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# The Timeline: A Qualitative Study Exploring Therapeutic Experiences in an Immersive Interactive Virtual Environment (IIVE) for Trauma Mental Healthcare

Tor Alexander Bruce  
Connected Experiences Lab (CXL),  
School of Design, Northumbria  
University  
tor.a.bruce@northumbria.ac.uk

Annessa Rebar  
Health and Life Sciences, Department  
of Nursing, Midwifery and Health,  
Northumbria University  
annessa.rebar@northumbria.ac.uk

Lars Erik Holmquist  
Connected Experiences Lab (CXL),  
School of Design, Northumbria  
University  
lars.holmquist@northumbria.ac.uk

## ABSTRACT

When facilitating mental health interventions, therapists typically involve clients in discussion within a room containing seating and a table. We argue that digital technologies can be leveraged to encourage physiological, multisensory experiences for users to work through their challenges. In the context of trauma in mental healthcare, where the body's involvement can play a critical role in the recovery journey, such an approach can offer potential in altering the dynamic of how interventions are delivered and received. This infers a client-led process where environment and features become inclusive to a holistic treatment pathway. We developed an intervention called *The Timeline*, situated in an immersive interactive virtual environment (IIVE). The iterative process was informed by interviews with 12 "Experts by Profession", as frontline mental health workers with an average engagement of 16 years. We then invited 12 "Experts by Experience", with lived understanding of a range of trauma, to trial and evaluate the system at a UK-based hospital. We report on data from participants across both studies, evidencing how *The Timeline*, as bespoke content, could lead to participatory choice and personalized control in the context of digital therapy. Finally, we discuss how IIVEs could become a new platform towards a more integrative therapeutic delivery in mental healthcare.

## CCS CONCEPTS

• **Applied computing**—Life and medical sciences; Health care information systems; • **Human-centered computing** Human computer interaction (HCI); Interaction paradigms; Virtual reality; Human computer interaction (HCI); Empirical studies in HCI.

## KEYWORDS

Immersive Interactive Virtual Environments, CAVE systems, VR Therapy, Trauma, Mental Health, Digital Intervention, Qualitative, Enactivism

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## 1 INTRODUCTION

Mental ill-health is globally regarded as a societal challenge where no country is immune. An estimated 792 million cases have been reported in a single year [53], approximately one tenth of the world's population. The World Health Organization (WHO) reports that healthcare systems have not yet successfully responded to the presented burden, with a visible gap between the need for treatment and its provision. One of four major WHO objectives focuses on the strengthening of research and evidence [73]. In UK mental healthcare, a biomedical<sup>1</sup> model approach is dominant across therapy-delivery and the National Health Service (NHS) offers several types of what are described as "Talking Therapies". These include: Cognitive Behavioral Therapy (CBT); Counselling; Interpersonal Therapy (IPT); Eye Movement Desensitization and Reprocessing (EMDR); and Mindfulness-Based Cognitive Therapy (MBCT). A person can directly visit the Improving Access to Psychological Therapies (IAPT) service, with or without a General Practitioner (GP) referral [48]. Typically, these treatments involve a discursive exchange where neither the setting nor whole-body physical movement are inclusive to the therapy.

In the context of trauma, involving the body in therapeutic pathways through digital technologies could open new possibilities, at an intersection where the appeal for innovations is broadening across mental healthcare. However, while authors such as Thieme et al. believe that technology design can become a useful vehicle to explore and test assumptions relating to how interactions can nurture aspects of mental wellbeing [67], other researchers point out that technology has yet to be applied sufficiently in mental healthcare [17]. Ongoing barriers and user-facing issues with immersive technologies exist and a literature analysis conducted by Suh and Prophet finds: *'little research has been conducted to better understand what we know and what we need to know about immersive technology and how users experience these technologies'* [62]. One potential reason why this is the case is highlighted by Sanches

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<sup>1</sup>The biomedical model posits that mental health challenges people face are disorders or illnesses of the brain and this emphasizes pharmacological treatments seeking to target presumed abnormalities that are biological.

et al. who consider a problem aligning to multidisciplinary efforts being made, suggesting that whilst a variety of therapies and theoretical models are out there, so are challenges in forming working relationships between HCI researchers, patients and psychology - toward potential of technologies becoming utilized within affective health [61]. A systematic review of reviews by Cieslik et al. suggests that due to the continuous advancements of VR hardware and software, further research of their application in psychiatric disorders is required [11].

In responding to challenges, our contribution is in providing insight into the design and build of a bespoke digital therapeutic intervention called *The Timeline*, as situated in an Immersive Interactive Virtual Environment (IIVE). This involved multidisciplinary partnership work with content and experience creators, as well as experts as frontline professionals in mental healthcare. In evaluating the approach we engaged actual trauma sufferers, as representative of a vulnerable population, and conducted a trial in a hospital setting. Results from the post-trial interviews follow a qualitative methodology and indicate the potential for *The Timeline* as a unique immersive mental healthcare intervention, where users can be embodied in an experience offering a level of personal choice and autonomy. Our work exploits a research gap where there is evident limited design, build and testing of immersive technology in mental healthcare.

## 2 RELATED WORK

### 2.1 An Interdisciplinary Approach To Engage With Trauma in Immersive VR

Trauma is summarized as a general term by Agaibi and Wilson, as ‘*stress events that present extraordinary challenges to coping and adaptation*’ [2], whereas Post Traumatic Stress Disorder (PTSD) is considered a potentially chronic impairment disorder, characterized by re-experience and avoidance symptoms, including negative alternations in cognition and arousal [44]. This distinction presents a minor tension in questioning where trauma ends and PTSD might prevail throughout a person’s life. A further 24 conditions are listed by the NHS, including: Agoraphobia, Anxiety, Bulimia, Depression, Psychosis and Schizophrenia [50]. A review of research on associations of trauma type with PTSD in the World Health Organization (WHO) World Mental Health (WMH) surveys involving representative participant-data from 24 countries, found that 70.4% of respondents experienced lifetime traumas, describing interpersonal violence; rape and other sexual assault; being stalked; unexpected death of a loved one [31]. In a clinical context trauma is broadly defined by Sweeney et al. who acknowledge that definitions vary, encompassing experience of violence through to complex childhood developmental traumas, also social trauma and historical trauma [66]. In his seminal work, Van der Kolk makes explicit reference to the body’s role in trauma recovery and describes:

*After trauma the world is experienced with a different nervous system. The survivor’s energy now becomes focused on suppressing inner chaos, at the expense of spontaneous involvement in their lives. . . This explains why it is critical for trauma treatment to engage the entire organism, body, mind, and brain [71].*

Likewise, Nelson discusses somatization and that trauma, in this case via child sexual abuse, has ability to “*uniquely*” inflict both the conceptual mind and physical body [47], making a case for involving the body in therapies, where technologies such as IIVEs might play a role with their ability to permit an embodied experience inclusive of the whole physiological self.

A systematic review of IIVEs and Virtual Reality (VR), inclusive of Head-Mounted Displays (HMDs) and multisensorial fully immersive environments was conducted by Rubio-Tamayo, Barrio and Garcia, who consider VR [regarded by them as a ‘*research field*’] as a ‘*tool for research in cognitive sciences or experimental psychology*’.

They suggest: ‘*Factors relating to embodiment, human perception and cognitive approaches, as well as proprioception<sup>2</sup>, will determine how information will be presented in immersive environments*’ [60]. HCI research has historically relied upon the cognitive sciences

(earlier termed cognitive psychology) and Boring describes that HCI requires cognitive science to understand the user as a means of explaining the interaction that occurs between them and the computer system [8].

Central to our study is an assumption that the whole organism (or person; agent) becomes affected through trauma, whereby an event or happening that impacts a person’s life might not be solely justified as a brain-related phenomenon. If this is the case, then a holistic approach to obtain a therapeutic outcome might arguably take into account the brain, body and environment inclusively as a single system, as well as purposefully in practice. This supports an underpinning theory and the interdisciplinary nature of our work where we investigate direct human experiences of participants within a digital setting. In viewing through an *enactivist* lens our research builds on, the view of de Haan shares:

*An enactive ontology thus requires us to ‘zoom out’; to enlarge the scope of the explanandum in space. With regard to understanding cognition, or rather sense-making, we should look at the whole organism – not just any of its parts. Moreover, in order to understand the whole organism, we should look at the organism in its environment [24].*

From a view of trauma in mental healthcare, we argue that it is essential to understand parts of a person’s life as related to the conceptual whole. Enactivism ‘*emphasises emergent cognitive structures that self-organise as a result of interaction between organism and environment*’ [72]. Therefore, from an enactive perspective, as a philosophy based on understanding the conceptual mind, potential exists to affect ways that mental healthcare is delivered and received, as our study’s findings highlight. The IIVE offers potential to step into and physically engage with it as a system and we invoke the embodied element in two ways: (i) by highlighting certain characteristics of the IIVE that relates to an enactivist conception of an embodied experience; (ii) through discussion around themes that combine to illuminate an understanding of connectivity, or coupling<sup>3</sup>, that takes on a certain significance in IIVEs. What this

<sup>2</sup> Perception or awareness of the movement or position of the human body; also known as kinesthesia.

<sup>3</sup> Enactivists regard the enactive process as being two-way between the person and their environment, also referred to as brain, body, environment coupling.

can encourage, if the enactivist philosophy is embraced in practice, is a step towards a way to ‘*operationalize holism*’, as Gallagher describes; suggesting that by focusing on the rich dynamics of brain-body-environment we can move closer to recognising a more holistic appreciation of cognition [19], towards a more integrative<sup>4</sup> method of practice.

While further evaluations of applications using multisensory VR technology in mental healthcare are needed, rapid progress is evidenced across a range of modalities of therapeutic treatment. As such, where psychology and neuroscience are beginning to consider VR as the most advanced form of HCI [56] the use of simulative technologies could allow a new embodied transdisciplinary research field to emerge [57]. Approaches that start with the body and physical sensations, as bottom-up<sup>5</sup> interventions, offer something supportive because older brain systems<sup>6</sup> that play a role in processing stress are not reached sufficiently via verbal interventions [70]. IIVEs, by offering a whole-body, multisensory experience, have the ability to complement, or at least present additional tools as facets of engagement. Rizzo, Wiederhold and Buckwalter suggest that with thoughtful system design targeting clinical applications, VR’s adoption as a rehabilitation tool will continue to grow in acceptance [59].

## 2.2 Immersive VR in Mental Healthcare

Our work adopts a VR system that projects onto three walls with an optional floor projection. Users can see their whole body here, rather than the rendered replacement [41] as with other technologies. As a walk up and use system, gestural interaction presents no requirement for controllers and users are unincumbered by HMDs, where tactile prompts offer unconstrained immersive experiences. Examples of previous research include experiments that took place using four projection screens with users provided active stereo glasses to observe the 3D world [68]; a 3D-multisensory Cave Automatic Virtual Environment (CAVE) laboratory used for immersion of participants where the position of the 3D glasses was tracked [36]; a system where users wear Volfoni Edge glasses to view surroundings projected onto walls around them [42]. The CAVE term usage is commonly embraced and refers to a walk-in environment first conceived in 1991 that made use of rear-projected screens [14], with various models offering a similar experience known via different names since mid-20<sup>th</sup> century. These have included: “*logical apparatus*” [26]; “*kinesthetic display*” [65]; “*an environment which has sub-environments*” [35]; “*high-resolution virtual reality inter-face*” [13]; “*fully immersive projection displays*” [58]; “*multi-sensory synthetic environments*” [16]; “*XR [Extended Reality] environments*” [29]; “*impacting environments*” [22]. Authors Loomis, Blascovich and Beall describe what they call an immersive Extended Reality

<sup>4</sup>An integrative model in psychotherapy, psychiatry or psychoanalysis, collectively understood as psy-sciences, might look at a person’s experiences in a physiological, sociocultural and existential context, whereby a person’s mental ill-health or trauma, as examples, are not reduced to a malady of the isolated brain or conceptual mind, but as inter-relating life experience; brain, body and environment combined as a system.

<sup>5</sup>Traditional talk-based psychotherapies can be viewed as top-down, whereas more somatically-driven interventions are characterized as bottom-up. Further methods such as proprioception introduce a side-door approach.

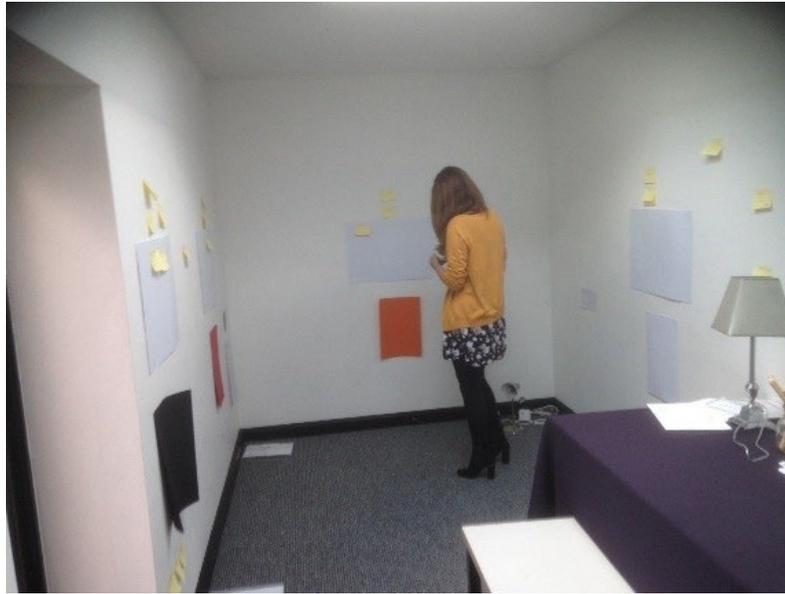
<sup>6</sup>Many regions that are fundamental to a person’s mood are located in the most primordial brain. The limbic system is the major primordial network underpinning mood. One major structure is the amygdala and this modulates the fear response in humans. Stress can induce a variety of neurotransmitter alternations in the amygdala.

(XR) environment and offer it as a space where ‘*the user is perceptually surrounded by the VE (Virtual Environment)*’. They suggest two variations one involving ‘*placing multiple projection screens and loudspeakers around the user*’ and the other involving ‘*the use of a head-mounted display (HMD)*’ [38].

IIVEs provide a multi-sensory cue representation within a setting that is highly interactive and emotionally engaging [34], with options to simulate environments that challenge the boundaries of everyday living. However, while Maples-Keller et al. report on the uses of VR technology with schizophrenia, psychosis and anxiety, describing it as a tool that can have ‘*lasting effects that generalize to the real world*’ [40], Best et al. question whether VR can ever become successfully implemented in a routine clinical setting, synthesizing data from clinical case reports relating to the adoption of VR for PTSD. Their review relates in most part to the use of HMDs as “*virtual environments*” (73% as the preferred choice of technology in this particular study) and indicates that more qualitative data is required. The authors also suggest that major gaps exist to incorporate VR technology within cognitively based approaches [6].

A more prevalent body of literature describing studies combining the use of VR technologies in mental healthcare relates to the use of 3D visualization in a CAVE and also HMDs. This includes Virtual Reality Exposure Therapy (VRET) for PTSD [5]; in vivo exposure therapy (iVET) and augmented reality (ARET) for phobias [54]; [63] involving exposure to content containing the feared stimulus or scenario [7]. Mostajeran et al. report on the effects of exposure to immersive videos, via an HMD [46]; and a review by Ionescu et al. seeks to understand the implementation of immersive 360° videos in clinical practice, viewed via an HMD [28]. Further examples include the use of VR in the treatment of anxiety and depression with a preliminary review describing a need for higher-quality study designs [74]; and a study into virtual environments describing the use of VR in treating autism, phobias, addiction and post-traumatic stress [25]. Gerardi et al. report on the use of Virtual Reality Exposure (VRE) with patients immersed in an environment providing users with a sense of presence to aid the emotional processing of fears [21]; [64]. Other studies found that as an acrophobic environment the CAVE provokes more anxiety than an HMD [30] whilst Cordeil et al. recount a participant reporting that within a CAVE style system they were able to absorb a large quantity of data at once, due to the physical dimensions of the system [12]. Meyerbr’oker et al. investigated the level of presence in Virtual Reality Exposure Treatment (VRET) and found no differences in effectiveness between VRET adopting an HMD-enabled device or a CAVE [43].

Pragmatic research is required to achieve a more realistic assessment of the potential of what some studies term Digital Mental Healthcare Interventions (DMHIs) [1] with advances in immersive VR discussed by Geraets et al. who describe a new generation of techniques adopting VR in therapy that transcend ‘*the translation of conventional therapy into VR*’ [20]. A systematic review conducted by Valmaggia et al. only includes studies using immersive VR and predicts that by adapting therapy to new forms of media will ensure more people can access the therapeutic process to establish factors that play a role in the onset of mental health challenges being faced [69]. This hints at a future where a range of additional technologies



**Figure 1: *The Timeline*: Original Rapid Prototype (2018)**

can be trialed independently or used within an IIVE to present users with complimentary tools in a surrounding setting.

### 3 THE TIMELINE

#### 3.1 Design context

*The Timeline* is intended as a bespoke, multisensory, digital therapeutic experience for trauma, situated in an IIVE. As an enactive experience the user and system relationship is conceptually coupled. To date within the study there are three iterations: (i) original rapid prototype (2018); (ii) lo-fidelity prototype (2019-20) and (iii) hi fidelity prototype (2021-22). The latter example is introduced in Section 6.

#### 3.2 Original Rapid Prototype

The prototype stages are shown in Figure 1-3. The original prototype was developed outside of a research context. It was situated inside a dining room in a residential house in 2018. A young man had attempted suicide via high alcohol intake and a rope and Author 1, who engaged many young people as part of a previous Third Sector role, received a message from a colleague asking if he could intervene. The typical delivery of such a solutions-focused sessions would be seated and last 30-70 minutes, involving an A3 paper-based tool called *The Timeline*, containing a horizontal printed line. Author 1 used this tool because it was pragmatic and effective in previous 1-1 engagement with young people facing challenges. Timelines are used widely in therapy as re-authoring tools, or as a technique, for example in work with suicide where a timeline was ‘drawn horizontally on an A4 page’ [55]. Using a marker pen and cardboard to indicate: *Deep Past*, *Past*, *Now*, *Future*, around the room, together with Post It notes, Author 1 requested the young man to stand up. This became an important step in recognizing that the dynamics of a conventional therapeutic delivery could be

experienced differently. An initial verbal exchange when the young man entered the room included his describing a *person* or *event* from the past that had any level of impact on his recent decision to attempt to take his life. As a process, this was a first iteration of what later became a digital version of *The Timeline*, situated in an immersive VR room at a UK-based university’s Clinical Skills facility. An original purpose was to permit a sense of movement through the intervention and offer that facilitator and participant were equal partners, standing beside one another and working things out. Author 1 then raised industrial sponsorship in 2019 to continue exploring the concept as an HCI-related study.

#### 3.3 Lo-fidelity Prototype

The next iteration, as a lo-fidelity prototype, took components from the original design and recreated these in an IIVE, between 2019-20. While the original design was functional, the 2D interface was limited in terms of lacking the affordances of an immersive interactive system in 3D. As a first step a series of Post-it notes were scanned and uploaded to the IIVE. Each Post-it was arranged chronologically to visualize a metaphorical journey from what had already been labelled the *Deep Past*, through to a more recent *Past*, a *Now* and a *Future*. We used the available Unity software to design and install features, such as interactive hot-spots. These allowed features of the IIVE to become revealed, such as a still or a moving image or a sound. We uploaded JPEG, MP3 and MP4 files to create imagery and audio with an intention to create an overall multi-sensory experience. This lo-fi model comprised VR backdrops including moving visuals depicting an underwater dolphin scene and the *Aurora Borealis* (Northern Lights). Research by Poulsen et al. into PTSD, indicates that nature has been adopted for health purposes for many centuries and natural surroundings can offer



Figure 2: Lo-fidelity Prototype(2019-20)



Figure 3: Hi Fidelity Prototype (2021-22)

space for self-reflection with lesser felt demands [51] and a calming influence upon the person experiencing these.

An IIVE of the type used in our study is installed bespoke to each setting, typically in a room ranging between 3-8m<sup>2</sup>; running Unity software capable of presenting audio, visual and touch-interactive content in a 270° sequence. The system offers user-capability to create 2D and 3D experiences with three ceiling projectors, wall sensors allowing for kinesthetic, real-time response; a ceiling-suspended microphone and a Scotia Medical Observation and Training System (SMOTS) camera, offering recording activity 24/7 within the room. As examples, to generate a detailed, high-quality image, a *single-wall* Jpeg was uploaded at 1280 x 800, whereas a *panorama* was uploaded at 3840 x 800 resolution. Technically, before the immersive system is user-ready a technician commissions the system involving adjustment of the projector outputs to each wall, calibrating the sensors and balancing the audio.

## 4 STUDY DESIGN: STUDY 1 – EXPERTSBY PROFESSION (SEMI-STRUCTURED INTERVIEWS)

### 4.1 Main Objective

The main research question we responded to in Study 1 was: *How might an IIVE act as a suitable space to conduct mental health interventions?* The objective was to present the lo-fidelity design via a video prototype and obtain feedback with interview discussions based on participatory observations, with data from Study 1 used to inform Study 2. A global pandemic restricted face-to-face contact, so this media was used to support the process. The video contained five scenes with 11-minutes duration, initially showing a technician powering up the IIVE, then a participant experiencing *The Timeline*, with and without the presence of a facilitator. Leiva et al. describe

that video prototypes have ability to ‘*capture the user interaction to communicate ideas and reflect on the design*’ [37]. This review builds on an earlier definition by Bardram et al., whose evaluation of a virtual video prototype in pervasive healthcare systems highlight how this technique, as a method, assisted in enabling user-relation to both the practicalities and context of individual technologies. They state: “. . . *it forces the designers to address very concrete design issues before the video can be produced*” [4]. Specifically, the video used in Study 1 showed features of *The Timeline*, as situated in an IIVE. These included: audio voice command that welcomes participants into the setting, as well as touch sensor features where users can navigate between the deep past and the future as they move through the process. There were also haptic features that reveal still and moving images showing, for example, a mountain scene or dolphins swimming. The lo-fidelity iteration was developed using the available Unity-package that supports the IIVE, with the design making no use of Adobe XD wireframing. Content was created by uploading Jpeg, MP3 and MP4 files, as examples. We consider the choices made in approaching the two studies in the in Section 9. As part of the protocol, each participant in Study 1 was asked to view the video prototype, then respond to a semi-structured interview based on this.

## 4.2 Participants and Recruitment

The main recruitment was via a research partner who deliver NHS psychological services, comprising therapists, counsellors and senior nurses with an average of 16 years engagement as mental health workers in frontline services in the United Kingdom. As part of an inclusion criteria each had insight into the types of environments where patients take part in therapies and collective knowledge of: Anxiety, Bereavement, Abuse, Post-Traumatic Stress Disorder, Severe Depression, Borderline Personality Disorder, Psychosis, Trauma and Suicide. The interviewees were 8 female and 4 male and provided consent for audio-recorded interviews. All respondents were recruited in the North-East of England as a purposive sample group.

## 4.3 Interviewing

The interviews ran from January to February, 2021. Participants were coded for anonymity (P001-P012) and initially asked about their current employed role. We trialed a Zoom meeting pre the interviews where the signal cut out twice, so mobile phone communication became the preferred option. The interviews lasted up to 32 minutes with an average of 24 minutes per interview. Some lead-in questions related to the types of therapeutic interventions participants had experience of and how they defined mental illness.

## 4.4 Data Collection and Analysis

Each interview was audio-recorded and transcribed verbatim. The transcripts were then used for the basis of a thematic analysis and followed Braun and Clarke’s [9] six-step guide involving: reading and re-reading the transcripts, semantic and latent coding, cohering themes and arranging the data. The semi-structured nature suggests that this is a study which is seeking a more defined and less of a casual response. Maguire and Delahunt offer guidance in achieving both a semantic and latent analysis of data, whereby the researcher

applies more than a general understanding and considers underlying ideas and assumptions [39]. Through the qualitative process interviewees have ability to become, in a central way, designers as informants and in providing views as end-users; experts *within* a process not external of it.

## 4.5 Ethics

Study 1 received university Ethics approval from a UK-based university.

## 5 FINDINGS

We offer abbreviated findings from the first study. The data analysis identified four themes that contribute to an understanding of how therapists became informants within the design process of developing: *The Timeline*. Themes were: *Multisensory Affordances in an IIVE*; *Apprehension to Intrigue to Control*; *Human versus Digital Facilitation*; *Environment as a Therapeutic Tool*. These contributed to participant attitudes toward the design of *The Timeline* as an immersive, interactive therapeutic intervention. A meta-theme: *Active Participation in Therapy*, emerged, which will be discussed in Section 9.

### 5.1 Multisensory Affordances in an IIVE

The discussion relating to the background of all 12 participants highlighted a typical mental healthcare setting offers the affordance of seating, with or without a table. None of the experts had experienced immersive technology as used in the study but some had experiences of technologies within their daily practice. P002 qualified as a mental health nurse in 1983, working predominantly with people with diagnosis of schizophrenia, describing previous use of technology in practice as “*telephone*”, “*email*”, “*video or cassette tapes or CDs with information for relaxation*”. P012 worked with psychosis, personality disorders and trauma and had “*quite a bit of exposure to Tele-health [ . . . ] also computerized CBT programs*.” *The interviews presented useful contrasts between a typical setting in mental healthcare and the capabilities of an IIVE, for example: “[ . . . ] two chairs, possible a desk” [P005]; Usually face-to-face in a room provided by my employer” [P007]; versus:*

*[ . . . ] really good that there were certain parts that were interactive and you could reach out and touch certain things [ . . . ] that would be really good for engagement and especially with trauma [ . . . ] I forget the author: The Body Keeps The Score [ . . . ] using their bodies (P009).*

Although Study 1 participants were not actually trialing the technology the responses indicated that they had a genuine feel for what was observed. These included: “[ . . . ] *calming for people who are surrounded by an image [ . . . ] to be able to get lost in that and then connect to that movement*” ; [P001]; “[ . . . ] *liked the engagement of it [ . . . ] the slamming of the door feature, that was really clever*” [P006]. IIVEs permit a space where a human can observe itself and be observed, affording possibilities to interact, exclusive as an environment in a mental healthcare context. An affordance is the property of an object that shows users the actions they can take, in a way that an activity can become supported [52]. In the video prototype a range of multisensory features were looked at, including: audio, visual, haptic and kinesthetic. Participant responses in

relation to the senses of hear, see, touch, feel, included: “*I think its good to hear a human voice [ . . . ]*” (P001); “[ . . . ] *very much a visible thing and imagery is very good I think, with trauma*” [P005]; “*very tactile*” [P006]. This was highly encouraging to indicate that an end user might feel attuned to this type of digital setting in a range of ways.

## 5.2 Apprehension to Intrigue to Control

Participants highlighted the potential of it being a daunting experience to visit an IIVE without any prior knowledge of the system. This led to design inspiration around using the video prototype as an instructional tool. Terminology such as “*industrial*” (P001); “*shocked*” (P007); “*sterile*” (P008) and “*clunky*” (P012) was expressed. These insights were based on viewing an opening video prototype scene, showing a technician stepping into and powering up the system. This was intentional to allow that the interviewees established understanding of the IIVE from a *switching-on* point forward. Two examples convey that intrigue began to outweigh initial apprehension: “[ . . . ] *it felt like it was going to be complicated but that was quickly erased*” (P005); “[ . . . ] *I just think its exciting the fact that you can go in and load a room up and swipe a wall and make things happen*” (P010). Other interviewees found the IIVE “*interesting*” (P004, P006, P009) and P003 built further on this:

*Well, I suppose I was curious, about it. So, interesting [ . . . ] I think if someone's not come across this before they'd be kind of intrigued, you know: What is this? I like the sense of space. I like that it's a proper room-size, you know, rather than just a little box. So yeah, I think intrigued.* (P003).

Responses indicated that interviewees wanted to gain insight into the capabilities of the IIVE and were making their own links into the ways the system could be applied in mental healthcare. P011, a Psychology Service Manager and Therapist with a clinical caseload, prompted us to ask whether the hands-on capabilities of an IIVE could offer something more than just being in a room:

*I think with the interactivity that there is that sense of control [ . . . ] something tangible as well being able to put your hands on something, it takes an element of control away from the therapist, but I think that's a good thing really [ . . . ]* (P011).

The inference of users maintaining control over a therapeutic process echoed what we felt could become an integral function of the design, with several interviewees mentioning this: “[ . . . ] *they would be more in control aren't they? They can choose to move around*” (P004); “[ . . . ] *it's your choice what you engage with and it's your choice how you control it*” (P006); “*it gives control to the clients as well and actually, ownership*” (P010). This enforced a notion that by presenting users with an option to move and feel their way around, an IIVE in therapy might encourage a different level of client-therapist interactivity.

## 5.3 Human versus Digital Facilitation

A steady pattern emerged throughout the data, indicating that whilst a facilitating therapist need not be present at every moment

during a psychotherapeutic intervention, their inclusion is certainly valued. As P001 described:

“[ . . . ] maybe I am just being a traditionalist here but erm, it kind of felt better [ . . . ] with the facilitator being there [ . . . ] We are social animals. We kind of look for packs, generally, in herds, that's how historically, we've progressed” (P001).

Eight of the twelve interviewees (P001; P004; P005; P008; P009; P010; P011; P012) described ways a facilitator would be supportive in therapy in this type of immersive setting. Three of the additional four respondents (P002; P003; P006) offered alternative views in support of no facilitation being required including: “*We, as therapists, we're just conduits [ . . . ] I think someone could really make use of it even just going through it on their own*” [P006]. All-inclusive, the data was in favor of two people being present or in some way available where therapy might be conducted in an IIVE. P012 suggested that a facilitator could be present, but not necessarily in the room itself:

*I don't know if you could have a facilitator either in the room or maybe you could have it just over the tannoy [ . . . ] but, I think it would be really helpful because one, they'll not know what to do with the technology but two, I think you need a little bit of reassurance and nudging at them points so I thought yes definitely for the facilitator-led part [ . . . ] maybe by the time the person did it at the end maybe they wouldn't need a guide with them; but I would assume that you would need guides for this* (P012).

## 5.4 Environment as a Therapeutic Tool

The broad response from interviewees was that rooms used typically in mental healthcare are not only seated spaces with perceived restrictions, but also exclude use of the environment in that they lacked interactivity. However, participants did describe use of whiteboards, computers, TV and video. From the data the study built an impression that what an IIVE has ability to achieve, is to take individual technologies such as these aforementioned (that may or may not be incorporated into a therapy) and present them in a single unit, or system, where a range of functions are consistent. Hook describes: “[ . . . ] *any design process needs to consider how the system we design will be integrated – becoming embodied – with our ways of being in the world*” [27]. We interpreted that typical mental healthcare settings were perhaps overlooked as environments and could be regarded more so as just an available room. Progressively and building on ways that IIVEs could lend to an embodied experience, the data offered insight into ways that a user and system features could connect.

[ . . . ] *I really like it [ . . . ] You could use it in different ways [ . . . ] It really sits comfortably with the therapeutic approach I would want to use it for [ . . . ] the benefit would be that if they are immersed in it and touching and making comments, I think it's just much better that sitting face-to-face with somebody and saying: Can you tell me what you felt when that happened?* (P002).

*The standing approach [ . . . ] I've got sort of tenuous inklings in my head but I'm not really sure what they are [ . . . ] there's something for me about, I think sometimes*

*we see therapy as sitting in a room face to face talking to someone and I think that it doesn't have to be that way and I think that sometimes that can be too intense and [...] again too forced and too fake, you know people like to move around you know they like to be a bit fluid, so I don't, I guess if this was me being specific in this context, but I do think it is important to mix it up and not see therapy as something where we're sitting down face to face; the ability to move around, to be physical as a way of expressing yourself. I think it's an important consideration (P008).*

In positing an IIVE as an interactive setting where an individual might move on from something they are challenged by, through connecting with the technology, the data revealed: “[...] it gives them the freedom” (P004); “[...] a lot more intuitive” (P012), in comparison to a setting without VR qualities. P012 was mindful about the effect of being mobile in a setting such as an IIVE: “[...] working with people with traumatic backgrounds, actually, they get stuck. It's almost they become part of the seat and I was wondering whether or not it would be helpful actually to be having your legs and your arms moving, just to keep you in that present moment.”

Participants engaging in mental health services who can interact with the environment as a tool to support their progress as a recovery pathway, can achieve, as the data infers, a sense of autonomy or control. From the Study 2 data in Section 8 this paper will examine whether users who trialed the system in situ felt this was the case. P001 suggested that *The Timeline* “could help facilitate a different kind of narrative”, supporting a view that the chronological nature of *The Timeline* might support ways for a user to view life events differently. From a perspective of directly engaging with trauma and using the body in an IIVE, P009 considered: “I think it could be really helpful. I think it would have to be [...] not being a standard treatment for everyone. Any kind of body themes with the trauma [...] then it's engaging them and their bodies and their recovery” (P009).

In direct relation to the IIVE as a physical setting and its potentially critical importance in mental healthcare P010 added: “I think it's the foundation of the work that we do, obviously the more respectful the environment is for the client the more easier it is to actually engage I think and less stigmatised if it's a better setting” (P010). Building on these responses this paper will now discuss how such insights were used to develop the next stage prototype that was positioned in a hospital environment for testing by participants with lived experience of trauma.

## 6 BUILDING THE HI-FIDELITY PROTOTYPE

From Study 1's data analysis we designed a next stage prototype of: *The Timeline*, working alongside content creators at a UK-based company who install IIVEs. Author 1 met with the team and discussed the design aims. Initially, components of the original and lo-fidelity prototypes were observed, then a scene-by-scene storyboard and a script were compiled. The Content Creation Team used a hub and spoke diagram and back and forth design discussions throughout several months helped to piece the vision together. An online workspace called *Confluence* was used to create a Design

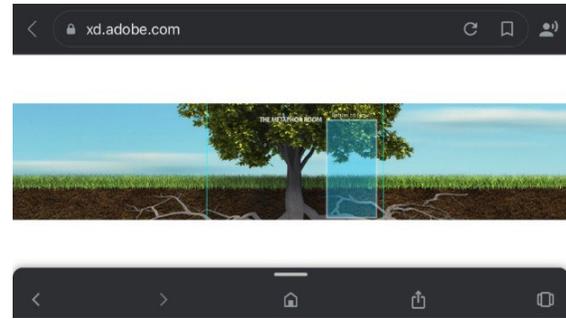


Figure 4: Wireframe imagery created using Adobe XD



Figure 5: SMOTS camera image showing participant accessing *The Timeline*

Document for the experience, then a wireframe prototype using Adobe XD, to develop an interactive mock-up (Figure 4-5).

There were several revisions to the wireframes before an exchange of the final assets required to build the overall experience. The component parts included: MP3 voice-over files; background imagery JPEGs; MP4 videos; items from the Unity Asset Store; subscription to and purchases from a stock-image website. User-interface graphics were created by an additional member of the team. The items were then passed to an Experience Creator who developed the final product in Unity, with a full-scale, functional test-build for the actual IIVE as in Figure 3.

In total, the hi-fi prototype design was influenced by data-responses from P001-P012, to incorporate ways that system-users might experience comfort and control, as well as having features to access in-situ as therapeutic tools. From the view of user entering an immersive interactive experience, features comprised: an automated voice that welcomes the user into the IIVE and introduces them to *The Timeline*; a backdrop that plays visual and auditory simulation with built-in triggers via wall-sensors for users to control these; a series of virtual doors with programmed features as prompts to guide the user chronologically from Deep Past to Future; VR rooms, as additional ways to involve participants in discussion from a perspective of creating an embodied, integrative experience. The latter features include The Metaphor Room; The Cognition Room and Reflection Room, as portals within the IIVE where a user can potentially form a unified understanding of their life-situation

**Table 1: The steps taken through the system by participants in Study**

2

STEP	PROMPT, CUE, COMMAND
1	Participant steps into the room and presses the start command
2	Audio human voice <sup>7</sup> welcomes and describes purpose of the system
3	Approach and press illuminated touch sensor point reading: <i>The Timeline</i>
4	Wall-size simulations show left side wall command: Deep Past
5	A facilitator now joins the participant, or they can proceed independently
6	Participant discusses their Deep Past and choose to close door <sup>8</sup> on Deep Past
7	Participant has option to remain in Deep Past or move to Recent Past
8	Participant proceeds from Deep Past to Recent Past through to Now
9	A series of Room options appear: Word Room <sup>9</sup> , Metaphor Room <sup>10</sup> , Cognition Room <sup>11</sup>
10	Participant proceeds to Future
11	Participant has options to reveal a backdrop image of choice
12	Participant can remain in the Future or proceed to Reflection Room

<sup>7</sup> This is a human, pre-recorded voice that welcomes a user into the system and describes its purpose. For a user who is hearing-impaired, this is also available visually on the wall, as verbatim.

<sup>8</sup> In *The Timeline* a participant can, if they choose, close a door down on the Deep Past. This is a virtual door. As the user touches the door, it disappears from view.

<sup>9</sup> Word Room contains a series of changeable words that act as discussion points for the participant or between the participant and facilitator

<sup>10</sup> Metaphor Room can contain any image. In our system it depicts a tree with branches and visible roots. From a viewpoint of trauma this is intended as a tool to probe the root of a person’s trauma and then explore ways they can view a life as flourishing, as extending upwards and out to the leaves

<sup>11</sup> Cognition Room contains four prompts linked to a person’s experiences, their physiology, their sociocultural background and a prompt that reads existential. This room builds on what authors have described as a holistic, integrative approach, whereby the action that can unfold in this room encourages insight into multi-facets of a person’s life

in relation to a conceptual whole – where brain, body and environment can be arguably acknowledged as a singular system. A more detailed insight into these rooms is in footnotes, in Section 7.

1 provides a summarized, step-by- step insight into what each participant engaged in.

## 7 STUDY DESIGN: STUDY 2 – EXPERTSBY EXPERIENCE (IN-SITU TRIAL AND SEMI-STRUCTURED INTERVIEWS)

### 7.1 Main Objective

The research question in Study 2 was: How do participants with lived experience of trauma as Experts by Experience interpret their experience of The Timeline situated in an IIVE? The objective was to increase understanding of how participants interacted with and viewed their experience of The Timeline. Because the data-collection took place at a National Health Service (NHS) hospital site, procedure included completion of the Integrated Research Application System (IRAS), used for applying for permissions for health, social care and community care research; then a Research Passport, as a mechanism for non-NHS staff to obtain a Letter of Access (LOA). This provides a standard form completed by the researcher and employer and validated by an NHS organization [49]. A further requirement was the completion of a detailed protocol document providing study background, problem formulation and rationale, together with evidence of consent, a definition of End of Trial and details relating to anonymity and data storage. Author 1 met participants on site and was present throughout each of the 12 trials. From a viewpoint of the study’s reproducibility, Table

### 7.2 Participants and Recruitment

A total of 12 participants were recruited via a research partner who deliver NHS psychological services. All participants were female with an age range between 21-72. This study’s sampling number is based on an anticipated number required, before repetition of the same data-response (as a saturation point) is reached. Guest, Bunce and Johnson [23] found 12 interviews enough to achieve saturation within a homogenous group. Where rich and trustworthy data is important and participants are assumed to be the holders of the knowledge required via an investigation, 12 may seem appropriate, although Baker and Edwards [3] conclude that the agreed upon sample number depends on multiple factors.

### 7.3 Interviews

The interviews were conducted in February 2022 and lasted on average 27 minutes. Participants were coded for anonymity (P013-P024). As part of the Inclusion Criteria each participant confirmed having lived experience of trauma and provided their own definition. A purposive, homogeneous sample was based on participants’ direct knowledge of the receiving of mental healthcare interventions.

**Table 2: Trauma as defined by participants**

PARTICIPANT	TRAUMA
P013	"Terrorist attack"
P014	"Bullied significantly"; "Lost my Mother; unexpectedly died when I was 16"
P015	"Emotional trauma"
P016	"Childhood trauma; Violence; Bereavement; Murder"
P017	"A minefield of bad memories"
P018	"Emotional trauma"
P019	"Quite debilitating; mental trauma"
P020	"Mental abuse; Divorcing a narcissist"
P021	"Birth Trauma"
P022	"Parental death at a young age"
P023	"Traumatic Loss"
P024	"Personal trauma through bereavement and loss"

## 7.4 Data Collection and Analysis

The transcripts were used for the basis of a thematic analysis and followed Braun and Clarke's [10] six step guide. The use of qualitative interviewing to obtain perspectives from potential future adopters of VR therapy follows other research such as Dilgul et al. [15]; Kip et al. [32]. When interpreting data, we were mindful of any subjective bias that might form, with Galdas [18] reporting on the need to employ mechanisms to minimize this. To ensure rigor we paid attention to what Morse et al. describe as qualitative research, like prototyping, being an iterative rather than a linear process [45], to establish validity.

## 7.5 Ethics

The study received university Ethics and Health Research Authority (IRAS) approvals. As part of a screening process each participant completed: *Impact of Events Scale – Revised* (IES-R). A total IES-R score of 33 or over from a theoretical maximum of 88 is said to signify the likely presence of PTSD. In this study a mean average score across all participants was 20.25. Three participants who scored higher than 33 were referred back to the study partner before being deemed suitable for the study and providing consent.

## 8 FINDINGS

A first intention was to learn how each participant defined their own trauma and to understand what constituted being regarded as a person with lived experience, as Table 2 shows:

Analysis of the data led to constructing four themes: *Active Participation in Therapy; Participatory control and choice; Therapeutic relationship dynamics; Sense-making of trauma*. These contributed to participant attitudes toward the use of an IIVE in a therapeutic context and a meta-theme: *Participatory Autonomy in Therapy*, as discussed in Section 9. From an opening dialogue it was understood that no participants had experienced technology such as an immersive room in therapy. In total, participants had previously taken part in counselling, CBT, High-intensity CBT, EMDR, yoga, meditation, reading and Transactional Analysis. Certain participants measured what *The Timeline* as a digital intervention could offer, against interventions that were not digital. For example, P018 related to the ability to display interactive words on the walls of

the IIVE and compared this to previous experience of therapy: "*It was good because I could see a start, a middle, an end and a future, where before with just CBT you don't see the end or the future*" (P018). Because each participant was able to trial the technology in-situ at a hospital, prior to their interview, they experienced as close to reality as possible of what *The Timeline* would feel like as a clinical intervention.

## 8.1 Active Participation in Therapy

All 12 participants responded positively to physically standing and moving in the IIVE and P022 talked about the level of "*digitalization*" in people's lives and as an "*immersive experience*", for example when gaming or watching Netflix. This participant saw it as "*a natural progression to seek therapeutic help in that way*". As we gained insight into interpretations from physically experiencing a proposed therapeutic intervention within an IIVE, all interviewees except one referred to past instances where therapy was received without moving from a chair. A single exception was P017 who described a combination: "*Seated. Certain points I could stand though when we've been doing like the more creative side of it to like pull out things that I didn't want to speak about.*" Other responses led to what could be interpreted as limitations of a seated process, where therapy delivered and received via two people facing one another might not match the needs of every client. P013 described: "*[. . .] when I did it, obviously we were sat like face-to-face and sometimes I felt like, a bit awkward, 'cause like you were having to physically stare at the person and things like that.*" P015 added: "*[. . .] if you're sat confined in a space you are only sat thinking, it's almost like you are mentally trapped 'cause you are just sat in a chair you are not going anywhere.*"

An IIVE can offer something potentially unique in a therapeutic context and responses described what such physical experiences might offer:

*It was very different to sitting down in therapy, but it was very interactive so you were, kind of immersed in the experience and really focusing on what you were doing, so I think for a client, they would get a lot from that, [. . .] obviously bringing their kind of trauma to that and talking and walking them through it, so yeah that*

*interaction and the standing up bit was really, really useful (P016).*

*Yeah, I think because you're stepping forward and you're doing the action [ . . . ] I think for people who have suffered trauma them just closing that door [ . . . ] talking can help a lot but the actual action that you do, yeah I think it would help people massively (P020).*

By becoming physically engaged in a therapeutic process we visualized ways a future user might become less of a passive receiver throughout a therapy process and more of an active agent. P024 described: “[ . . . ] it just brought different dimensions to therapy.”

## 8.2 Participatory control and choice

Participant interpretation of the IIVE as a technology was less apprehensive than participants in Study 1. Additionally, the participants were now experiencing the technology in-situ, by contrast to observing video stimuli. They were also stepping into a more developed iteration of *The Timeline*, as indicated on the central IIVE wall. When Study 2 participants entered the IIVE, they were welcomed by background music and simulation content based on the *Aurora Borealis*. As such, while “vulnerable”, “cold” and “ap- prehensive” was expressed by P016, P020 and P024 respectively, this could have related to the clinical setting itself rather than the simulation. Additional comments based on first impressions were supportive, including: “[ . . . ] really visual and obviously kinesthetic for people [ . . . ]” (P014); “I liked it ‘cause it felt like safe and you were away from everything outside” (P017).

What emerged was a sense of multiple ways to engage with trauma within the IIVE and this could be interpreted as offering some description of autonomy, as important in mental health applications. This re-enforced what Study 1 experts had noted in relation to both choice and control:

*I felt I was more in control [ . . . ] and I was controlling it [ . . . ] rather than sitting on a couch and somebody trying to drag something out of me (P018).*

*I really like that they're doors because what it's giving somebody is that choice of there's a door there and whether they choose it or not [ . . . ] but also about choos- ing, you know, where to go, erm, in terms of the deep past or the recent past [ . . . ] (P023).*

In furthering the potential of a user choice, the word “option” was expressed by five of the participants (P015; P016; P017; P020; P021). An example here relates to a user experiencing one of the features of *The Timeline*: “[ . . . ] it would be shutting that off again. I felt the doors were a good option for me” (P021).

Control, in this study’s case, relates to a person having ability to move forward in their life and to build some form of momentum to project them away from a current state, towards a future where they gain alternative perspectives in relation to where they current sense they are at. The data evidenced that participants automatically grasped the metaphor of *The Timeline* and, in particular, described favorably the potential to step away from their deep past towards the future:

*That was how you are going to live moving forward. . . so you've opened up about your trauma, the aftermath of*

*your trauma; how you are now dealing with the trauma and the aftermath, your future is your plan moving forward. It allows you to assess everything that you've done so far and take action to make better steps moving forward (P015).*

*I liked it because it took you through your deep past to your like recent past, where you are now, it took you through all these different factors [ . . . ] I thought that was nice because you can kind of look at how you're feeling about yourself and how you want to feel and you're already thinking about right what am I going to do moving forward with all of this? (P017).*

Having ability to physically step away from trauma could be an important factor in mental healthcare interventions and digital technologies such as an IIVE might provide a platform where this action can be taken. What this can also build towards in a new way for participants and facilitators, as therapists, to interact, as now discussed.

## 8.3 Therapeutic relationship dynamics

An IIVE is a walk-in technology that allows participant and facilitator to stand beside one another. As in Study 1, participants valued human facilitation and noted what this approach could offer in the altering of delivery and receipt of therapy. As co-developers of potential on-going iterations of *The Timeline* it was felt that participatory responses affirmed a notion of togetherness being something akin to supportive, in the context of the delivery and receiving of a therapeutic intervention.

*I think the fact that you're standing together you're almost like a team if that makes sense [ . . . ] almost like you are viewing it through the client's eyes as opposed to viewing it through your eyes and watching it [ . . . ] usually when there's a better therapeutic relationship between the client and the therapist, usually that's when you get the better outcomes [ . . . ] I was thinking for me personally anyway, if I felt much more together that would improve my own therapeutic relationship (P014)*

*I think you get a lot more out of being able to talk through things and look at what it is that you're actually talking about through the prompts that were on the walls than if you were just sat opposite somebody in a more clinical setting [ . . . ] (P019)*

*I think somebody else there is, reassurance, yeah, I think I would prefer somebody else to be there [ . . . ] for the other side of it like coping strategies and other ways of using that immersive therapy, I think that would be helpful for someone to go in on their own and just be in a safe place, but I think working with trauma, for me, I would prefer somebody else to be there (P024)*

Through *The Timeline* an opportunity emerges for a client-led approach, where standing and accessing visual cues can offer a unique dynamic for those engaging in trauma-related therapy. This has potential in affecting both the behavior as well as the language exchanged within the therapeutic scenario. Participants voiced

that in conventional therapeutic approaches the seated, face-to-face exchanges can sometimes be “awkward” (P013) where in an IIVE the experience of The Timeline “lessened the pressure” (P014). Participant P015 suggested that the experience of standing and moving around was “a lot more freeing” and further data describes “very interactive” (P016) where “[. . .] the space of the room makes it a lot easier, I would imagine, particularly for people who struggle with social interactions” (P019).

#### 8.4 Sense-making of trauma

When reading and re-reading the transcripts to determine whether participants envisaged *The Timeline* as being able to assist a user in making sense of trauma, it became apparent that not every form of therapy permits access to a deep past, a present and a future inside of a single space. P021 discussed how she was stuck in the trauma of being told her son was going to die and this impacted by triggering responses to other traumas she had faced. Several participants revealed that by seeing visual “prompts” [P018; P019] and “links” [P014; P017; P024] in ways *The Timeline* displays within the IIVE, these were useful as tools with sense-making potential:

*I think seeing them in front of you prompts you to talk about them and prompts you to realise that you are actually talking about them, whereas if you are just sat opposite somebody you could well be going through the exact same thing, but you don't realise because it's not prompted in front of you as it is, in the immersive room (P018).*

A two-way interaction between person and environment in an IIVE builds on what enactivist philosophy interprets as cognition, where sensemaking is formed via an organism's continuous response in its surroundings, with less regard to conceptualize an internal or an external reality. A combining of user and technology forming what can be described as a dynamic system, builds towards potential for a person to not only seek ways to use their environment to their advantage, but in doing so recognize that in effect *the environment can be used*. In a typical mental healthcare setting it appears that greater attention is paid to a person to person dynamic and less so of the dynamic of person and their occupied space, as in our study:

*[. . .] like I just said before, like you are physically stepping forward, touching a wall [. . .] physically you are like stepping into that, stepping into The Timeline and then opening up about the trauma, closing the door, moving on to the next and then looking at your future and that long road (P020).*

*I think in the way it's set out [. . .] I think the fact that its got a natural progression so in some ways it's got a structure [. . .] if there's a structure there it helps you to make sense of things [. . .] it helps to give perspective on things that have happened in a particular trauma or in life [. . .] (P023).*

It became clear that participants were not only experts due to their lived experience of trauma, but had, through events that had impacted them, become experts at managing and understanding more than just the root cause. Eleven of the twelve participants

in Study 2 had become pro-active in their response to trauma and became therapists and counsellors in their own right. From a view of an IIVE becoming adopted in mental healthcare and *The Timeline* as a process being installed in this type of technology, P019 described:

*[. . .] trauma type of problems, don't get fixed [. . .] you learn how to live with them, you learn to rationalise and you learn to understand. You learn how your thoughts create your feelings and your feelings create your behaviour [. . .] in my interpretation that's what therapy is it's not going in there and expecting to come out fixed in an hour's time [. . .] But what you do in that hour is it teaches you how to manage or how to deal with in future what it is that's caused your problem [. . .] You wouldn't see it the way that you would in that room; you wouldn't see the prompts, you wouldn't see how that leads to that leads to that. It just gets talked but this is more, it's more of a, it's an interactive therapist (P019)*

The idea of an IIVE as a digital system being related to as an interactive therapist, does more than simply attach technology to a person with some user-instructions. What was voiced by P019 points directly towards a notion of person and system becoming combined in a way where no separation is apparent, as they interact with chronological epochs of their trauma narrative. To the enactivist view, this type of circularity as a person-world combination offers possibilities for sense-making systems to involve participants, as agents, in such a way that the reciprocal process and the person become perceived as one. In this type of simulated reality the user is constantly involved in sensemaking and in a way physically embraces stepping into the role of a facilitator themselves. For self-directed therapy in an IIVE, as part of a personalized, solution-focussed recovery-plan, this could be empowering.

## 9 DISCUSSION

The current study set out to leverage large-scale immersive multimedia and through analysis of data investigate how experts experienced and acknowledged the feasibility of a digital therapeutic intervention called *The Timeline*. We have taken what is typically a static, lesser-interactive treatment and stood it up. By positioning this in an IIVE it enables a multisensory, chronological journey from Deep Past to Future, by accessing features in an extended, virtual reality. The data from *Experts by Profession* is based on remote viewing of a lo-fidelity prototype, informing the design of a hi-fidelity prototype. Kitson, Prpa and Riecke consider the use of immersive interactive technologies for positive change, but their scoping review highlights a limitation that many studies use student populations as participants and questions whether outcomes for more vulnerable populations would present the same outcomes [33]. In our study we validated our initial findings by conducting an in-situ trial at an NHS hospital with *Experts by Experience* who had lived with trauma. We now unpack our insights and provide guidelines as an indication of a direction for researchers developing digital interventions in mental healthcare. Overall, two meta-themes were identified from our analysis. The first study gave us an overarching meta theme: *Active Participation in Therapy*. What the data highlights is that compared to a typical therapy in a traditional environment,

*The Timeline* permits a participant to engage and interact with the setting as an assistive tool. The next study gave us an overarching meta theme: *Participatory Autonomy in Therapy*. The data provides evidence that through *The Timeline* a participant has freedom to explore outcomes with a clear sense of experiencing control and choice in guiding what is traditionally regarded as a led process.

### 9.1 Active participation in therapy

Analysis from Study 1 indicate that experts who are frontline mental health workers are pragmatic in their approaches to practice and adopt tools they deem necessary. They infer immersive technologies offer something of a niche approach and while no interview participants had experience of these directly, they were open to fresh strategies of engagement with potential to bring something new to therapy. They highlighted that pre-knowledge of an IIVE would be required prior to a user entering the system and it was voiced that with interactivity arrives potential for a sustained sense of participatory control. Also, IIVEs were regarded as unique environments affording a level of user choice. Facilitation was considered a must for some participants, via joint human presence, but there could also be ways to explore self-direction in an IIVE. As an intuitive system, as one interviewee described, the IIVE could be used across a range of modalities of treatment, building toward a user leading their own therapy, as opposed to being led, supporting autonomous user interaction.

### 9.2 Participatory autonomy in therapy

In Study 2, further important findings were that participants with lived experiences of trauma have a broad understanding of therapies and in some cases reflected on a sense of awkwardness in traditional, seated approaches. They valued the immersive, interactive qualities of *The Timeline*, engaging in an action-based approach. This re-emphasized the control and choice elements highlighted in Study 1, offering potential to incorporate body and movement to experience therapeutic relationships in a new way, offering an additional layer of interactivity compared to typical mental health-care therapies. *The Timeline* breaks down a person's life experience into sequential parts, presenting these via a range of visible options. This, externalization of a person's narrative, is made possible through what could be described as prompts, cues and sense making tools. Participants related to these as links in a process where the challenges from the past could be reimagined as a future life plan moving forward. What rooms such as The Metaphor Room or The Cognition Room open up, is to encourage understanding of a person relating to themselves and what is regarded as a social problem in mental healthcare in new ways. As an example, as pre-mentioned in footnotes, The Cognition Room provides a platform to explore a person's experiences at a physiological, sociocultural and existential level, through having ability to visually see and interact with these prompts as they appear upon walls of *The Timeline*. This indicates a dedicated design-focus in practice, to understand the whole organism, person or agent in relation to its social setting as an environment. In itself, this has potential in building towards an integrative approach as it offers a therapeutic discussion additional and novel ways to externalize and explore varied dimensions of a participant's being.

In proposing a shift toward a form of therapy that acknowledges the role of the body in therapeutic treatment for trauma, our findings are encouraging and highlight: (i) in an IIVE system-users acknowledge (as in proprioception) that their full sensorimotor system is impacted in trauma and can be used in recovery. Our study therefore involves and does not exclude the body; (ii) in an IIVE system-users experience a connectivity or a coupling to their environment where physiological-technological embodiment is possible. Users are automatically curious to explore ways it can be used; (iii) by interacting with *The Timeline*, possibilities emerge to affect a life trajectory, as a proposed intervention with capacity to perceive a shift from past to future in a single space; (iv) sense-making possibilities exist in an IIVE for participants with lived experience of trauma, where multisensory interaction engages the user in an intervention they actively experience, rather than passively receive via lesser multisensory interactivity.

### 9.3 Rationale for each study approach

In Study 1 the participants viewed a video prototype, providing responses based on the observing of what was introduced as a low-fidelity model of *The Timeline*. Because Study 1 involved gathering qualitative data to inform Study 2 and the design of the high-fidelity prototype, it is considered that video prototyping can be an effective, cost-efficient approach and one that offers replicability of the intentions of the study at a distance. Due to regional lockdown restrictions and challenges in accessing an actual working prototype, this was a useful alternative that allowed the study to continue. In Study 2, participants experienced the technology in-situ and were active in following a series of prompts, as cues or commands, as in Table 1 in Section 7. Choosing an IIVE as a platform from the start point of this study was, pragmatically, because it resembled a room. This offered potential to recreate components of the rapid and low-fidelity prototypes within a similar architecture, as described in Section 6.

## 10 LIMITATIONS AND FUTURE WORK

IIVEs are not used commonly in mental healthcare and for work to continue their adoption could be more widely evidenced. Because content creation and multisensory partnerships can be required, this may be a resource and labor-intensive process, particularly, as we encountered, when seeking to position a study in a hospital. We envisage that future research could weigh up both the costs and efficacy of an approach such as *The Timeline*, versus more traditional treatment pathways; also, by involving experts as coproducers of a digital intervention from day one, this could decrease or increase challenges. Future studies could, for example, examine effects of higher order cognitive functioning, such as reflective thinking. The experience of movement, walking and interacting with *The Timeline* as a metaphor were voiced as supportive to the process as an intervention. However, these could be features of a non-digital environment, as with the original prototype. As the IIVE can arguably offer more ways to illicit more multisensory responses and ways to interact, future studies might investigate and compare the benefits of a low-tech system versus one that is digitized. In viewing *The Timeline* as leveraged towards a digital response in alleviating a social problem of a growing demand across

mental healthcare services, future studies could investigate how underpinning theoretical frameworks: embodiment, enactivism, can be applied to designs of systems. These studies might then apply to a critique of conventional mental healthcare approaches to consider what benefits exist in practice, by exploring digital-based options. Additionally, many more elaborate technological developments began their days in non-conventional research spaces, making use of what was piecing together available component parts of the time. This study considers that future work might realize first-stage prototypes across a range of workspaces that points less towards funding being a barrier, more the boundaries of imagination. In the current study, IIVE-type systems are becoming more widely installed, but the real work is in the design of user-interactive content, as the hardware tends to not differ very much from location to location.

## 11 CONCLUSION

Our research finds that IIVEs have potential in offering a new way for people to engage with an in-person, therapeutic pathway, via a bespoke intervention called *The Timeline* - offering support to those identifying chronologically with events that have led to a personal, impactful crisis. This work builds on an assumption that brain, body and environment seamlessly interconnect and what unfolds here is a unification of both the experience and the experienter, as a system; with the setting itself recognizably and purposely playing an important role. In our approach a distinction exists between a person as a passive recipient of a static treatment, versus being an active agent as part of a more engaged, interactive, multifarious experience. At an intersection where digital innovations are becoming more prevalent in mental healthcare, decision-makers have opportunity to trial what might become models that complement or even surpass what are currently biomedically-focused, mainstream options. In societies facing potential traumas not yet imagined, this could be important for future rumination, where users can explore autonomously and where action taken in a virtual reality might transfer as an effective solution, designed for taking individual control back in the real world.

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