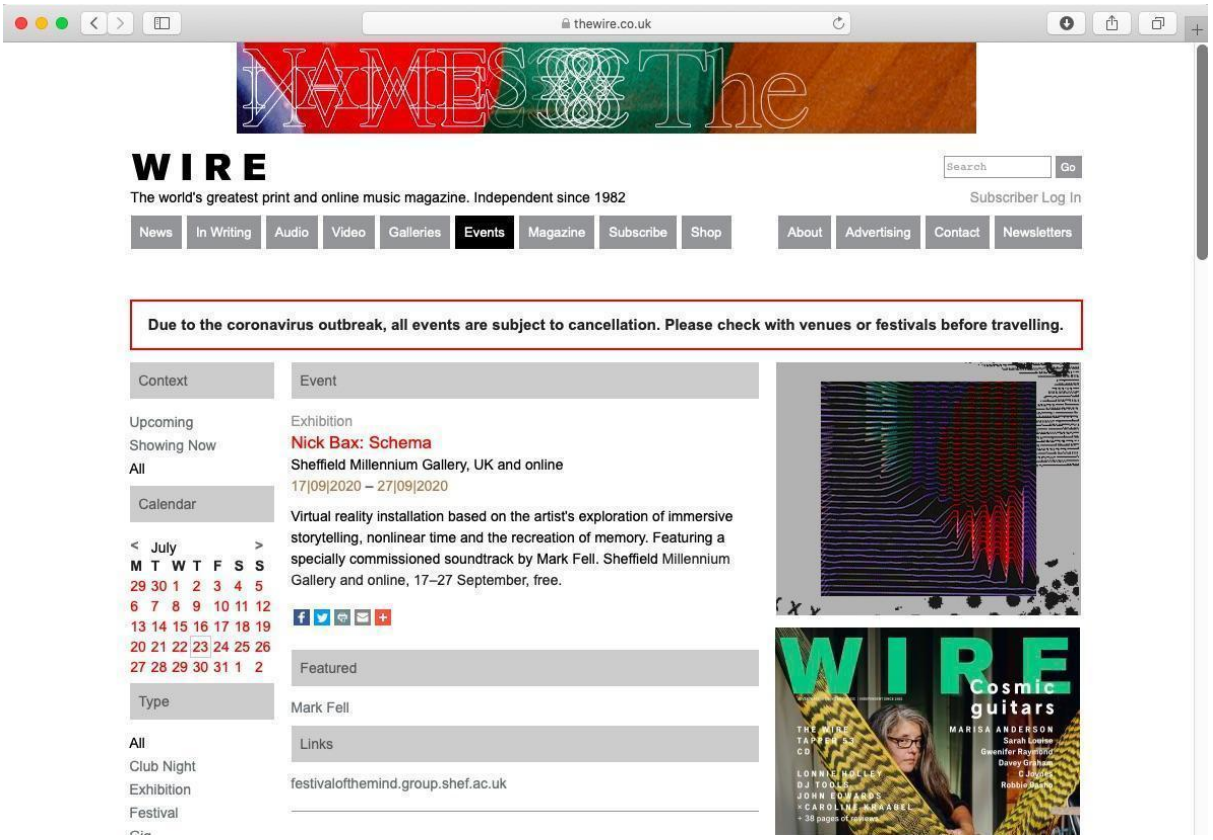
Appendix



Original *Schema* plan and storyboard sketch, drawn by the author, March 2019.

Schema timepiece reference images, taken by the author, February – March 2019.

CGI clock models produced by Human design team for *Schema* (production screenshots), March – June 2019.



The Wire magazine, online listings (screenshot), 23.07.20.

Exhibitions, talks, workshops & screenings

A Slightly Curving Place Germany
Centred around an audio play and a video installation, this exhibition explores the work of Indian sound technician, inventor and audio archaeologist Umashankar Manthravadi. Berlin HKW, until 20 September, free, hkw.de

Nick Bax: Schema UK
Virtual reality installation based on Bax's exploration of immersive storytelling, nonlinear time and the recreation of memory. Featuring a new soundtrack by Mark Fell. Sheffield Millennium Gallery and online, 17–27 September, free, festivalofthemind.group.shef.ac.uk

The Botanical Mind UK
New dates for exhibition exploring the intersection of art, music, mysticism and plants, featuring work by David Tudor, Sarah Angliss, Adam Chodzko, Ghislaine Leung and Linder. London Camden Arts Centre, 24 September–23 December, botanicalmind.online

Tony Cokes: If UR Reading This It's 2 Late: Vol 3 Belgium
Two new works combining text, music and images that engage with pop, electronic music, capital and race. Brussels Argos Centre For Audiovisual Arts, 6 September–20 December, argosarts.org

Double Lives: Visual Artists Making Music Germany
Group exhibition featuring art and videos of performances by Captain Beefheart, Yoko Ono, Alan Vega, Carsten Nicolai, Laurie Anderson, Die Tödliche Doris, Yves Klein, Nam June Paik, Wolfgang Tillmans

Tai Shani: Tragodia Austria
The Turner Prize winning artist's installation bringing together sculpture, virtual reality and a soundtrack composed with Maxwell Sterling. Grazer Kunstverein, until 4 September, Wednesday–Friday, 11am–6pm, grazerkunstverein.org

Transmissions Season 2 UK
Second series of this online platform. Episodes include a broadcast on Black liberation by Kat Anderson (9 September), an audiovisual set by Plastique Fantastique, and episodes curated by Juliet Jacques (23) and Lawrence Abu Hamdan (30) London Somerset House Studios, Wednesdays 9pm, repeated Fridays 9am, online, somersethouse.org.uk

Unsound Lab Poland
Five day online workshop programme over two weekends dedicated to survival strategies for the pandemic and beyond for those working in the music industry. 19–20 & 26–28 September, limited places, unsound.pl

Floris Vanhoof: The Wandering Light Belgium
The Belgian musician and interdisciplinary artist's exhibition connects the history of cinema to prehistoric fossils with a new 16mm film, projections and sound works. Brussels Cinematek, until 3 October, free, cinematek.be

On stage

Caribou + Kaitlyn Aurelia Smith
Rescheduled dates for the Canadian producer with support from modular synth composer Smith. Leeds O2 Academy (6 September) Bristol O2 Academy (7), London Cafe Oto, 30–31 March 2021, 7:30pm, £18–£10, cafeoto.co.uk

Hidden Notes Vol 2 UK
A historic church setting for Jonny Greenwood/Katherine Tinker/Oliver Coates, Penguin Cafe, Peter Broderick, James McVinnie, and more. Stroud St Laurence Church, 25 & 26 September 2021, £56.50, hiddennotes.co.uk

Loop Germany
Ableton music and technology summit, with Khyam Allami, Uwalmassa, duendita, NYX Electronic Drone Choir, Deena Abdelwahed, Georgia Anne Muldrow and Colin Self. Any programme changes will be announced nearer the time. Berlin Silent Green, 23–25 April 2021, loop.ableton.com

Meltdown UK
Grace Jones curates this concert series featuring Solange, Peaches, Baaba Maal, Lee 'Scratch' Perry & Adrian Sherwood, Oumou Sangaré and more, including the singer herself. London Southbank Centre, 11–20 June 2021, southbankcentre.co.uk

Monheim Triennale Germany
Adventurous festival for multiple projects from Ava Mendoza, Pan Daijing, Kris Davis, Jennifer Walshe, Shabaka Hutchings, Terre Thaemlitz, Sofia Jernberg, Marcus Schmickler, Park Jiha, Sam Amidon, and more. Monheim am Rhein various venues, 1–4 July 2021, monheim-triennale.de/en

Music Current Ireland
Contemporary international electronic music festival with music by Seán O'Dálaigh, Alexander Schubert, Aisha Orazbayeva, Dublin Sound Lab, Decoder Ensemble, Schallfeld Ensemble and more, now taking place in December. Dublin

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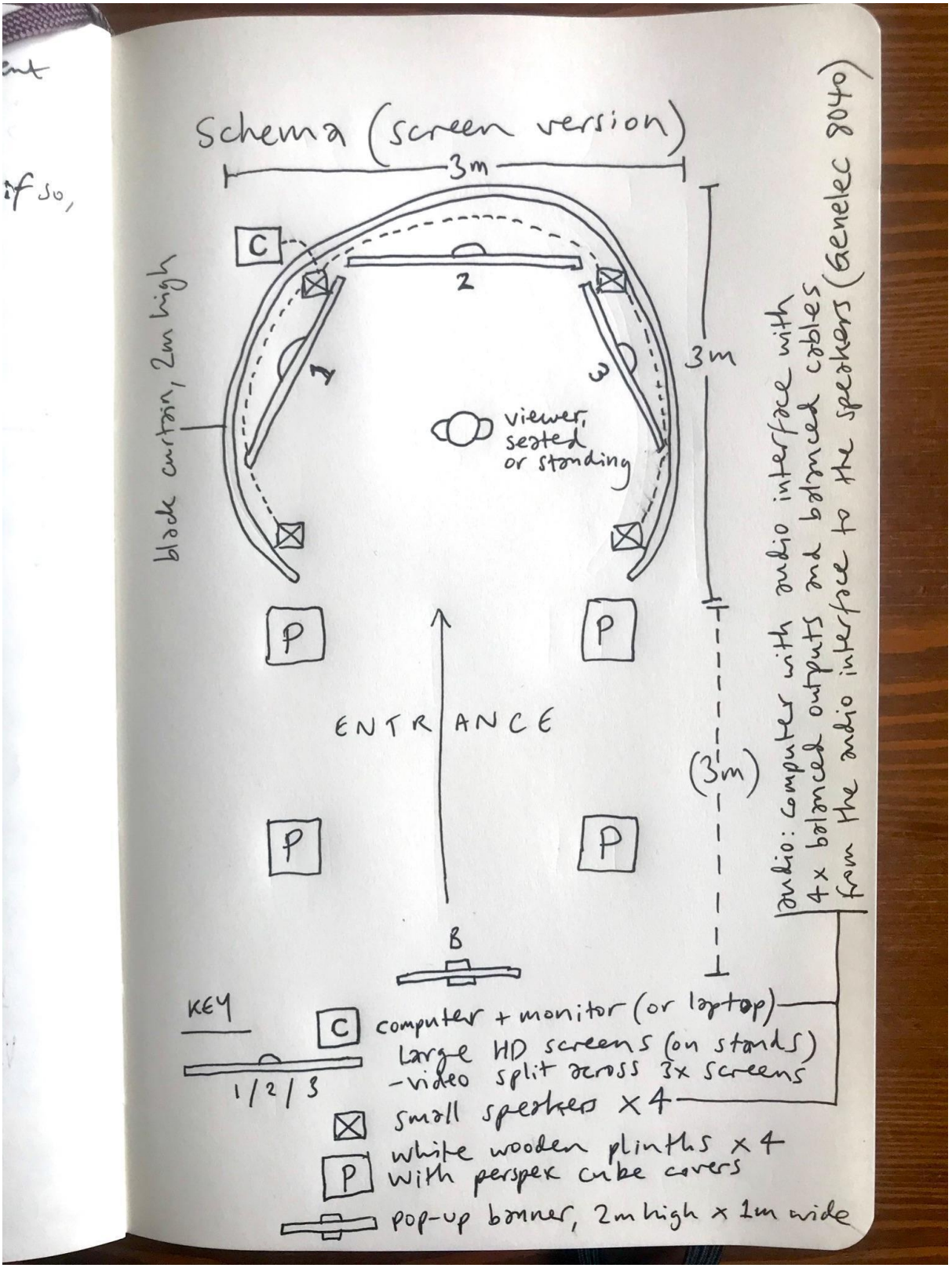
Listings, *The Wire* magazine, September 2020 issue, p. 93.



Schema installation (screen version), plan drawn by the author, August 2020.

PhD supervision session at Human studio, Park Hill, Sheffield, 21.08.20.

Schema

3D/360 Hope VR/AR

The project

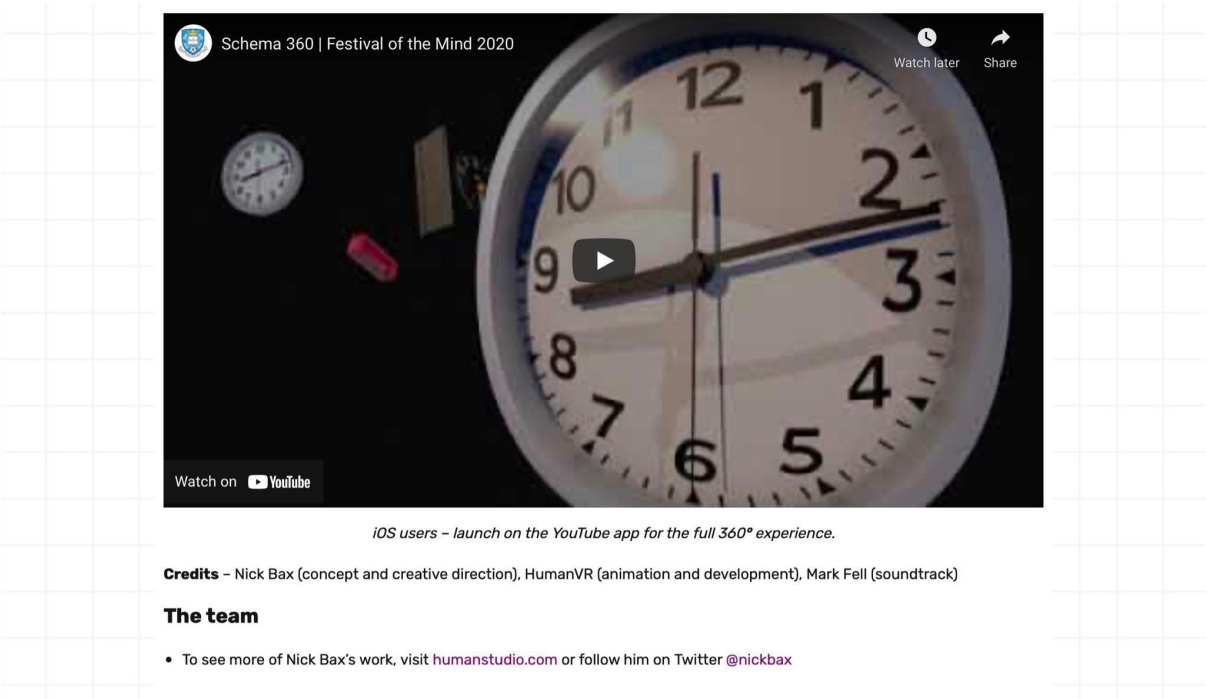
A surreal journey through time and space where past, present and future collide, Schema is an immersive experience directed by Nick Bax.

The piece is shaped by Nick's research exploring non-linear time and the recreation of memory in virtual reality and immersive storytelling. Nick's partners on the project are Mark Fell (soundtrack) with Abby Hambleton and Michaela White from HumanVR.

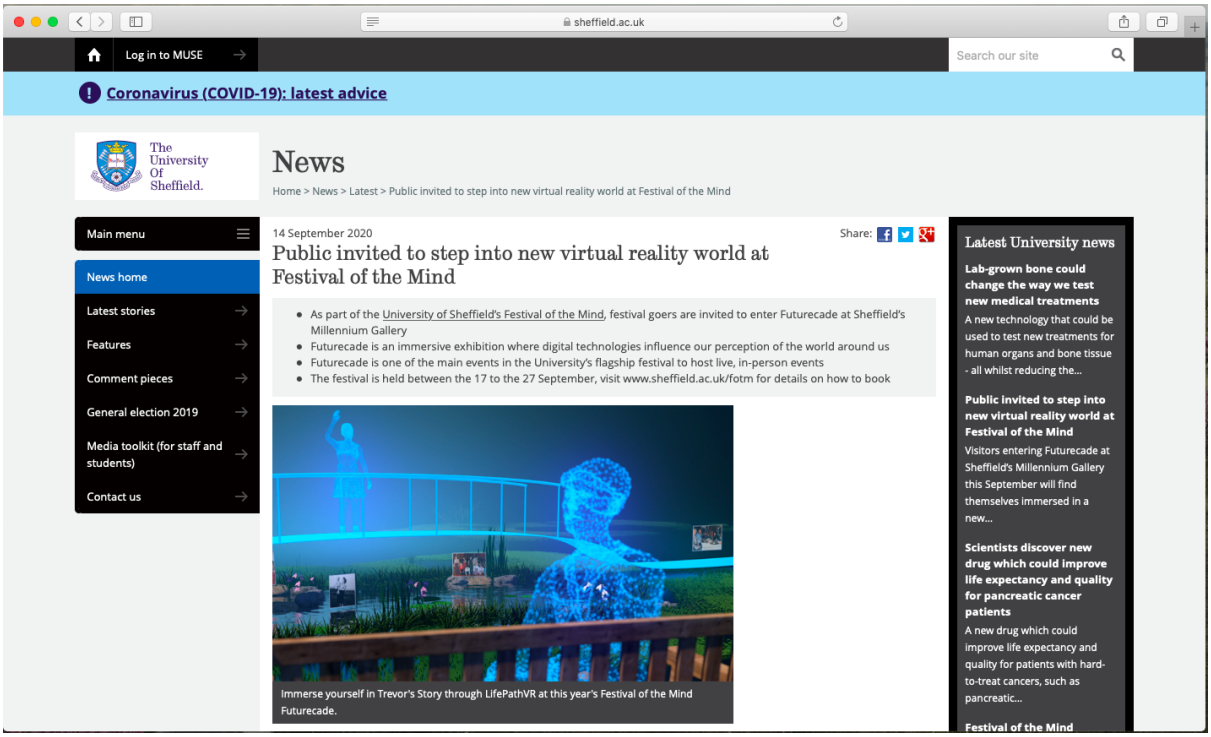
As science fiction transforms into science fact, Schema gives us a teasing glimpse of multiple dimensions.

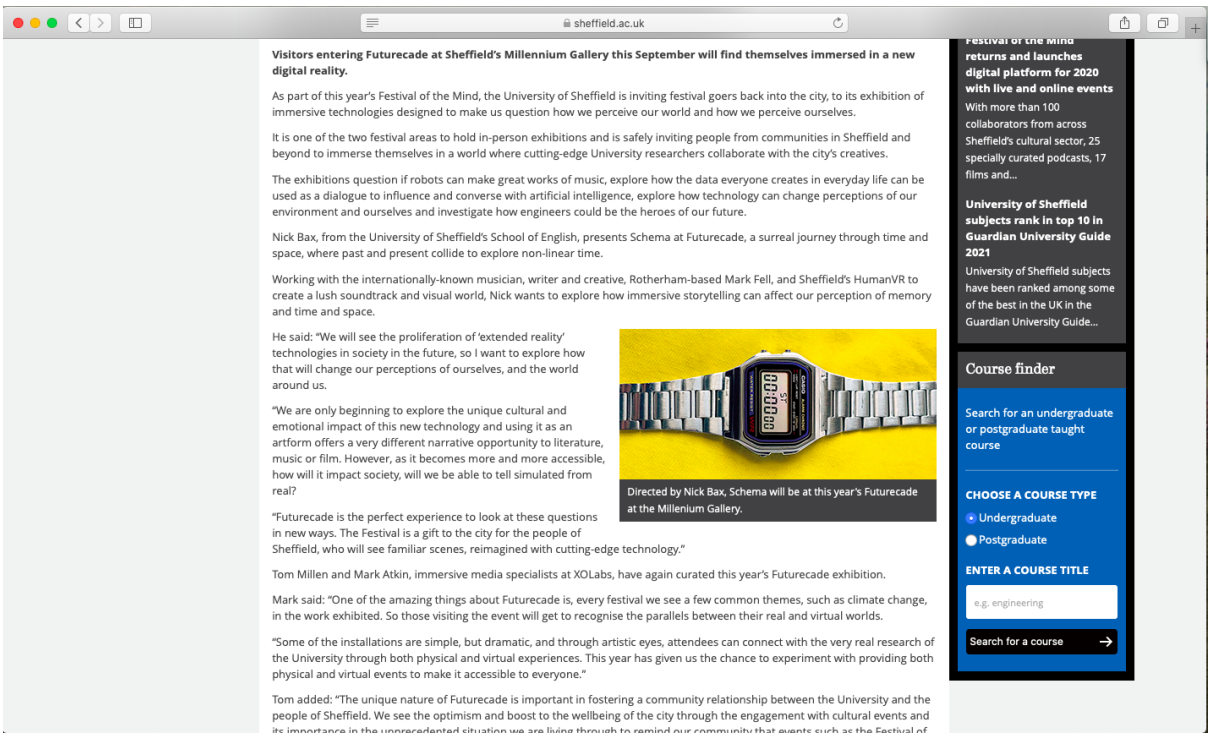
The film

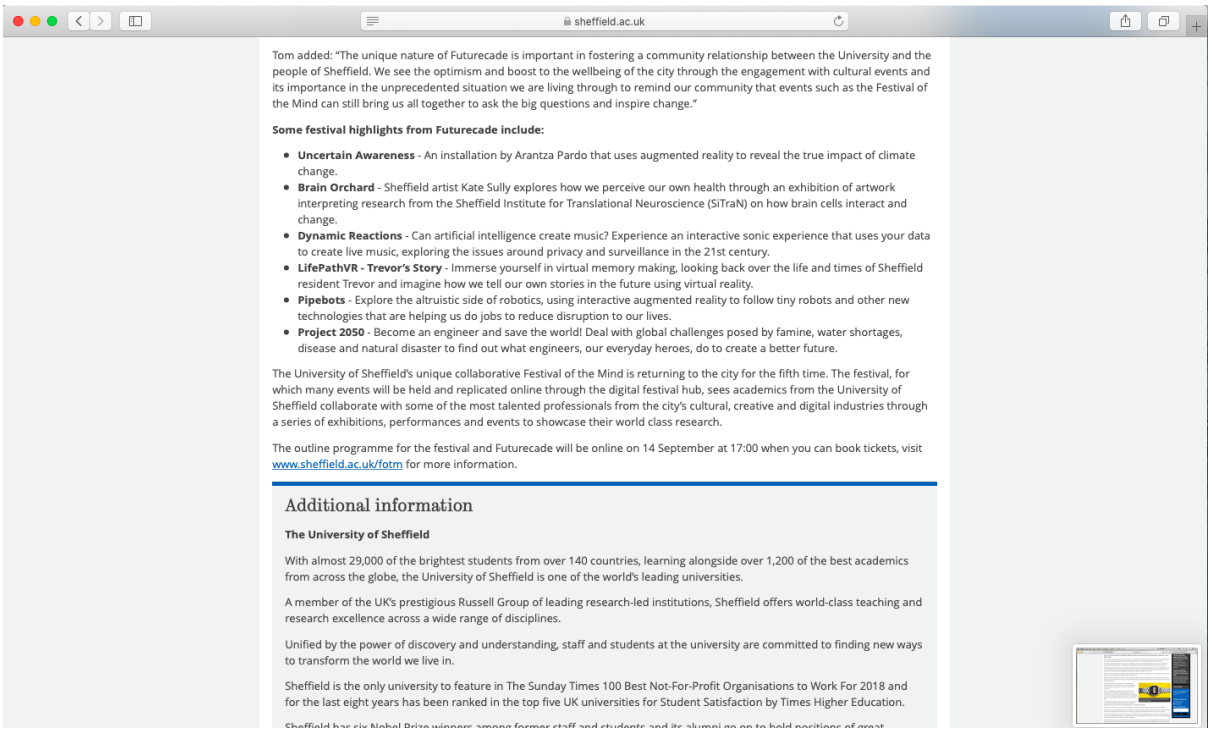
View Schema – a 360 film with ambisonic soundtrack (headphones recommended) on your PC, laptop, mobile or tablet.



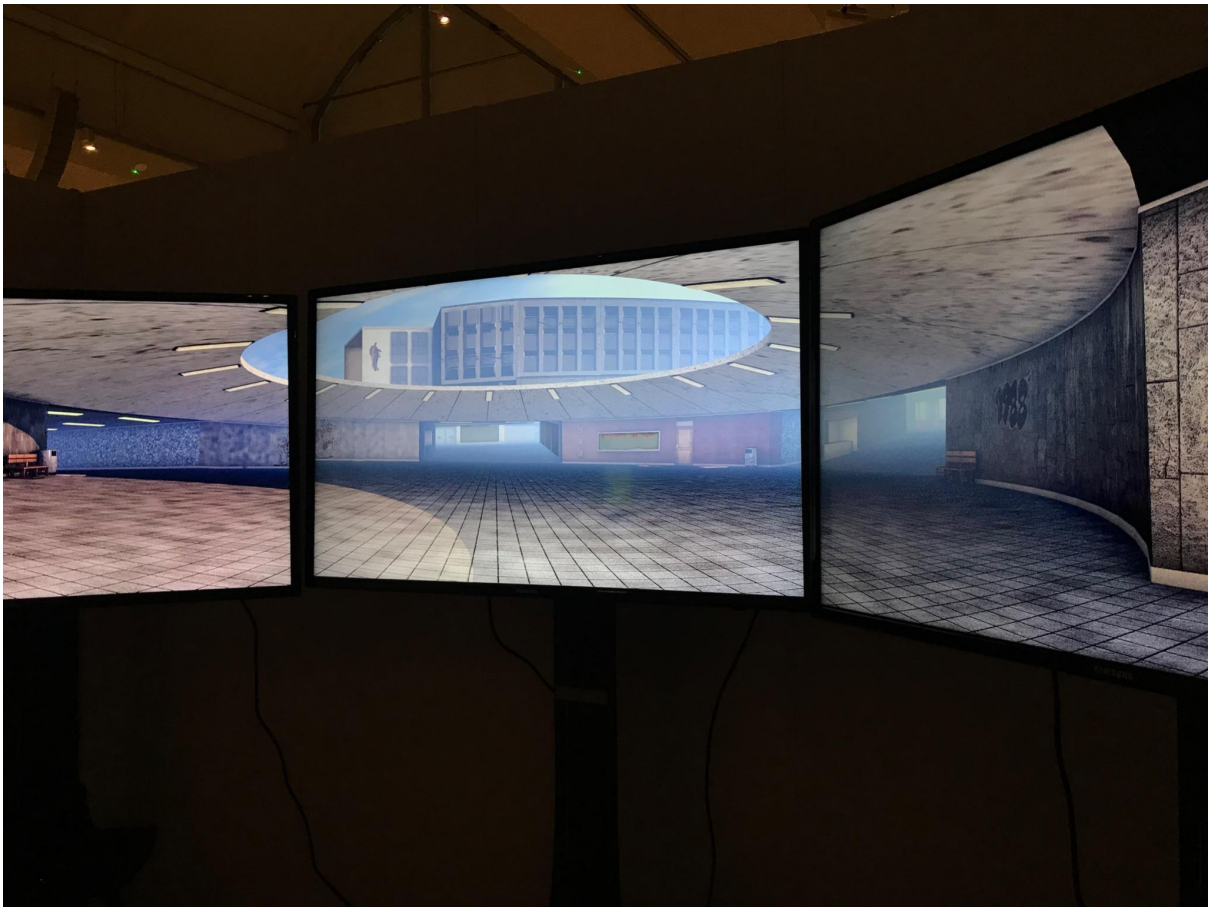
Festival of the Mind (FOTM) project website page (3x screenshots), September 2020.







University of Sheffield *Futurecade* news story, 14.09.20 (3x screenshots).



Schema installation, Millennium Gallery, Sheffield, September 2020. Photographs taken by the author.