Northumbria Research Link

IMMERSIVE ENVIRONMENTS, ENACTIVE SYSTEMS

THE TIMELINE: DESIGNING A DIGITAL

EXPERIENTIAL INTERVENTION FOR TRAUMA

TOR ALEXANDER BRUCE

PhD

2022

TOR ALEXANDER BRUCE

A thesis submitted in partial fulfilment of
the requirements of the University of
Northumbria at Newcastle for the degree of
Doctor of Philosophy

Connected Experiences Lab, Faculty of Design
Faculty of Health and Life Sciences

September 2022

ABSTRACT

When facilitating mental health interventions, therapists typically involve clients in discussion within a room containing seating and a table. This thesis argues 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 interactive modalities 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.

The thesis reports on two studies via the iterative, human-centric design of a bespoke, digital therapeutic intervention called *The Timeline*, situated in an immersive interactive virtual environment (IIVE). Study 1 involved qualitative interviews informed by 12 "Experts by Profession", as frontline mental health workers with average engagement of 16 years. Study 2 involved 12 "Experts by Experience" with lived understanding of a range of trauma, who were invited to trial and evaluate the system in-situ at James Cook Hospital in Teesside.

The interdisciplinary research, situated in the field of Human Computer Interaction (HCI), draws upon theoretical underpinning from an enactivist view within the cognitive sciences. This provides insight into the psychology of behavior between people and systems, offering useful concepts when applying an interaction design methodology to the user experience of technology.

The main findings evidence how *The Timeline*, as a bespoke intervention, could lead to participatory choice and personalized control in the context of digital therapy. Data showed that conventional therapeutic interventions in mental healthcare can be restrictive and the ability to actively use prompts with the system offered autonomy and opportunity to make sense of a narrative. The IIVE is a technology with enabling properties offering a supportive alternative to mainstream therapy as an enactive system. The contribution builds on a lack of empirical evidence of designing, testing and evaluating digital interventions in mental healthcare, particularly those that nurture multidisciplinary partnerships and recruit participants with lived experience of trauma.

ACKNOWLEDGEMENTS

planned for and drafted at 80,000 words, now condensed due to the efforts made in designing and positioning the Enactive System and *The Timeline*. I acknowledge the most recent supervising professor, head of Connected Experience Lab (CXL) at Northumbria University, whose breadth of multi-sector experience in HCI-related industry and academia led to months of dedicated drafting of research papers, as well as virtual-conferencing in Japan, a seminar presentation trip to Stockholm in Sweden and a conference trip to Aarhus, Denmark. The 'I' throughout this study became more of a combined effort with each supervisor and day-to-day contact with Professor Lars Erik Holmquist has built toward aligned projects, holding potential to further research interests via future study and publications within the HCI field. Professor Kristina Hook from KTH Royal Institute of Technology; Mario Romero from the KTH Visualization Lab and Mattias Jacobbson from Sodertorn University, for hosting a three-day seminar series of presentations. To Colin D. Roberts, who prior to any notion of a sponsored doctoral study offered insight and mentorship and has continued to enlighten with his brilliance. To Dr Jeremy Bruce, whose vocal support and reference formed part of my being accepted to study at doctoral level. To Yulei Li, a colleague who became a friend and joined the climb with sight from his own academic mountain. To others who were already on the journey when I joined it, then departed; who were present and have remained; who will join me on the journey and to those who are on the journey as co-joined without realization.

Finally, to Mary Catherine McDonald, Jane Esther Bruce Donaldson, whose particles still float, with appearance, everywhere.

DECLARATION

I declare that the work contained in this thesis has not been submitted for any other award and that it is my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

At no time during the registration for the degree of *Doctor of Philosophy* has the author been registered for any other University award without prior agreement of the Graduate Committee.

This study was financed via a studentship award through *Immersive Interactive* and further supported via *Northumbria University*.

Any ethical clearance for the research presented in this commentary has been approved. Approval was sought and granted through the Researcher's submission [Ref. 32928] to Northumbria University's Ethics Online System / external committee [June 2022] on [21]. Research title: *Exploring opportunities for immersive interactive virtual environments (IIVEs) in supporting an enactive approach to narrative sense-making for participants with experience of trauma in mental healthcare.*

In addition, Health Research Authority (HRA) approval [REF 1100/89/122/81] for this study was provided [November 29, 2021], with Integrated Research Application System IRAS Project ID: 306798 – for permissions obtained in situating this study at James Cook Hospital, Teesside, UK.

I declare that the Word Count of this Thesis as practice-based, is 49,475 / 60,295 words

Name: Tor Alexander Bruce

Date: October 6, 2022

Final submission with modifications: April 28, 2023

University of Northumbria

PUBLISHED RESEARCH AND CONFERENCE CONTRIBUTIONS

RESEARCH PAPERS

Tor Alexander Bruce, Annessa Rebair, Lars Erik Holmquist. 2022. *The Timeline: A Qualitative Study Exploring Therapeutic Experiences in an Immersive Interactive Virtual Environment (IIVE) for Trauma Mental Healthcare*. In Proceedings of NordiCHI 2022, Denmark. Participative Computing for Sustainable Futures, October 8-12. Available: https://researchportal.northumbria.ac.uk/en/publications/the-timeline-a-qualitative-study-exploring-therapeutic-experience

CONFERENCE PRESENTATIONS AND POSITIONING PAPER

Tor Alexander Bruce, 2022. *The Timeline: A Qualitative Study Exploring Therapeutic Experiences in an Immersive Interactive Virtual Environment (IIVE) for Trauma Mental Healthcare*. NordiCHI, Participative Computing for Sustainable Futures. Available: https://dl.acm.org/doi/10.1145/3546155.3547725

Tor A. Bruce, Lars E. Holmquist. 2021. *Study Overview: Immersive Multisensory Environments in Mental Healthcare – A contribution to the ACMCHI21 Workshop Program: Design and Creation of Inclusive User Interaction Through Immersive Media*. May 08, 2021. ACM CHI IICW 21, Yokohama, Japan. Available: https://sites.google.com/view/acm-chi-iicw21/home

Bruce, T.A. 2020. *Enactive Approaches to Designing and Understanding Immersive Interactive Virtual Environments in Mental Healthcare*. Doctoral Consortium: Proceedings of the 33rd International BCS Human Computer Interaction Conference (BCS HCI 2020). Available: 10.14236/ewic/HCI20DC.19

TABLE OF CONTENTS

	14.5 A recipe for disruption		
	References	5348	199-212
TOTAL		**60,293**	

LIST OF ABBREVIATIONS

ACRONYM	DESCRIPTION	PAGE
IIVE	Immersive Interactive Virtual Environment	5
HCI	Human Computer Interaction	5
NLP	Neurolinguistic Programming	20
CBT	Cognitive Behavioral Therapy	20
WHO	World Health Organization	21
NHS	National Health Service	21
HMD	Head Mounted Display	24
HRA	Health Research Authority	27
IRAS	Integrated Research Application System	27
BMA	British Medical Authority	35
PTSD	Post Traumatic Stress Disorder	36
WMH	World Mental Health	36
TRM	Trauma Resiliency Model	40
EMDR	Eye Movement Desensitization and Reprocessing	40
CMT	Concentrative Movement Therapy	40
IAPT	Improving Access to Psychological Therapies	40
ENS	Enteric Nervous System	41
CNS	Central Nervous System	41
PNS	Peripheral Nervous System	41
BPS	Biopsychosocial	42
CBT	Cognitive Behavioral Therapy	43
CTM	Computational Theory of Mind	56
CAVE	Cave Automatic Virtual Environment	67
VR	Virtual Reality	67
XR	Extended Reality	68
VE	Virtual Environment	68
ACM	Association for Computing Machinery	70
IVET	In Vivo Exposure Therapy	71
ARET	Augmented Reality Exposure Therapy	71
AR	Augmented Reality	74
MR	Mixed Reality	74
2D	Two Dimensional	110
3D	Three Dimensional	110
SMOTS	Scotia Medical Observation and Training System	112
LOA	Letter of Access	147
IES	Impact of Events	148
AIP	Adaptive Information Processing	179
3MDR	Multi-Modular Motion assisted Memory Desensitization and Reconsolidation	179
NIHR	National Institute for Health Research	193
AHSN	Academic Health Science Network	193

LIST OF FIGURES

LIST OF TABLES

APPENDICES

ITEM	DESCRIPTION	TYPE	PAGE
0	Published Research Paper	Document	-
1	Research Framework	A3 Chart	25
2	A History of Positions and Beliefs	A3 Chart	25
3	A History of Immersive Technology	A3 Chart	25
4	Enactive Origins	A3 Chart	25
5	1,000 word summary of the NHS	Document	40
6	Epistemology	Document	84
7	Video Prototype Shooting Schedule	Document	90
8	Protocol	Document	96
9	IRAS Checklist	Document	96
10	Impact of Event(s)-R	Document	97
11	Participatory Information Sheet	Document	109
12	Consent Form	Document	109
13	Interview Template	Document	110
14	Storyboard	Image	127
15	Storyboard	Image	127
16	Inclusion criteria	Document	141
17	Interview questions	Document	142
18	Themes	Document	144
19	An enactive system	Image	182

PART 0

Backstory

I am stood in the doorway of a Newcastle quayside bar, employed 6pm to 1am on behalf of Professional Security Services, for what is colloquially referred to as "working the doors". It's November 2017, horizontal raining and as a customer walks up through the foyer tunnel enclosure he pauses: "*You don't see this too often. What are you reading*?" I explain in less words that Paul Michel Foucault is a character who is currently prominent on my journey; that I am working evening-shifts whilst studying towards completion of a Masters. I have become so engrossed in the history of mental illness I consider by my own reckoning I am formulating a broad, chronological insight into what has actually unfolded, historically to the present, rather than accept what society presents as fact. It appears society en-masse has followed a more populist view, leaving critiques only for those who will dare challenge a mainstream opinion. I acknowledge here that I am: (i) a seeker of more than what presents itself at the surface, one of the reasons I likely became interested in trauma-based research, (ii) a human being who believes it is rational to start at the very beginning, or as close as possible, to learn how events have unfolded, in this case throughout thousands of years. In total, feeling a late entrant to the academic game at age 44, I am building assumptions, toward an as-yet restricted insight into: What exists? Associated reading has already insisted that Immanuel Kant is held in high regard as a philosopher; Renes Descartes thought way more conceptually than separating mind from body; Ivan Illich, Sarah Nettleton and Nikolas Rose each in their own way regard the practice of psychiatry and aligning psychotherapy as requiring further shaping, i.e. particularly where formulating discussion around the social aspects of a person's trajectory are concerned, including empowering the patient as expert of their own experience.

I enrolled in academic study because my vocational path was at a dead-end. To this point I had taken off with a Nikon FE camera and equivalent of $60 to my name, to work and live abroad in the United States and Canada. I returned after 18 months in 2001 where, unemployed and in a nothing-to-lose position, I tenaciously built from a government-scheme grant of £5,000 to what became a registered charity, in support of young people who presented signs of being marginalized. This was formative to my mettle as a human, innovatively shaping and steering a service to enable day to day interaction among those who were carrying emotional weight, just as their journey was getting started, including barriers such as homelessness, drug

addiction, criminal offender activity and abuse, both physical and mental. This latter 'category' of affliction made a dented impression, together with those who were branded as less-able, or sensory impaired. After engaging more than 5,000 beneficiaries and the charity after 12 years of operations arriving at a natural winding up of business, I found myself again without full-time employment, training then via a further bursary towards a qualification in a subject I'd never even heard of to this point: Neurolinguistic Programming (NLP). Several months into this I became awake to the fact that any formal career as a psychotherapist would require something more aligned to Cognitive Behavioral Therapy (CBT) or counselling – but with some of the techniques from NLP's toolbox I experimented and continued with.

At some time around the evening of standing in the doorway absorbing the literary works of Foucault, via text message one evening I received a request to "work with" a young man (J) who lived nearby and during the week previous had hanged himself; cut down after a few minutes by his flatmate. When J was en-route to visit, I sat in the dining room at the back of the house where I engaged in these type of 1-1s and looked down at The Timeline, a sheet of A3 paper containing a single, printed line. I'd used this as a resource on perhaps more than 100 occasions, very much so through the days of the charity. I found it to be an effective tool because:

i.   It has structure: a past, now and future;

ii.   There was a solution-focus toward an end goal;

iii. It can arguably apply to anybody with a story and everyone I had worked with already, had one;

iv.   By applying the clean language technique[1] (from NLP that I later used and applied this), I was encouraging the person to use their own words as opposed from excessive input from myself;

---

[1] One of the techniques used in Neurolinguistic Programming is Clean Language. Clean Language minimises impact on a client-participant's where questions are directed more as prompts. As a discussion technique it explores and works with a person's own metaphors and model of their world, i.e. rather than the therapist imposing their own views or attempts to fix

v.   The participant could (potentially for the first time ever) visualise and sense their life as a chronological map, containing both the concealed, foreseeable and potential;

vi.   It wasn't possible for a participant fully engaged in The Timeline to remain in 'the past event', because by nature of a timeline some movement is required as a shift beyond this

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*' (Rimkeviciene, 2016: p. 231-245). I first started using them purely from a pragmatic view that they could be a straightforward means of conducting and documenting a discussion that contained, junctions, of what J referred to in our encounter as "epochs". As J was somewhere close to approaching the house I considered what he was bringing quite literally, to the table; a young man having reached a point of actually wanting to cut off his life support, without backing out. At what became (upon reflection) a pivotal moment, I stood up from the dining room bench and with pen, paper and Sellotape, chartered across three walls: Deep Past, Past, Now, Future. I admittedly felt apprehension, but it intuitively felt applicable, to take this step.

Words attributed to the physicist Albert Einstein: *Nothing Happens Until Something Moves*, might apply here, conjuring an image of a *biological* being containing *chemical* components interacting within a *physics* particle-reality, whereby the shifts a human perceives as conscious, are actually an entire system response, all biological, chemical and particle elements combined – of paramount importance to this thesis. What is suggested here is that whilst 'I' can be regarded as making any particular decision, the environment's itself presented affordances and coupling these with the intention to support J, it could be argued there was more going on (metaphysically) than just a person standing up and sticking some paper to three walls, as a whole system response.

To add, my interest in the "gut brain axis[2]" builds on a sensing that decision making might require more than only a reaction born of one single organ such as the brain. This shift in the room as J was approaching then, might also be recognised as a call to action. The author Joseph Conran considers that journeying into such a void can form part of a first stage of what has endured as a mythological journey where "*destiny has summoned the hero and transferred his spiritual center of gravity from within the pale of his society to a zone unknown*" (Conran, 1949: p.58). I cite this not to draw attention egotistically to my own efforts but to acknowledge that both J and myself were figures stood against the backdrop of a landscape where neither had an understanding where it would lead. I refer to this also because from a viewpoint of engaging participants with lived experience of trauma, the hero journey metaphor could apply with emphasis to those who have experienced, endured, stood up to and in some way sought to work through a war waged upon their entire physiological and sensory being.

When J entered the room I asked if he was comfortable with the standing arrangement and he agreed. I stood beside him (something immediately, intuitively 'felt' to be important). I asked him to approach the 'Now' as signalled on the central wall and describe a response to: *Where Are You At*? I also requested one current positive. My reason for this was so at any point in the process we were about to enter, we could return to a something in the Now that was something like reaffirming. Bisson et al. refer to the "*here and now*" in their paper documenting a randomized controlled trial for male military veterans presenting treatment resistant, service-relates post traumatic stress (Bisson et al. 2020: p.1-11). During the next three months I worked with a further 12 participants, 11 of whom described some form of past person or event that had become intrusive to such as extent as altering the way they interacted with reality from then on. What was also voiced during these encounters, was that by standing up and moving, the participants described some physical shift was taking place, later discussed in the Results section. The typical delivery of such a solutions-

---

[2] Where evidence shows communication between the central nervous system and the enteric nervous system and where life experiences, nutritional intake and general day-to-day living can effect the millions of nerves and neurons signalling in one way via the vagus nerve

focused sessions was generally seated and lasted 30-70 minutes, never previously involving standing up, although I had walked with individuals, or stood alongside them while engaged in arts -based activities at the charity. One example was a young girl with a history of physical abuse who I engaged with throughout several weeks as she painted a series of butterflies – her choosing this medium.

Building on a 'hunch' (see section 4.5) that there was something worth investigating from the involvement with J, plus being already enrolled at the university in mid-completion of a Masters, I approached Ellis, a technician based at the Clinical Skills facility. I was making weekly attempts to seek funding and made contact with the company who installed what became known to me then as a room containing immersive technology, namely three ceiling projectors, wall sensors and a keyboard. Where I had previously used a marker pen and cardboard to indicate: *Deep Past, Past, Now, Future*, around the room, together with Post It notes – recognizing that the dynamics of a conventional therapeutic delivery could be experienced differently - with support from Ellis the paper items were scanned in and uploaded on to the walls of the room. This became a first iteration of what later became a digital version of *The Timeline*, where the technology company then sponsored the three-year Ph.D. An original purpose, as pre-described, 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. Figure 1 shows the original room containing an actor. This image was taken in the same month as engaging with J.

Figure 1: Original Prototype (2018)

From the entry point into this thesis, the relevance and importance of *doors* both in tangible terms as well as conceptual and virtual, is not overlooked. From being stood in the doorway of a bar reading Foucault, through to J entering a rear-room door at a house; to doors that involved access to those who supported the current study through initial, formative and evaluative stages; then with the participants who were presented a choice: Close The Door On The Deep Past - the door metaphor has been integral. People who face certain, physiological challenges might be impacted upon not solely through their trauma, because many will have identified where the root of the trauma stems from – but instead from a lack of options, relating to how to compartmentalise life events and where to go now (see 12.10 in Discussion section). Some form of portal could be desirable, to enter or leave as chosen, or seek the closing a door completely, as one that has signified an uninvited memory, wound, scar. It seems profound almost too straightforward, to suggest that by simply standing, moving and opening or closing a doorway as a symbol, a person might of their own volition free themselves toward a myriad of possibilities that contain not the same offering if a person is stood still – no occurrence of change until they take it upon themselves, to move. However, as the

Limitations in this thesis will discuss, the standing up of therapeutic approaches in mental healthcare can never be straightforward, where the value of alternative to mainstream approaches are only at first steps of being recognised and integrated into practice.

PART I

CHAPTER 1: INTRODUCTION

The formation of an autonomous identity is inconceivable without the environment. It provides the processes that the organism is made of

(Kyselo, 2016:603).

1.1 Ontology: Scope of the Problem and Motivation

Ontologically, this thesis assumes that alternative approaches are required in the delivery and receiving of mental healthcare interventions, where the adopting of digital technologies holds promise in offering complimentary solutions both as concepts and in practice. In designing a novel, digital therapeutic intervention called *The Timeline* and situating this in what is described as an immersive interactive virtual environment (IIVE), the thesis examines a prevalent mind-body problem, embracing an enactive view. Cognition is here-defined as a process of sense-making, between an organism as coupled to the environment it is inseparable from, as discussed and more rigorously defined throughout a two-part literature review. All combining, this thesis argues that a dominant biomedical[3] model in mental healthcare has potential to evolve via a more holistic, integrative focus. In this reality, individuals can externalize, visualize and interact in an upright, multisensory way with their life-narrative, revealing possibilities to move on from the burden of past traumatic events by physically taking action to close these down. In this thesis an "enactive system" relates to an organism-environment interconnectivity, where human beings as agents are engaged in a dynamic, reciprocated exchange, essential to survival.

There are complex, unaddressed problems associated with mental ill-healthcare, as a global issue. Almost a billion people are burdened by what are considered diagnosable disorders and the World Health Organization (WHO) suggests that countries everywhere step up and take action. Determinants of mental health can be linked to biological, interpersonal, socioeconomic, geo-political and environmental factors, with mental health systems marked by major gaps in resources, services, governance and, technologies (WHO, 2022: p.6-51). The United Kingdom (UK)

---

[3] The biomedical approach posits that people's mental health challenges, as labelled disorders, are brain defects or diseases.

National Health Service (NHS) describes: *Technology is continually opening up new possibilities for prevention, care and treatment* (NHS, 2019: p.91) supporting a view that paradigm shifts are required in research (Leichsenring, Steinert, Iaoannidis, 2019: p.2114) where new ways to develop personalized treatments in fit-for-purpose settings can resume.

A central tenet resulting from the biomedical model is that psychologically-based challenges are literal diseases of the brain (Deacon, McKay, 2015: p.231) and require pharmacological treatment. Practices that result from this model traditionally follow the format of a face-to-face, seated discussion. As a neuro-reductionist[4] approach, this can present a dissonance in mental healthcare by restricting the view of a person as a biological organism, whilst disregarding variables such as their social relationships or being situated in the broader context of an environment. While a number of diverse, combining factors result in a person's presentation of sensing they are challenged, discussions paying less attention to the whole picture might not identify a person's need.

In mental healthcare for trauma specifically, as the focus of this thesis, acknowledging the role of the body and the environment is akin to a holistic[5] approach, contrasting a representationalist view of inner minds and outer worlds. What can emerge here, is for both facilitators and participants to engage the whole physiological self throughout the recovery process, described more fully in Chapter 2. The focus here is less towards a human in isolation, more in seeking how the human connects to and occupies a domain it recognizes as being part of, not separated from.

1.2 The role of HCI in mental healthcare

The leveraging of a specific classification of technology called immersive technologies, in Human Computer Interaction (HCI) as a multidisciplinary research

[4] At a basic level in psychology, a neuro reductionist view might seek to explain a person's mental healthcare via focus on the neurological processes of how a person thinks and behaves.
[5] Holistic relates to a concept where the whole is taken into account, rather than being reduced to a sum of parts. In the context of a therapeutic intervention in mental healthcare this relates to viewing a person physiologically in relating to their social setting and wider environment, where the parts are interconnected to the whole.

field, has ability in supporting recovery models in mental healthcare. HCI draws on many disciplines such as psychology and cognitive science but in computer and systems design it should be accepted as a central concern (Dix et al., 1993: p.3). Suh and Prophet consider that whilst immersive technologies will become more widespread in the future, more empirical studies are required to theorize the effects on user experiences or performance (Suh, Prophet, 2017: 88). Digital technology permits entry into a new frontier in mental healthcare, in the ways that therapeutic interventions are delivered and received. It also connects people to something other than themselves, with potential to make sense of a problem through interactive involvement. This presents new ways for people to conceptualise the reciprocated cognitive relationship between themselves and reality, or in the case of a facilitating therapist, understanding in novels ways how people and their reality relates. As Dourish writes:

In contrast to approaches such as cognitive psychology, which tended to restrict their focus to mental processing and were defined by the boundaries of the head, ecological psychology was concerned with the organism living and acting in the world…"cognition" was not purely a neural phenomenon, but was located within (and throughout) a complex involving the organism, action and the environment.

(Dourish, 2004: p.118).

A major challenge persists in developing mental healthcare interventions based on interpreting how people function. If reduced to a biological organism separated from its environment as a social reality, this can lead to therapeutic focus where the person is viewed independently and subjectively. This can perpetuate forms of treatment that position a facilitating therapist as an expert in relation to a person's internalized brain-head-mind problem that requires fixing.

1.3 Applying enactivist concepts

In this thesis, an enactivist[6] view supports an ontological assumption where people and their world are interconnected, where cognitive processes involve both physiological and environmental factors (Gallagher, 2017: p.1). Enactivists accept that the role of the environment is a constitutive aspect in the process of shaping agency (Heras-Escribano, 2021: p.4345) as an action producing a particular effect. This can build to an integrative view in mental healthcare delivery.

Zarbo et al. describe the integrative psychology model as one that '*aims to respond to the person, with particular attention to affective, behavioral, cognitive, and physiological levels of functioning, and to spiritual beliefs*' (Zarbo et al., 2021: p.2) In sub-section 1.3 in Chapter 2 and throughout the literature review, the enactive and integrative perspectives are broken down. Overall, the response of this thesis to an identified social problem is to design, develop, trial and evaluate a system, by adapting an existing technology with ability to offer people with trauma in mental healthcare an opportunity to address a perceived problem in their own way. In theory, what this can achieve is to place therapeutic practice in a previously unexplored environment, as one where multi-faceted personas in a multi-dimensional reality can become intent towards achieving autonomy, maintain control and, ultimately, becoming involved in a process of sense-making. The thesis will argue that the integration problem can have steps taken toward resolve by considering the environment initially, involving clinical experts and experts with experience to provide views relating to how particular types of settings can be shaped, recognized in the thesis as enactive systems.

1.4 Problematising from identifying a literature gap

Generally-speaking, less attention is paid to the role of the body and environment in therapy-practice in UK-based mental healthcare services. Particularly, therapeutic interventions involve a discursive exchange between participant and facilitator, where

---

[6] Enactivism is a position in cognitive science arguing that the organism and environment are coupled, stressing a co-dependency as a person-world system.

more multisensory involvement in practice can be overlooked. As such, there is a more prevalent literature relating to mental health trauma and its implications with the body, but less relating to actual interventions involving the body.

There is significantly more prevalent literature adopting immersive environments in mental healthcare involving Head-Mounted Display (HMD) technology, than literature positioning a study in an immersive, full-body, walk-in room, for evaluation. Because of this a range of literature suggests a lack of insight into how a system can be designed, built, tested and evaluated, as within the current thesis.

In the cognitive sciences more literature exists surrounding embodied and enactive understandings, as philosophical and conceptual, with less understanding of what an embodied, enactivist model might resemble in practice, for example, as enactive systems brought to life. What this has built towards is a more apparent discussion around the philosophy of what *could be* implemented in practice, rather than advancing beyond the philosophy *into actual practice*. Additionally, systematic reviews show limited studies that seek to engage in multidisciplinary ways to develop, implement and evaluate digital mental healthcare interventions in practice with people with lived experience of trauma. The thesis will examine these three areas as a combining research problem and investigate through its study design towards a possible solution.

1.5 Research questions

From the literature review an overarching research question is:

How can concepts from an enactive theory of mind in the cognitive sciences, be applied to the design of a digital system to support a therapeutic intervention for trauma mental healthcare?

This thesis will present two studies. Study 1 gathered and analyzed data from Experts by Profession, as therapists with lived experience in the delivery of mental healthcare. Study 2 gathered and analyzed data from Experts by Experience, as individuals with lived knowledge of trauma.

The central research questions throughout each of the two studies in this thesis are:

Study 1: How might an IIVE be viewed by Experts by Profession as a suitable space to conduct mental health interventions?

Study 2: How do participants with lived understanding of trauma as Experts by Experience, interpret the experience of an IIVE for trauma mental healthcare?

By developing the system and performing the two studies, these questions are responded to, as described in the research findings.

1.6 Research Objectives

As interdisciplinary research between HCI and the cognitive sciences the main purpose of this thesis is to determine the efficacy of a bespoke, digital intervention for trauma. Four clear objectives set out the intentions as an epistemological approach in investigating what is ontologically assumed as existing:

i. To survey and synthesise literature in fields of: mental health history; immersive technologies; phenomenology, embodied cognition and enactivism; to develop a research framework [Appendix 1] for designing IIVEs [Appendix 2, 3, 4] items present detailed A3 charts to show how these histories have merged;

ii. To develop storyboards and Video Prototypes of IIVE design within the research framework and use this to gain feedback from "*Experts by Profession*" (Study 1 - senior mental health staff and clinicians) to inform an interview protocol involving "*Experts by Experience*" (Study 2 - participants who have endured trauma);

iii. To iterate through three prototype stages the design in an IIVE and create a bespoke environment in an IIVE and a software toolkit incorporating Unity software, where people with experience of trauma can re-author their life narrative and gain efficacy;

iv. To situate a hi-fidelity system in a hospital environment and run evaluative, qualitative interview sessions to understand these experiences (with "trauma" participants); to transcribe this data.

1.7 Structure of the Thesis

The thesis is presented in four parts and 14 chapters. Part I offers contextualisation and well as motivations and objectives. In Part II the thesis brings together literature

from three main areas in order to identify a research gap and problematise in order to establish research questions. In Part III the study describes its epistemological approach, as guided through an exploratory, qualitative methodology; then providing insight into how the iterative prototyping process unfolded, as user-centered research leading to results from the gathered and analysed data. In Part IV, the study discusses the findings, offering suggestions for future work and then concludes. A summary of each part of the thesis is:

Part I: Contextualisation; Motivation; Objectives (Chapter 1)

Part II: Literature Synthesis (Chapter 2-3)

Part III: Methodology; Ethics; Prototypes; Study Design 1; Results; Prototypes; Study Design 2; Results (Chapter 4-11)

Part IV: Discussion; Limitations and Future Work; Conclusion (Chapter 12-14)

Following the introduction two literature review chapters (2-3) will drive towards an understanding of an *enactive* perspective of the conceptual human mind-body system, in a context of developing digitally interactive tools made available in an IIVE. These theories are useful in adding to an insight into how people (as actors – see page 57 and footnote 23) might experience immersive interactive virtual environments, in a mental health context, leading to future design incentives in novel ways. The next literature review chapter will consider how immersive technologies evolved and presents a further chart showing how early inventions stemming from the 1950's built technological systems originally considered for use within entertainment and the military, then developing toward technologies used in healthcare. Between two chapters the thesis will argue that a human being, as a conceptually autopoietic[7] system whose organisation and ability to maintain itself is defined by the arrangement and

---

[7] Autopoietic relates specifically as a concept to nature of cells and living systems having ability to reproduce its own elements and structures. In the context of this thesis a human being's biological system can maintain itself, whereas the IIVE as an environment could arguably support this, where a person's healthcare is in decline.

order of the things around it, can self-sustain as an autonomous system via the reconstruction of its narrative through IIVE technology.

In Part III (Chapter 4) the study presents its methodology: This chapter discusses the epistemological and methodological approach. The approach is inductive, qualitative exploratory research and fits the parameters of human or user-centered, interaction design; through the iterative development of storyboarding, video prototyping and the process of qualitative, semi-structured interviewing; leading to an in-situ evaluation of a proposed sense-making tool in IIVEs. Chapter 5 will discuss ethics in HCI, covering topics such as: the welfare of human beings, trust, autonomy, ownership, privacy, informed consent. There are two studies in this thesis and ethical approval was gained for each of these: Study 1 received Northumbria University ethics approval; Study 2 received Health Research Authority (HRA) Integrated Research Application System (IRAS) approvals.

Chapter 6 will introduce and discuss how the IIVE technology was adapted in designing and installing the rapid and lo-fidelity prototype models. Chapter 7 describes the design for the first study (Study 1) in relation to how participants became engaged via recruitment. Chapter 8 presents results from the qualitative semi-structured interview process in Study 1. Chapter 9 introduces the hi-fi prototype, describing the design of the hi-fidelity prototype. Chapter 10 describes the design for the second study (Study 2) in relation to how participants became engaged. Chapter 11 presents the results from Study 2.

In Part IV the thesis presents its discussion. This chapter describes the leveraging of the large-scale multimedia adopted throughout the current study. The chapter brings together the findings based on response to the research questions and will reflect on the learning from the thesis. Chapter 13 offers limitations to the study and thoughts around future work. Chapter 14 is the conclusion and provides further insight into the main research contributions.

Overall, by identifying research gaps this thesis acknowledges it is positioned in a complex landscape, as one where the mental health challenges people face are dealt with via what healthcare services provide as a mainstream package of support. However, because mental health services are overburdened, technologies in various forms are being adopted and applied to social challenges, with society having reached an intersection in terms of what is being embraced as potentially enabling alternatives. This thesis embraces potential for fresh insights to be gained, by applying a digital

focus to a particular type of mental healthcare challenge, whereby the design, build, test and evaluation of what is called The Timeline, as situated in an IIVE, is used to gain qualitative insights based on participatory experiences of a novel approach. What this thesis will examine in total, is whether the assembly of unique content in an existing but to a lesser regard applied technology, could permit a system for use by participants who as actors-agents, have lived experience of trauma.

1.8 Research Framework

The research framework [Appendix 1] developed from an on-going review and synthesis of literature as in Figure 2, initially looking at the history of mental healthcare settings since the birth of the asylum.
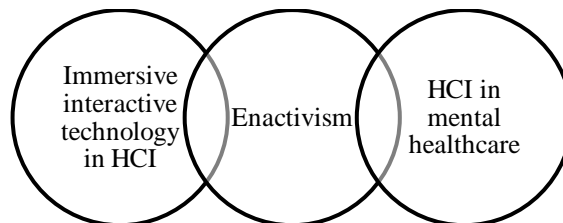
Figure 2:Literature Synthesis

Insights from authors such as Foucault and Scull described an in-depth account of types of treatments administered to people throughout centuries and a complex landscape involving healthcare systems and experimental mental health intervention processes. The literature highlighted the concept of *iatrogenesis* (Illich, 1976), relating to risks associated with medical interventions, which led to insights into a variety of healthcare models, such as the bio-medical model. This focuses on biological factors, excluding links with social or environmental influences surrounding a person's life and ability to cope. As the PhD study relates to people's direct experiences of proposed future healthcare settings, the literature review expanded into what is termed the *Philosophy of Mind* debate. The psychological sciences involve professional practice around understanding workings of the human brain and the conceptual mind. Debates surrounding this are influenced by 17th and 18th century philosophers such as Descartes and Kant, extending through to phenomenologists such as Husserl, Merleau-Ponty; embodied cognition theorists (Gibson, 1979; Varela, 1991; Dourish, 2004; Barsalou, 2010) and enactive theorists (Chemero, 2009; Kyselo, 2016; Gallagher, 2017). These

latter theorists argue from within the field of the cognitive sciences, that brain, body and environment have intrinsic qualities, which builds from these views into a more holistic perspective of mental healthcare services. Here, mental healthcare becomes more person-centred with a focus upon the journey of an individual throughout their recovery to a point of self-discovery. This can be framed as a narrative journey (White, Epston, 1990; Frank, 1995), in that, from a therapeutic intervention viewpoint, a person can be encouraged to recognise the (narrative) story of their life and their ability to re-author and take control of its direction, building into the latter-listed research objective (iv). Additionally, HCI research has relied historically upon the cognitive sciences (earlier termed cognitive psychology) with the thesis exploring experiences of people (how people and world combine from the first-person perspective – phenomenology) in an IIVE. Further reading has highlighted the concept of *sense-making*, stemming from a viewing of reality through an enactivist (ontological) lens. Relating to this concept, de Haan discusses:

> *On an enactive view then, our physiological processes are not neutrally unwinding in a secluded domain; they are rather shaped by being part of a living being with its specific concerns and specific behaviors. This means that both our sense-making capacities and the properties of our physiological processes emerge from this person-world system* (de Haan, 2020: p.12).

In a person-world system in a mental healthcare context, the ways people understand themselves may require interaction with sense-making tools, or environments which contain these. Providing interactive capabilities within an IIVE, as a platform, is a central consideration of this thesis. Here, people have access to sense making tools and experiences that conceptually lead to a person as coupled within a unified system. This affects the language in a mental health context as the thesis embraces through its research framework an enactivist ontology, a phenomenologist epistemology and a pragmatist paradigm of inquiry. How this applies to the experiences of participants in an IIVE will be discussed throughout the discussion chapter.

1.9 Contribution

This thesis comprising the aligning two studies makes contributions in two ways:

(i)   to new knowledge in digital mental healthcare, at an intersection where services are seeking innovative solutions to cope with an increasing demand;

(ii)   from an interaction design viewpoint in HCI, as user-centered research the thesis offers insight into the iterative development, in-situ trial and evaluation of a system to support trauma, as tested by participants with lived experience

While it would be a strong claim to suggest a contribution to the cognitive sciences in a design thesis, this study has proceeded with an intention to apply enactivist concepts in practical terms. The enactive theoretical view as a philosophy is amplified and affixed to a particular type of digital setting throughout this thesis and in doing so illuminates potential for researchers to apply the enactive framework to future studies.

PART II

CHAPTER 2: LITERATURE REVIEW I

Literature Review (Contextual Review) Part I:

Trauma in mental healthcare and how the Philosophy of Mind discussion has led to the mental healthcare models adopted today

2.1 Ontology

2.2 Trauma and the body's role

2.3 Expanding on the bio-medical model

2.4 Towards an enactive view

2.5 A pragmatic, integrative perspective

2.6 Synthesis and Summary

2.1 Ontology

How society has chosen to conceptualise thought, mind and consciousness has led to what this thesis author refers to as a "*cognitive evolution*". This steady line of perspectives, as beliefs, has grown into the paradigms embraced in mental healthcare and in turn this has affected practice, in psychology, psychiatry and psychoanalysis, collectively understood as *psy-sciences* or disciplines. As McAvoy offers, these are '*expert arenas where consequential judgements are made about people's health, behavior, cognitive capacities, personalities, and social functionality*' (McAvoy, 2014: p.1). As society entered the 21st century, more investment in technologies in mental health has built to become an industry worth billions worldwide, as part of a landscape becoming more increasingly digitized. This thesis highlights what is assumed as building towards a critical line of argument, whereby the way society has framed its understanding of thought, mind, consciousness, has in turn led to the way that mental healthcare or ill-healthcare, has become shaped. Overall, the argument relates to what are widely accepted as problems concerning illnesses, disorders and diseases that are said to be located within or emerging from the human brain. This influences ways that society has chosen to deal with or seek to fix what is assumed as a highly complex social problem, as a biomedical approach.

Both historical and recent responses in society to an increasing social problem is factored into by political and economic agendas, as well as paradigms whereby healthcare models that have become established can be difficult to alter once in place. For example, in trauma mental healthcare Sweeney et al. describe a paradigm shift in treatment where participants were asked: *What happened to you*? This replaced the language: *What is wrong with you*? As a trauma-informed approach such a detail, as a shift in the delivery of language, offered new ways for services to connect with users (Sweeney et al., 2018: p.330). Likewise, research undertaken by Leichsenring, Steinert and Ioannidis propose a research agenda as a paradigm shift in the research of mental health disorders, encompassing '*methodological improvements and strategies to discover new treatments, to identify and evaluate new settings for interventions, and to improve available treatments*' (Leichsenring, Steinert and Ioannidis, 2019: p.2113). This is of relevance to a current thesis proposing the adoption of a digital form of treatment, as situated in an IIVE.

Author Thomas Szasz wrote his first book entitled: *The Myth of Mental Illness*, in 1961, with a critical reflection by Bening who points out that Szasz held no denial over humans having difficulties, but he preferred to conceptualise these not as illnesses or diseases but as '*problems of living*' (Szasz, in Bening, 2016: p.292). As such, a conventional way to treat depression, for example, is via practiced forms of treatment such as medication or face-to-face psychotherapies. However, there are far fewer trained clinicians in the world than there are people and an urgent call now with a rising population to examine new tools and techniques of engagement. For example, the Royal College of Psychiatrists highlight that only 4,500 full-time consultant psychiatrists exist for 56.5 million people, with workforce shortages causing lengthy waits up to several years for treatment (Royal College of Psychiatrists, 2021). A mental health workforce report conducted by the British Medical Association (BMA), together with a companion report, highlight that UK mental health services continue to suffer from inadequate staffing with demand outpacing available resources (British Medical Association, 2019: p.2) and to achieve a genuine parity of esteem, the health service should ensure that people facing mental health challenges receive equal standard of care in comparison to those presenting physical health problems (British Medical Association, 2020: p.15). These reports make no indication of a physical health problem that could have manifested as a mental health problem or vice versa.

Interestingly, the views of three consecutive authors, in 1976, 2006 and 2017 voice opinions against the way mental ill-health has become both framed and engaged with. Illich's work describes critically the author's distaste for a person's healthcare being managed by an external party and writes: '*The greater the potential for autonomous adaptation to self, to others, and to the environment, the less management of adaptation will be needed or tolerated*' (1976 [1995]: 274); whilst Nettleton contrasts the biomedical model against those that could be interpreted as fitting a more phenomenological or an enactivist framework, adding:

> *Students of sociology and social-policy will no doubt quickly recognize the limitations of this [since the 18th century - biomedical] approach to health, disease, illness and healing. The body is isolated from the person, the social and material causes of diseases are neglected, and the subjective interpretations and meanings of health and illness are deemed irrelevant*

(Nettleton, 2016: p.3).

In a similar vein Gallagher expands on a notion where a person's being extends beyond their own personal body and space:

We are in the world in a way that is not reducible to occupying an objective position in the geography of surrounding space, and in a way such that the world is irreducible to an abstraction of itself represented in one's brain. We, as minded beings, are definitely 'out there', dynamically coupled to artefacts, tools, technologies, social practices, and institutions that extend our cognitive processes. Enactivist and extended mind conceptions are, or at least should be, of one mind in this regard

(Gallagher, 2017: p.59-60).

Views such as these point toward a current landscape holds potential for change and that its image can alter, depending on whatever power of influence is viewing through whichever lens. In building an argument toward alternative ways to deliver and receive a therapeutic intervention, in an interactive setting, this thesis will now briefly focus on trauma, as a type of mental ill-health, whereby the whole physiological system of an individual can become compromised and where because of this, emerging philosophies of mind and digital technologies could become incorporated to support those on receiving end of treatment and recovery.

2.2 Trauma and the body's role

Psychological trauma is a powerful concept in science, with potential to impact both the individual and the community (Kleber, 2019: p.1). A review of research on associations or trauma type with Post Traumatic Stress Disorder (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. The survey concluded that trauma exposure is common throughout the world and that mean symptom duration is considerably longer than previously understood (Kessler et al., 2017: p.12). Trauma is summarized as a general term by Agaibi and Wilson, as '*stress events that present extraordinary challenges to coping and adaptation*' (Agabi, Wilson, 2005: p.196) whereas PTSD is considered a potentially chronic impairment disorder, characterized

by '*re-experience and avoidance symptoms, including negative alternations in cognition and arousal*' (Miao et al., 2018: p.1). This distinction presents a minor tension in questioning where trauma ends and PTSD might prevail throughout a person's life and research suggests that not everyone who experiences trauma will endure post-trauma experiences (Agaibi, Wilson, 2005: p.204).

As examples, biologically, brain areas are implicated in the stress response, as with trauma, where this can be associated with lasting changes in, for example, the amygdala, hippocampus or prefrontal cortex (Bremner, 2006: p.445); also brain structural change is detectable in white and gray matter prior to onset of schizophrenia, where language processing can also be affected (DeLisi et al., 2006: p.76). With this arrives consideration that whilst areas of the biological brain may be affected, the human system's response to this, as a biological organism with agency, might seek solutions beyond implicating or isolating the brain, as a psychotherapeutic response. Figure 3 shows effects of trauma on the human brain with this thesis acknowledging that it is not trauma that is located in the brain, but trauma that affects the system of an individual to such a level that the brain as well as an extended system of self (the whole body) registers this distress.
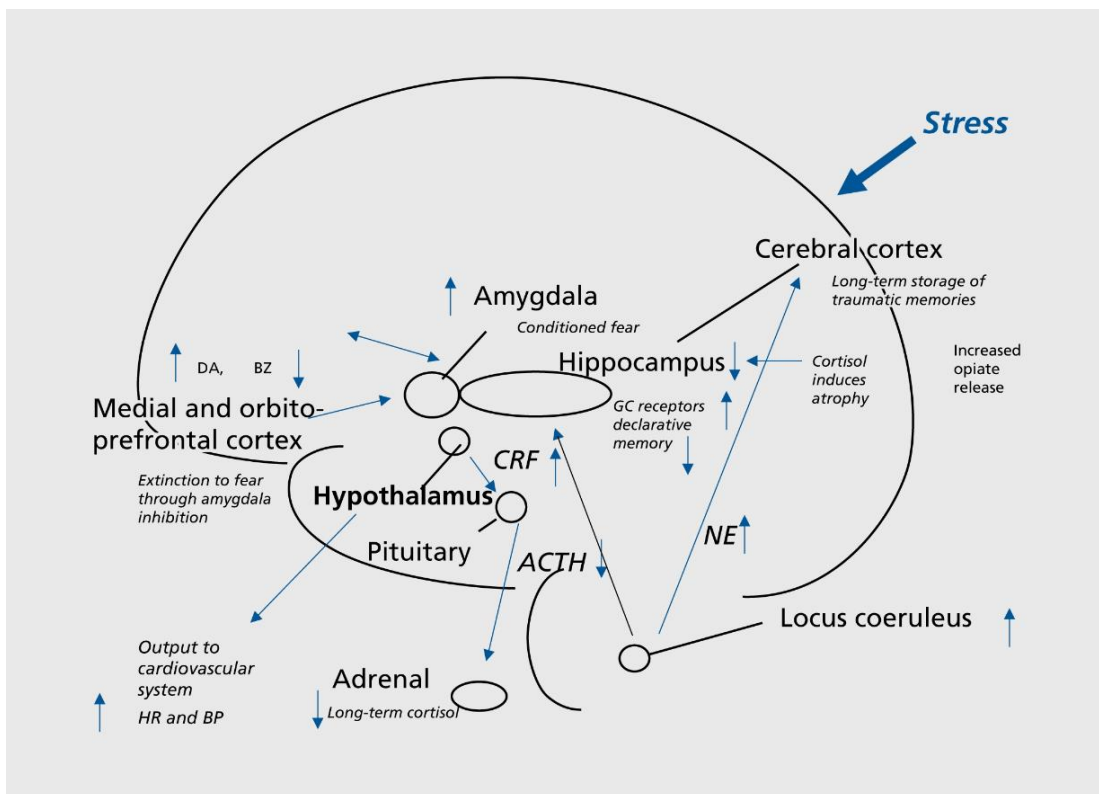
Figure 3: Brain Image (Trauma): Bremner

From the enactive[8] view (as described more fully in sub-section 2.4) the thesis could extend further to suggest that the environment itself, as cojoined, also registers the trauma. These nuances seem critical to acknowledge, because if trauma, for example, causes a dysregulation in the autonomic nervous system (Payne, Levine, Crane-Godreau, 2015: p.5); this ideology supports an argument where by including the body's role in therapy, this may be effective in seeking to engage with the trauma and support a person moving through it. Despite a continuing focus toward the biological brain and the conceptual mind in therapy, including work with trauma, Van Der Kolk, the author of a seminal work in this field of research, points out:

> *If the memory of trauma is encoded in the viscera, in heartbreaking and gut-wrenching emotions, in auto-immune disorders and skeletal/muscular problems, and if mind/brain/visceral communication is the royal road to emotion regulation, this demands a radical shift in our therapeutic assumptions*

(Van Der Kolk, 2014: p.101).

Trauma is experienced physiologically throughout the system of an individual and this could suggest new ways in forming therapeutic assumptions and practices. Sweeney et al. who acknowledge that clinical definitions vary, suggest encompassing experience of violence through to complex childhood developmental traumas, also social trauma and historical trauma (Sweeney et al., 2016: p.175). Van Der Kolk furthers: *We have learned that trauma is not just an event that took place sometime in the past; it is also the imprint left by that experience on mind, brain, and body* (Van Der Kolk, 2014: p.24). This author also explicitly points toward the physiological system of an individual as being equipped with its own capabilities to maintain emotional balance: '*Some 80 percent of the fibers of the vagus nerve (which connects the brain with many internal organs) are afferent; that is, they run from the body into*

---

[8] As from the introduction page 30: Enactive cognition offers a unique mind-world topology where capacity to make sense of things depends not just in the head, but on the emerging reaction and relationship between person and world.

the brain. This means that we can directly train our arousal system by the way we breathe, chant and move...' (Van Der Kolk, 2014: p.147). The relevance here is that mainstream practice in psychotherapy might involve less a focus of a participant to consider their own bodily functionality and movement, with the current thesis explicitly driving toward something akin to this.

Although a range of psychological therapies are used with people exposed to trauma, most therapies adopted in a context of engaging children and adolescents are based on common elements including: psychoeducational; psychodynamic; exposure. Explicitly however, there is strong neuroscientific evidence for the cultivating of bodily or somatic[9] awareness, to develop bottom-up[10] approaches and resilience in trauma (Grabbe, Miller-Karas, 2017: p.1). Practices and methods such as yoga, meditation, dance, exercise, outdoor pursuits associated with the body, Somatic Experiencing[11] (SE), Trauma Resiliency Model[12] (TRM), Sensorimotor Psychotherapy[13], each involve potential therapeutic responses to a presentation of trauma and add to the likes of Exposure Therapy, Eye Movement Desensitization and Reprocessing (EMDR) and Cognitive Therapy. Psychological therapies can be targeted to an individual or can be group based, where the frequency and treatment-duration can vary widely [Gillies et al., 2016: p.6]. Likewise Concentrative Movement Therapy (CMT) is an approach of psychodynamic body psychotherapy adopts movement sequence and movement with props, to assist, for example, people with depression who have issues with self-motivating, to rediscover their interest in the environment and re-engage with a desire to explore it (Schreiber-Willnow and Seidler, 2013: p.254-275).

---

[9] Relating to the body, especially as distinct from a conceptual notion of a mind.
[10] A bottom-up approach in therapy takes a perspective that information is acquired through bodily sensations.
[11] Somatic Experiencing is a body-centered approach that expands on a focus on thoughts and emotions by including the body, as conceptualized by Dr Peter Levine.
[12] Trauma Resiliency Model is a somatic alternative to mind-based or conversation-based therapy developed by Elaine Miller-Karas, Geneie Everett, Laurie Leitch, originally developed as physiological first aid for survivors of natural disasters.
[13] Sensorimotor Psychotherapy was developed by Dr Pat Ogden who worked as a yoga and dance teacher and began exploring a correlation between client's disconnection from their bodies and their psychological challenges.

In the current thesis, the core argument is notably positioned in a complex landscape, in exploring the how and why questions of designing and positing an approach that factors in a person's physical movement and implicates the surrounding setting, in a therapeutic context. To achieve this, the UK NHS biomedical model is examined, to consider how recent Philosophy of Mind[14] discussion contains concepts in support of an argument toward a more interactional approach, as one where therapies could expand their focus and where a bespoke environment offers an affordance of physical movement combined with unique features not widely achievable in mainstream practice settings. In doing so, other approaches as pre-mentioned are acknowledged, but with these arrives an understanding that more evidence is required to try and test new models, such as those in support of a theory where *dysfunctional memories* form a basis for a range of what are termed mental disorders. An example is provided in sub-section 12.9 in the Discussion section.

2.3 Expanding on the bio-medical model

The item [Appendix 5] provides an approximate 1,000 word summary of the UK's NHS service, including insight into current statistics; the Improving Access to Psychological Therapies (IAPT) service and Stepped Care Model. This concludes with: From a UK Government perspective a consultation outcome relating to a reform of the Mental Health Act highlights approaches to new ways of doing things, whereby an act that is arranged around a system established in 1959, does not fit in with a modern sense of how healthcare should be delivered in the 21st century. Respondents involved in the report described experiences of an over-reliance on medication an emphasis on a common standard for therapies that must be well evidences, effective and personalised. This would, as the report points out, prompt a more holistic approach to patient care that takes into account a range of options and the wider environment (Gov.UK, 2017: p.17).

---

[14] A branch of philosophy that studies the ontology and nature of the conceptual mind and its relationship with, for example, to body and the environment.

A dominant biomedical model of mental healthcare directs a greater focus towards the brain in the head than, for example, the neural connectivity in the stomach, although together these form a connected, complex system, involving the Enteric Nervous System (ENS), Central Nervous System (CNS) and Peripheral Nervous System (PNS). The Central Nervous System of vertebrates is divided into the CNS and the PNS. The CNS is the main division and consists of the brain and spinal cord and what is referred to as a spinal canal contains the spinal cord and the cranial cavity contains the brain. The ENS both receives and sends impulses and has ability to absorb and record experiences. It also reacts emotionally and it appears that both the '*gut and heart neural systems evince complex processing*' as neural systems involved in higher functioning (Soosalu, Henwood, Deo, 2019: p.2) Neurotransmitters influence both the gut and nerve cells of the brain and the ENS uses up to 40 known neurotransmitters, with around 100 identified in the brain. The human ENS contains approximately 400-600 million neurons and is the most complex unit of the PNS (Fleming, 2020: p.1), while ninety five percent of the body's serotonin is found in the bowels and fifty percent of all dopamine.

Despite understanding how brain and the rest of the body interact as a system, Deacon points out that science has yet to identify a biological cause for a mental disorder, with the biomedical model dominating policy and practice for over three decades. Deacon also describes that a biopsychosocial (BPS)[15] model, by contrast, '*avoids futile searches for simple explanations of complex phenomena*' and that '*this approach prizes multidisciplinary attempts to stitch together different levels of analysis by establishing principles that elaborate how processes at one level affect those at another*' (Deacon, 2013: p.856). A critical analysis of the biomedical model highlights a sharp increase of medication use associated with this, coupled with poor mental health outcomes. This author writes that the approach has inhibited treatment innovation with the biopsychosocial model offering an appealing alternative that can embrace multi-explanatory perspectives in informing the understanding of a complex

---

[15] The biopsychosocial model is an interdisciplinary model that takes into account an interconnectivity between psychology, biology and socio-environmental factors.

yet natural phenomena including neuroscience, an individual's personality and the environment (Deacon, 2013: p.846-856) – a model Engel refers to as a "New Medical Model" (Engel, 1977: p.129). Antonuccio, Danton and McClanahan describe a potent concoction of political and economic forces that have fueled a biomedical paradigm (Antonuccio, Danton, McClanahan, 2003: p. 1028–1043) where an advantage to a functioning and over-run healthcare system might be that this model is already fully implemented, established and up and running. The biopsychosocial model, however, is steeped in criticism that fall into three broad categories, the model being (i) too vaguely defined and untestable; (ii) the model was too generic and could not be effectively put into practice and; (iii) the model did not involve any method to identify suitable data (Farre, Rapley, 2017: p.4). By contrast, this thesis adds that the enactive theory it supports has potential to build towards a non-vague and tested model, in practice, by building on concepts that can be operationalized.

As a non-reductionist approach to mental healthcare and the delivery of labelled disorders therein, the enactive view extends beyond biomedical and biopsychosocial models and offers an opportunity to view psychiatric disorders from neurophysiological (inclusive of psychological), sociocultural and existential perspectives. What this can offer to a person on the receiving end of mental healthcare, as well as those facilitating mental healthcare interventions, are possibilities to acknowledge a more-broad reality of events as possible causal factor and not narrowly pinpoint to a fault in the inner workings of the brain. This thesis chapter argues that concepts from an enactive philosophical view, when applied in a mental healthcare context, can alter how mental healthcare interventions are designed, delivered and received. This sits well with an epistemological approach that investigates the prototyping of a technologically robust system, to find out what potential user-attitudes are towards this.

2.4 Towards An Enactive View

As described in the introductory section in 1.3, enactivism is a perspective on cognition, whereby person and their reality combined to form a unified system. This view has evolved through its own historical stages and in this sub-section now seeks to unpack them. Emerging philosophies of the human mind have dictated how society interacts with and influences social problems relating to this conceptual *mind*

phenomenon. In an alternative reality the blueprint for how society has chosen to form current services and systems, could look very different. A traditional view of mind is that it is located in the brain and an individual presenting a mental ill-health concern requires a discussion, as with Cognitive Behavioral Therapy (CBT), or some form of hands-on healing, as with Somatic Therapy, as examples. Explicitly, in the context of this thesis, what this first literature review chapter seeks to gain in terms of what exists, is how traditional views surrounding cognition have built towards more contemporary views.

In an alternative type of environment, such as an immersive interactive digital one, exploration may look different. For example, Chemero describes a radical embodied cognitive science whereby: '*the thesis that cognition is to be described in terms of agent-environment dynamics, and not in terms of computation or representation*' (Chemero, 2009: p.x). This builds into more contemporary and emerging philosophies where Baggs and Chemero consider: '*two main flavors of radical (i.e. non-representational) embodied cognitive science*' (Baggs, Chemero, 2018(a):1), that are, respectively, ecological psychology and enactivism. This, both a radical and embodied view of cognition, has roots in *phenomenology*, as Gallagher reveals:

> *A variety of approaches, including phenomenology, the neuroscience of motor action, animal studies, and developmental psychology, are needed to understand aspects of self-experience, self-recognition, agency, and social interaction, and how such things contribute to the generation of self-identity. In the end, if good explanations of these various aspects of experience are developed, a cognitive science that incorporates the insights of phenomenology has the potential to recast the central philosophical questions about the self*

(Gallagher, Zahavi, 2008: 213-214).

In a summarised run-through of some of the historical steps that have led up to an enactivist view, this thesis first considers Kantian phenomena and noumena, through phenomenology (Husserl, Heidegger, Ponty); to Koffka and the Gestalt movement; Gibson's ecological psychology; into embodied cognitive worlds of Varela, Clark, Dourish - finally resting with contemporary voices involving Chemero, Gallagher, Barandiaran, Rowlands and de Haan, in an enactivist domain. The stages are:

Philosophy; Phenomenology; Gestalt Psychology; Ecological Psychology; Grounded Cognition; Embodied Cognition; Enactivism. Table 1 shows theoretical stances taken with varying beliefs and perspectives on human *being* in the world, as listed via the chronology of how they appear in Chemero's: *Radical Embodied Cognitive Science* (Chemero, 2009). What these indicate are varying philosophical and discursively voiced positions, that ultimately have ability to take root, becoming paradigms realized and embraced in society, such as within mental healthcare services or industries of psychiatry. Table 1 contains page numbers to indicate how each position appears in Chemero's work.

Table 1: Theoretical positions on concept of *mind*
as summarised from Chemero's: *Radical Embodied Cognitive Science*. (Bruce, T.A.)

THEORETICAL POSITIONS ON MIND	PAGE
Atomist	11
Connectionist	17
Representationalist	17
Eliminativist	17
Functionalist	18
Structuralist	18
Naturalist	19
Computational	20
Behaviorist	21
Ecological Psychologist	21
Embodied	22
Objectivist	27
Extended Mind	31
Extended Cognition	31
Phenomenalist	79
Phenomenological	79
Realist	81
Dynamicist	81
Instrumentalist	83
Physicalist	136
Reductionist	136
Selectionist	137
Radical Empiricist	140
Enactivist	152
Internalist	179
Neutral Monism	183
Irrealist	185
Radical Embodied	28-208
Naturalising Cognition	208

Phenomena and Noumena

The radical and embodied cognitive science Chemero describes has a history which, Lobo, Heras-Escribano and Travieso describe as a '*genesis[16] of ecological psychology*'. According to these authors; '*the main influence that gave rise to ecological psychology*' were '*James[17]' radical empiricism[18] and neutral monism, behaviorism, phenomenology and Gestalt theory* (Lobo, Heras-Escribano, Travieso, 2018: p.2). The original phenomenologists in psychology saw themselves as a *third way* between the deep and difficult theories of psychoanalysis on the one hand and the biological, number-crunching experimentalist approaches on the other. As a result, phenomenology was all about treating people as *human beings* first (which is why one of the other labels is *humanistic* psychology: Rogers, Maslow), and trying to understand human beings' lived *experiences* (which is why the label phenomenological is also used). This Literature Review chapter is building toward an understanding of historical stances in what has become a consequent developing and embracing or disputing and disregarding of concepts, from the birth of philosophy through phenomenology and ecological psychology, to embodied cognitive science and enactivist and extended mind approaches to cognition. Because these views combine in the current thesis toward a practical understanding of how a mental healthcare environment could become shaped, a further view of Gallagher sheds light on an approach that meets with a pragmatist Paradigm of Inquiry[19] from the current study:

> *Enactivist and extended mind [current] approaches to cognition have different roots. Enactivist approaches typically point to phenomenology and theoretical biology; extended mind approaches are ore influenced by analytic philosophy*

---

[16] The origin or mode of the formation of something.
[17] William James was an original thinker between the disciplines of philosophy, physiology and psychology. His book entitled: *The Principles of Psychology*, is said to contain seeds of pragmatism and phenomenology and influenced Husserl, Dewey and Wittgenstein.
[18] Radical empiricism asserts that any philosophical worldview is flawed if it stops at the physical level and fails to explain how meaning, values and intentionality arise from it.
[19] Paradigms of Inquiry are the philosophical stance of a researcher, reflecting how the inquiry is designed.

of mind, computational models, and cognitive science more generally. Rarely noted, however, or sometimes only noted in passing, pragmatism is something of a forerunner of both of these approaches

(Gallagher, 2017: p.48).

Pragmatic inquiry through a study seeking to understand an interconnectedness between people and their experiences, as actionable knowledge, meets with both principles and tenets of pragmatic inquiry including contributions by those with individual, lived experience (Allemang, Sitter and Dimitropoulos, 2021: p.41) and responds to questions relating to how an intervention can be used (Holtrop, Glasgow, 2020: p.424) in this study's case, as tested in a clinical, hospital setting.

Kant distinguished between what was termed the phenomena, as a human perception of things and how they are or appear to be (as interpreted via a conceptual human consciousness), versus the noumena, which are the (nature-born) things in themselves. Weber and Varela introduce that Kant '*was very focused on how the transcendental subject and the world are related*' also concluding: '*that it is possible to go beyond Kant in an account of life and purpose. But only after almost two centuries and radically new developments in both science and philosophical research. We truly*', these researchers state, '*stand on the shoulders of a giant*' (Weber, Varela, 2002: p.103-121). Kant's philosophy can be more wholly understood as reflecting a gap in knowledge of the mind-body problem, or debate, beginning with the reductionist monism[20] of a subject constructing a categorial reality.

Phenomenology

Husserl, a German philosopher born approximately half a century after Kant's death in 1804, established the school of phenomenology with the slogan that '*all consciousness is conscious of something*', implying a distinction between the acts of thought (noesis) and the intentional objects of thought (noema). Thus, the correlation between noesis and noema become a first step in a constitution of analyses of a

---

[20] Monism is a position that mind and body are not ontologically distinct entities.

conceptual consciousness. Husserl is widely regarded as the founding father of phenomenology whose work influenced later philosophers '*such as Edith Stein and Maurice Merleau Ponty*' as Hayman (Hayman, 2016: p.14) points out. Hayman's own contemporary research in a study of mirror neurons would also seem *influenced*, as it concludes with a consideration of intersubjectivity[21] being '*a topic essential the Husserlian thought*' and '*the overlap between Husserl and enactivism* [pertinent to this thesis' discussion] *seems sufficient and significant*' (Hayman, 2016: p.21). The French philosopher Maurice Merleau-Ponty, who Hayman mentions, whose phenomenological philosophy underpins enactivist philosophy, noted: '*Our own body is in the world as the heart is in the organism: it keeps the visible spectacle constantly alive, it breathes life into it and sustains it inwardly, and with it forms a system*' (Merleau-Ponty, 1962: p.203). Figure 4 imagines biological systems that interlink, as cells within cells and systems within systems.
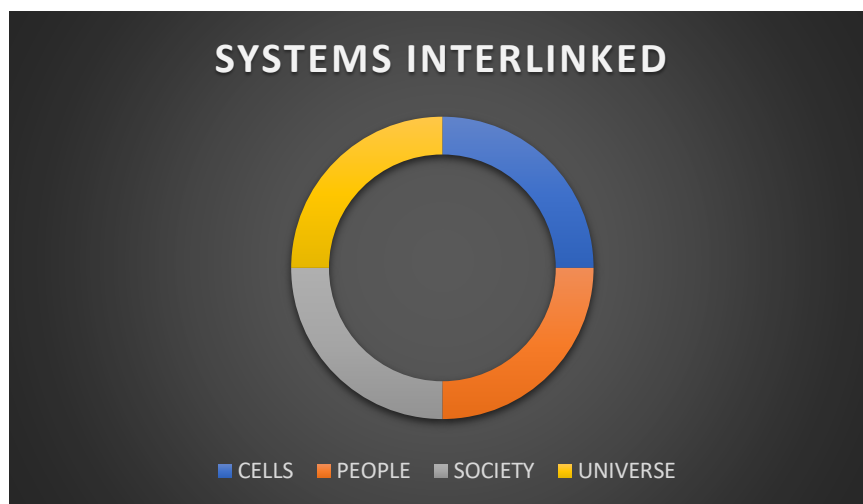
Figure 4: Cells within cells; systems within systems

Where Husserl is recognised as a founding father of phenomenology, John Dewey, born in the same year (1859) and outliving Husserl by just over a decade, is considered as having characterised what has become known as enactivism. As recognised as a naturalist, Dewey's ontology assumed a world that could not be

---

[21] Intersubjectivity relates to the experience of an individual as a self-determining entity.

understood by breaking it into parts: *'The mind is formed out of commerce with the world and is set toward that world'; it should never be regarded as 'something self-contained or self-enclosed'* (Dewey, 1934: 269 in Gallagher, 2017: p.81). This links back to Hayman's notion of intersubjectivity, as a human being understood as a self-determining entity co-joined to its world. Phenomenology is considered as having influenced Gestalt therapy as now discussed.

Gestalt psychology

Max Wertheimer and Kurt Koffka worked with Wolfgang Kohler and as representative of the gestalt[22] movement, helping to establish theories that gave rise to the birth of Gestalt psychology. This was based on an idea that it is best to experience what we feel here and now and not continue to think about the past nor concern of the future. Gestalt therapy as an approach encourages a personal growth by focusing on personal needs in the present. Gestalt psychology has its roots in Kant's philosophy and Husserl's phenomenology that *'accepted perception process as a synergic cooperation, which united perception elements and constitutes a holistic interpretation of a stimulus, and where parts are much less important than the whole'* (Celicoz, Erisenm Sahin, 2019, p.25). What this relates to is how people see the world and interact and behave in it and builds toward an understanding that our perception as human beings can be based on what is regarded as a whole picture. Here, as in the Gestalt approach a person can reflect on the past and consider a future while being grounded in the now. From a perspective of the whole person being involved in treatment pathways, Garcia suggests:

> *Responding to the integrative character of humanistic approaches, not only the dialogue but also the body should be considered to have a primary role in therapeutic interventions since it mediates the contact between client and therapist...In Gestalt therapy, interventions pointing to bodily expressions of the client are commonly used...to unfold the experience of the client and to*

---

[22] An organized whole that is perceived as more than the sum of its parts.

reach a meaningful insight, that is, a clear and defined Gestalt in reflective consciousness

(Garcia, 2021: p.2-10).

As a humanistic therapeutic approach, the Gestalt approach supports a view that the therapist has no privileged knowledge that disempowers the client. A therapy that involves the world of the client-patient-participant as their physically-felt experience offers rise to a holistic outlook, one that can involve a person in their surroundings and does not exclude it. In the context of the current thesis this seems important to consider, where acknowledging a connected role of body and world in therapy might alters how a person experience it.

Ecological psychology

Ecological psychology studies knowledge in the world rather than knowledge in the head, viewing cognition not purely as a natural phenomenon, but as '*located within (and throughout) a complex involving [sic] the organism, action and the environment*'. At the heart of ecological psychology is a three-way relationship between the environment, the organism and an activity, or an '*affordance*[23]' (Dourish, 2018: p.234), whereby a property of an environment affords action to appropriately equipped organisms. From a viewpoint of cognitive activity, as relating to a whole-body or whole-system of cognition in a given setting, the brain and adjoined parts are afforded what results accumulatively as a state of cognition. This ultimately, with all system parts combined, is the basis for how an individual might react, behave or *be* in the world.

Ecological psychology is also referred to as Gibsonian ecological psychology, as a non-representational approach. The main principles are the continuity of perception and action and the organism-environment as a unit, combined with a study of affordances as objects of perception; together with emphasis on perceptual learning and development. Affordances are among the properties of what an organism

---

[23] A chair offers the affordance of sitting to a human and offers the affordance of perching to a bird.

perceives in its environment (Natsoulas, 2004: p.323). Lobo, Heras Escribano and Travieso consider this as one of the most innovative approaches in the psychological field and describe a growing number of scholars who are engaging in the ecological program. They explain: *'The organism-environment duality is probably the most important dichotomy that ecological psychology aimed to overcome...ecological psychology offers one of the most powerful alternatives for developing a non-representational and non-dualistic psychology'* (Lobo, Heras, Escribano, 2018: p.5-12). Clark adds: *'Cognitive science's aspirations to illuminate real biological cognition may not be commensurate with a continuing strategy of abstraction away from the real-world anchors of perception and action'* (Clark, 1997(a): p.59). Clark states further:

> *...we will see an increasing sensitivity to what might be termed the ecological... the way what needs to be internally represented and computed is informed by the organism's location in, and interactions with, a wider environment*

> (Clark, 1997: p.103).

The brain, the body and the environment are resources that form a system. These are tangible features of reality but do not account for the space in-between which may seem apparent but are not visibly detectable. Von Uexküll describes how physicists discuss the same world, whereby organisms and their couplings belong as one within the same environment; whereas biologists refer to '*as many worlds as there are subjects*' (Von Uexküll, 1929: p.70). In von Uexküll's reality the *Umwelt*[24], is where preceptor and effector worlds form a closed unit together, arising via the coupling of a single organism through repetitive functional cycles of perception and action (von Uexküll, 1929: p.1957). For cognition to be regarded as an extended system, new methods of gaining first-person perspective (from the perceiving-acting cognitive agent) may be required to comprehend the links between the individual perception,

---

[24] The world as it is experienced by a particular organism.

their bodily acting or reacting and how this relates to a '*perceptual coupling*' to their environment (Wilson, Golonka, 2013:11) where Feiten asks: *What if, in order to study cognition as embodied action, we first have to solve the problem of how to relate the perspectives from the inside and the outside?* (Feiten, 2018:121).

From accounts of phenomenological, Gestalt and ecological perspectives, this thesis acknowledges a pattern whereby thinkers throughout centuries who do not necessarily follow a mainstream view, have considered the interrelation of brain, body and environment and built their own theoretical assumptions, as well as concepts. The current thesis draws on such perspectives and considers ways that these become relevant and perhaps essential, when applied to people with lived experience of trauma in mental healthcare, interacting with technology in order to make sense of a life journey that no longer reflects what they want to see in themselves. Here, with technology as world in a digitized landscape, a joining together of this with the person as a user of the technology, offers something unique from them figuring it out alone, technology mirroring hand-held tools of ancient time in a contemporary setting.

Embodied Cognition

Neuroscientific advancements support an embodied nature of brain mechanisms whereby physiological action including neural processing and interplay with environmental forces are constantly combined in dynamic feedback loops. The person and sensory stimuli here create perceptual experiences as a combined occurrence, or entity. The theory of embodiment, or "*Embodied Cognition*" (Bandura, 1994; Clark, 1997; Grigorovici, 2003; Dourish, 2004; Rocha, 2012; Kirsh, 2013; Jasanoff, 2019) supports a notion that some features of cognition are shaped by aspects of the entire body of the organism, in that they influence one another. Rowlands adopts an '*amalgamated mind*' terminology and describes that the embodied mind thesis '*doesn't relocate the mental so far from its traditional home*' (Rowlands, 2013: p.85-217). In the introduction commentary of their seminal text: *The Embodied Mind*, authors Varela, Thompson and Rosch attribute their own research journey as: '*a modern continuation of a program of research founded over a generation ago by the French philosopher, Maurice Merleau-Ponty*', whose writings '*have both inspired and guided our orientation*' (Varela, Thompson, Rosch, 1991: p.xv). Within the work of Varela, Thompson and Rosch, it becomes clear that whilst the *mind sciences* of the mid-20th century were fragmented into non-communicating disciplines involving

psychoanalysis and experimental behaviorist psychology, a more interdisciplinary field opened up toward the dawn of the 21st century where the then cognitive sciences brought together cognitive psychology, artificial intelligence, linguistics and including cognitive technology as a motion in a new direction. The authors consider:

> *Through technology, the scientific exploration of mind provides society at large with an unprecedented mirror of itself, well beyond the circle of the philosopher, the psychologist, the therapist, or any individual seeking insight into his* [their] *own experience*

(Varela, Thompson, Rosch, 1991: p.5-6).

The authors point towards cognitivism as a central core of cognitive science, where the general guiding metaphor is the digital computer and where cognition is the result of mentally represented symbols, then offering an alternative emergence, typically referred to as connectionism. Arabski and Wojtaszek write:

> *Being motivated by the recognition that the brain is a neural network, connectionism equates mental representations with patterns of neural activity, which is what connectionism shares with enactivism, both presenting a clear contrast to traditional cognitivism in this respect*

(Arabski, Wojtaszek, 2010: p.95).

However, as de Haan shares, a *network model* lacks theory or an ontology (de Haan: 2020: p.43) and in building a focus toward an enactive-integrative approach with the development of a digital therapeutic intervention, a metaphysical underpinning is required. This thesis now seeks to gain further insight into how an enactive theoretical framework has drawn on the pre-mentioned person-world views and developed its own assumptions, towards what can be described as a holistic practice. Additionally, whilst some authors have critiqued the enactivist view in its attempt to '*unseat cognitivism*' as a dominant paradigm they still agree to it being a '*novel lens through which to interpret the phenomena of cognition*' in line with '*something more integrative*' (Meyer, Brancazio, 2022: p.1-8), adding to a view that while enactivism as a philosophy may not be altogether there, it is building towards something that could become useful in picture more holistically unfolding and with a useful conceptual language ripe for application.

Enactivism

Enactivism argues that cognition arises via a dynamic interaction between an acting organism (agent) and its environment and *'emphasises emergent cognitive structures that self-organise as a result of interaction between organism and environment'* (Ward, Silverman, Villalobos, 2017: p.368). Building on the work of Varela, Thompson and Rosch who proposed the *enactive* term, Barandiaran supports that enactivism is both: '*maturing and diversifying as a theoretical framework'* (Barandiaran, 2017: p.409). Enactivism argues that cognition arises via a dynamic interaction between an acting organism (a human *agent*) and its environment and *'emphasises emergent cognitive structures that self-organise as a result of interaction between organism and environment'* (Ward, Silverman, Villalobos, 2017: p.368).

Whilst this theoretical framework diversifies in terms of how the interaction of people within environments are perceived, recent theory considers ways to make sense of what Baggs and Chemero point to as a: '*move beyond talking about the need to reconcile ecological psychology and enactivism to actually beginning the hard work of developing scientific collaborations between these two varieties of radical embodied cognitive science'*. These authors, amongst others, call for '*unification*' between '*an enactive story of agency, and an ecological story of the environment to which the agent is coupled'* (Baggs and Chemero, 2018(b): p.2-14). What this can hint towards is little more than people with varying insights, or perspectives, or intuitions – from different analogous camps or villages, arriving together and forming a collective stance, or world view, as in the previous theoretical positions in Table 1. In the context of the current thesis, possibilities open up in paying attention to the role of the environment in mental healthcare. Stendera writes of the '*distant philosophical ancestors*' of an enactivist tradition, '*found in the philosophies of biology and life advanced by thinkers such as Jacob von Uexküll and Hans Jonas, who affirmed the inseparable connection between an organism and its environment* (2015: p.234) with Gallagher reaffirming the enactivist view that computationalism, representationalism and modularism are scientific ideologies [as philosophies] that need replacing and asserts:

> *Dynamical systems theory can be used to explain the complexities of brain function but can also capture the dynamical coupling between body and*

environment. The brain, taken as a dynamical system, operates as it does because it is a system coupled to a larger dynamical system of brain-body-environment

(Gallagher, 2017: 40).

These ideologies as perspectives Gallagher describes involve:

1.   Computationalism: a view as a '*progressive research tradition*' (Milkowski, 2018: p.515-541) that intelligent behavior is causally explained by computations performed by the agent's cognitive system (brain); also referred to as the Computational Theory of Mind (CTM). The human mind here is an information processing system and theories here consider input in the form of symbols where these representations are computed;

2.   Representationalism: a philosophical assumption that any act of perception (perceiving one's reality) is a sense impression (or *sense datum*, as a unit of experience resulting from the stimulation of a sense organ); Constant, Clark and Friston suggest that '*what is at stake in the representation war is not whether there are or aren't representations. Rather, the problem is to know whether they play a role in cognition or not.*' The authors offer generative models with potential to accommodate both representationalist and dynamicist views on cognition (Constant, Clark, Friston, 2021: p.10-11).;

3.   Modularism: a notion that a mind could be composed or neural structures or mental modules with established and evolutionary developed functions. Features of modularity could include: Domain specificity, Fast-processing, Fixed neural-architecture. Authors Pietraszewski and Wertz suggest that evolutionary psychology should abandon modularity (Pietraszewski, Wertz, 2021: p.465-490).

Emerging views in cognitive science can point towards an enactive model, where fresh concepts of how the relationship between brain, body and environment become manifest. Human brains participate in complex, worldly interactions here, as part of a system in a process they have no full control over (Gallagher, 2017: p. 161). Gallagher

also questions whether neuroscience can begin to speak a different language to enter into a necessary dialogue (Gallagher, 2017: p.162) in forming fresh world assumptions. Inductively and in support of this view, the thesis moves toward a final sub-chapter in this section before introducing discussion based on a classification of technology where empirical study can be situated.

2.5 A pragmatic synthesis

A variety of philosophical views have built into ways that society has perceived and shaped its services in mental healthcare, inclusive of what models and practices become as interventions. One view supports a view of the human brain as a *dynamical system,* (Varela, Thompson, Rosch, 1991; Gallagher and Zahavi, 2008; Chemero, 2009; Fuchs and De Jaegher, 2009; van Elk, Slors and Bekkering, 2010; Gallagher, 2017), defining equations as an appropriate tool in modelling human behavior, as representing an agent's trajectory through the course of a life. This applies with relevance to a thesis that posits an assumption of a seamless inner and external co-joined reality between a human being in its reality. An individual can be understood here as an autonomous agent (or organism) adapting to an environment via interaction within this, co-constructs a fresh understanding of what this contains.

Dynamical systems theory offers a conceptual apparatus to describe the unfolding operations of complex systems. In HCI, Berkel et al. describe that this discipline investigates interactions between humans and technology, proposing dynamic systems involved in non-linear patterns of activity, as behavior and potentially complex causal effects among the users and system (Berkel et al., 2019: p. 280). The reciprocity between a conceptual human mind and a sensing active body, as part of a relational environment, underscores a need for holistic and integrative mental health approaches (Vaisvaser, 2021: p.2). To shift from a philosophical assumption to real life and achieve something akin to a holistic therapeutic practice, or one that offers an integrative form of delivery, requires first that both a setting and an intervention exist. For example:

i.   A setting, or environment
ii.   An intervention containing tools of a required level of therapeutic inquiry
iii.   Perceived affordances and direction to allow a person to interpret these

In *Enactive Psychiatry*, Sanneke de Haan (2020) looks to solve the problem of integration in psychiatry, where a whole range of factors at play in a person's life can become understood. The author seeks to develop an explicit, enactive, interactive framework, as one that takes into account the treatment rational including explaining the decisions made that surround a patient in mental healthcare and encourages a shared language between those involved. Here, different perspectives on psychiatric disorders emerge, as experiential, physiological, sociocultural, or existential challenges people face and attempt to manage or come to terms with throughout their lives. Ultimately, what de Haan seeks to develop is an interactive framework to serve as a basis for further enactive modelling, one that is the most rigorous than embodied and embedded approaches. Enactivism offers a unique perspective on the inner mind and outer reality by merging these to form a single, unified system – as a seamless interaction where no interaction is required because all is one. The author offers a useful language for any of the psy-sciences to adopt, in considering less that which is regarded as underlying and more an entire picture of what becomes manifest in a whole reality. As the author discusses, both biomedical and biopsychosocial models in mental healthcare can be insufficient in showing how the dimensions (experiential, physiological, sociocultural, existential) relate:

> *The enactive focus on the person in interaction with her world implies the relevance of the role of patient's environments. Part of treatment may consist in finding an appropriate niche for this person to flourish…abilities themselves have an interactive character, and different settings can thus affect our abilities. Psychotherapy can be regarded as practicing sense-making in a helpful setting, making it a practice of participatory sense-making*

(de Haan, 2020: p. xvi).

If space to practice is required in a setting that supports sense-making outcomes then design-thinking (Co-Design; Participatory Design; User-Experience Design, Somaesthetic Design, Human-Centered Interactive Design as examples) can be pragmatically applied in determining what these spaces will resemble, what features they will contain, how the space will become navigated and who is involved in this process, amongst many other considerations. What we now begin by discussing in Chapter 3, in Literature Review 2, is a history of a technology that provides strong

indication of it being an arguably suited platform, where enactive-type, holistic, integrative interventions can become situated and explored. If the perspectives of centuries of philosophies have built to a current pinnacle of understanding where relationships practiced in an accessible, safe setting offer opportunity for individuals in a mental healthcare context to try out new behaviors, then to enable this, an environment as a platform is necessary where these can be staged. An enactivist inquiry can begin here with the subjective, first-person point of view (Baggs, Chemero, 2018(c): p.52188) with the world as it is experienced, enacted by the individual. Here the thesis[25] imagines agents as actors.

2.6 Summary

This chapter has described how a steady line of views in society has led to certain paradigms being embraced in mental healthcare. This has led to opposing views whereby mental healthcare practice can assume on the one hand that the challenges people face are illnesses of the brain that require fixing. Other views consider that both the body and the environment play a role, where mental healthcare practice can limit its view to engaging with patients by excluding additional factors. In trauma, explicitly, the role of the body and the environment could play a part in the recovery process. The UK NHS service offers a conventional tried and tested biomedical approach to healthcare, now being stretched to a point where technology is becoming leveraged via services, to explore alternative ways to meet demand for therapeutic interventions. Additionally, due to emerging views from within the cognitive sciences, new ways to conceptualise how brain and body form a unified system could arguably be supportive. The current chapter has built towards an understanding of how enactivism, as an emerging stance, could be applied through its concepts to new thinking, applicable in this thesis to the design-thinking around environments in mental healthcare and the tools people might access as features within these. In Chapter 3 we now consider a specific classification of technology that could act as a

---

[25] See 8.4 relating to participants being understood as actors.

pragmatic response to a social problem in need. What becomes possible here is to take hold of enactive concepts and condense them into a single space, where a multi-dimensional form of therapeutic intervention, as an experience, could provide a solution, where a philosophy of mind can only journey so far. Some recent authors discuss theoretically the use of virtual reality technology in support of deep narrative experiences (Georgieva and Georgiev, 2022) and what this next chapter will argue towards, is less of a talking science as rhetorical, more one that rolls up its sleeves up and engages in action, towards recognition of an enactive system in practice.

CHAPTER 3: LITERATURE REVIEW II

Literature Review (Contextual Review) Part II:

How specific forms of immersive interactive technology offer potential to reconceptualise the ways that mental health interventions are delivered and received, as enactive systems.

3.1 Ontology

3.2 IIVE origins

3.3 Immersive technologies in mental healthcare

3.4 The language of enactivism: Making sense of concepts

3.5 Applying enactivism to the design of enactive systems

3.6 Summary and reflection

3.1 Ontology

In the previous Chapter 2 this thesis has examined a changing reality, whereby conventional biomedical approaches to a social problem in mental healthcare, are becoming recognisably in need of solutions that involve more than just a discussion in therapy - society at an intersection. The thesis has looked at trauma, as a specific type of societal challenge, with seminal texts highlighting that whilst the signals in the brain indicate it is affected, the body of an individual can play a critical role too, in understanding a whole system response to trauma and also in recovery. The study has taken a detailed look at how views in cognitive science have altered, where aligning with these are suggestions that a biomedical model can become complimented or surpassed, via a contemporary view that the brain, body and surrounding environment are formed less in isolation of one another and more as a unified system. As a *Philosophy of Mind* debate continues, responses are required that take a pragmatic hold of arising questions and focus toward solutions in a reality beyond unmanifested concepts. In Chapter 3 this thesis now presents a specific classification of technology in HCI to provide space to reconceptualise philosophies of mind toward an enactive, interactive understanding of developing future healthcare interventions, where the concept of an enactive system could be brought to life. In opting towards an IIVE, the study chose an actual environment, as a setting a participant can step into, as opposed to a wearable device. In Chapter 6, Section 6.1, the originating context of the study offers more detailed insight into the reason for this choice being made.

3.2 IIVE origins

There are varying types of immersive technology by distinction. In the following this thesis will concentrate on immersive technologies as walk-in rooms. Other technologies will be described such as head mounted displays (HMDs) but the explicit focus are systems that are not worn by the user-participant. This thesis is primarily interested in this type of technology alone, as a system that provides a simulated experience and presents an affordance of being virtually present in a variety of computer-enhanced worlds. The etymology of *virtual* stems back in history as far recorded as the 15th century relating to *'being something in essence or effect, though not actually or in fact'* (Online Etymology Dictionary, 2019). An historical example

of an IIVE was introduced in the 1950's by Morton Heilig, whose *Sensorama Simulator* (Figure 5) as a pioneering, patented invention, was to a achieve the means of: '*stimulating the nervous system with a wide variety of sensory stimuli in forms that are natural to it, i.e. colour, visual movement, complete peripheral vision, 3-D, binaural sound, breezes, odor and tactile sensations*' (Heilig, 1955: p.279-294). An aim was to permit a human experience with capabilities of replicating as close to a true-to-living experience as possible. From the viewpoint of individuals becoming *immersed* in such technologies, the ability to *immerse* has been around for as long as human beings have closed their eyes and visualized a reality apart from or as an extension of their own. What constitutes a *virtual* environment and a process of *virtualization* has altered decade-by-decade since the mid to latter part of the last century. Ellis writes that '*virtual environment displays represent three-dimensional generalization of the two dimensional "desk-top" metaphor*' (Ellis, 1991: p.321).

Figure 5: Heilig's Sensorama

Heilig's *Sensorama* as the world's first VR machine was followed by his *Telesphere Mask*, the world's first head-mounted display, in 1960. Interestingly, Heilig's vision for a cinema of the future was intended to align with machines with functionality in: '*providing the artist with a much wider palette of sense material and*

enabling him [them] *with precision into an aesthetic unity as he* [or she] *never could before*' (1955 [1992: p.281]). What Heilig describes as an aesthetic unity and sensory interaction or unification, was through a pioneering technology that took decades to evolve. Noted here is the 1961 Comeau and Bryan's Headsight (Prema, Roopa, 2018: p.1567) as the first motion-tracking HMD and the 1968 Sword of Damocles – later described in the next sub-section. In a world not quite ready to embrace the early pre-mentioned device en-masse, it wasn't until 1975 when Myron Kreuger[26] created VIDEOPLACE that a more rapid succession of interactive platforms began to appear and inventions were beginning to see a wider uptake, particularly within the military. As Kreuger describes: '*...the environment might be able to respond to the participant*' and '*an entity which engages the participant in a dialogue*' (1977:p.430); an environment with sub environments with '*ability of the environment to evoke and expand behavior*' (Kreuger, 1977: p.431-432). Kreuger adds:

> *In the long range it augurs a new realm of human experience, artificial realities which seek not to simulate the physical world but to define arbitrary, abstract and otherwise impossible relationships between action and result*

(Kreuger, 1977: p.433).

This notion of action and result, as well as a user being able to engage with some for of dialogue, or a narrative, are important features as these systems developed from Heilig's *Sensorama* (1956) and Kreuger's *VideoPlace* (1975) to the generic Cave Automatic Virtual Environment (CAVE) systems (Cruz-Neira, Sandin, DeFanti, 1993) as seen in (Figure 6). These evolved through iterative stages of re-invention, as discussed by Febretti et al. (Febretti et al., 2013: p.1-12), building toward a typical type of three-projector system being installed in the UK across universities and schools, hospitals and care settings, globally since 2012 *(Figure 7)*.

---

[26] Myron Kreuger is an American computer artist who developed early interactive works in his career, also considered as a first generation virtual and augmented reality researcher.

Figure 6: Cave Automatic Virtual Environment (CAVE)

Figure 7: The Immersive Interactive

A distinction between virtual environments

The CAVE terminology is commonly embraced and refers to a walk-in VR environment first conceived in 1991 that made use of rear-projected screens (DeFanti et al., 2011: p.17) with various models offering a similar experience known via different names since mid-20th century. These have included: "*logical apparatus*" (Heilig, 1955:p.282); "*kinesthetic display*" (Sutherland, 1965: p.2); "*an environment which has sub-environments*" (Kreuger, 1977: p.431); "*high-resolution virtual reality interface*" (Cruz Neira et al, 1992: p.71); "*fully immersive projection displays*" (Rizzo, Kim, 2005:p.129); "*multi-sensory synthetic environments*" (Domingues, 2013: p.1); "*XR* [Extended Reality] *environments*" (Jantz, Molnar, Alcaide, 2017: p.1); "*Impacting environments*" (Gomes et al., 2019: p.1). Authors Loomis, Blascovich and Beall describe what they call an immersive Extended Reality (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)'* (Loomis Blascovich, Beall, 1999: p.557). Head-worn devices have shown popularity in military settings as well as personal entertainment via the 21st century gaming industry and have edged their way into sectors such as education and health, spawning from the *Sword of Damocles* widely considered to be the first VR HMD system, co-created in 1968 by computer scientist Ivan Sutherland with the help of his student Bob Sproull as a three dimensional display (Sutherland, 1968: p.757).

Whilst the head-mounted devices have seen their own trajectory of evolving as products for example Occulus Rift; HTC Vive, this thesis consider the developments of an immersive environment technology, as a broadly communicated type of immersive product which originated with co-use of LCD shutter-glasses and a wand (used to pick and move virtual objects) now becoming re-modelled for 21st century consumption. Czernuszenko et al. state: *'It is easy to share the VR experience in a projection-based system'* where such technology is *'less invasive than HMDs'* (1997: p.48). A systematic review of immersive environments and virtual reality, inclusive of HMD's and multisensorial fully immersive environments – with an emphasis on *fully* where the body is also immersed - was conducted by Rubio-Tamayo, Barrio and Garcia, who consider VR [regarded by them as a *'research field'*] and other Information and Communication Technologies (ICTs) as having: *'…high potential for transforming the real world and the way in which we interact with it*'. They point out the *'changes in social reality'* which can be brought about via this *'tool for research in cognitive sciences or experimental psychology'* where '*factors relating to embodiment, human perception and cognitive approaches, as well as proprioception[27], will determine how information will be presented in immersive environments'* (Rubio-Tamayo, Barrio, Garcia, 2017: p.1-15). This thesis considers the language associated with these types of immersive systems (or environments) and

---

[27] Perception or awareness of the movement or position of the body; also known as kinesthesia.

relates solely to the types of models associated with Table 2. This includes Edward Link's model due to its *whole-body* immersive abilities, as opposed to devices which only immerse the vision of a human being.

Table 2: Evolution of the immersive interactive system

DATE	TECHNOLOGY
1929	Edward Link's *Link Trainer*
1956	Morton Heilig's *Sensorama*
1975	Myron Kreuger's *VideoPlace*
1991	Cruz-Neira, Sandin, De-Fanti's *Cave Automatic Virtual Environment*
1995	Chet Dagit, Bob Jacobson's *Virtual Environment Theatre*
2001	Maurice Benayoun, David Nahon's *SAS3*
2012	David Salt, Christopher Porter's, *Immersive Interactive*
2013	Febretti at al. *CAVE2*

This study now examines uses of immersive technologies in a therapeutic context. To state, whilst attempts are being made to combine digital technologies in mental healthcare that combine HCI with more embodied or holistic approaches, little evidence relates specifically to the evaluation of immersive IIVE settings as those proposed through the current thesis being adopted and adapted. Further, from a view of the cognitive sciences combined with HCI, what the current thesis argues is for a combining of views and disciplines, less in discussion, more in practice. Bennett et al. offer than work in recent years suggests that interaction can be well modelled as a dynamic process where behaviors arise among elements between humans and technologies (Bennet et al., 2021: p.1). This offers potential to explore how these types of processes can become manifest, which, in a word, requires action.

3.3 Application of immersive technology in mental healthcare

An ACM Digital Library search discovered a more-broad use of digital technologies within HCI in a mental health or mHealth context, as adopted across a range of: Avatars, Wearables, Smart Phones, Sensors, Immersive Virtual Reality, Gamification, Monitors, Devices, Interfaces, Applications, Chatbots, Robots, AI, Machines and Systems. These are listed to show the diverse ways technologies are

being adopted in mental healthcare research. A grey literature[28] review examined government documentation in the context of mental healthcare and technology finding that the UK government will support the implementation of '*cutting edge technology*' with ability to offer innovative solutions in supporting self-management, against a landscape where '*almost one million adults access psychological therapies*' each year (Department of Health, 2017: p.3-6).

A UK NHS Long Term Plan sets out: *People will be empowered, and their experiences of health and care will be transformed, by the ability to access, manage and contribute to digital tools, information and services* (NHS, 2019: 93). More than 100 published items documenting a range of studies link to innovative uses in improving access to and engagement with technologies in a mental healthcare context. Examples included: design activities to identify needs and preferences for mental health tools amongst college-student populations (Lattie et al., 2020: p.1-15); a smartphone tool called MORIBUS to encourage participatory insight into the behavior of people presenting depression (Rohani et al, 2019: p. 282-291); a study that builds novel methods and a model to detect stress, with aim to explore how the choice of devices used in mental healthcare interventions changes with context (Mishra, 2019: p. 388-392); a combining of virtual reality (VR) technology with exposure therapy in designing an examination system to induce anxiety of candidates as a method to study adolescent mental health (Luo et al., 2019: p.1-8) What these provide evidence of is that over the past decade there has been a growing research community in mental health and technology design.

Authors Rudd and Beidas believe that society requires expansive solutions, where the power of people can become a harnessed commodity in the delivery of interventions, with technology supporting this (Rudd, Beidas, 2020: p.3). Thieme et al. suggesting that human computer interaction for mental health should expand its focus. The authors state: '*The* [HCI] *field needs to increase its effort to include*

---

[28] A grey literature review relates to materials and research produced by bodies outside of traditional commercial or academic publishing such as government documents, policy findings, white papers, working papers and evaluations, some of which show agendas of the state. These are valuable as they are relatively rapid in terms of publication and voice the discourse and on-going plans of the governments and respective authorities.

strategies that can positively contribute to people's mental wellbeing in both the design and evaluation of future technology' (Thieme et al., 2015: p.6). Examples of immersive technologies adopted within mental healthcare environments can be seen in Table 3:

Table 3: Mental healthcare therapies in a VR setting

YEAR	AUTHOR(S)	VR HEALTHCARE LINK
2000	Schuemie	Virtual Reality Exposure Therapy
2002	Blascovich et al.	Exposure Therapy
2004	Banks et al.	Psychosis
2007	Gregg, Tarnier	Social Psychiatry
2008	Doherty et al.	Mental Health
2010	Mohr et al.	Behavioral Intervention
2014	Matsenidou et al.	Autism
2015	Thieme et al.	Mental Illness
2017	Hankala et al	Children's mental health
2019	Gomes et al.	Schizophrenia

A more prevalent body of literature describing studies across mental healthcare relating to the use of 3D visualization in a CAVE and also HMDs include: Virtual Reality Exposure Therapy (VRET) for PTSD (Beidel et al., 2017: p. 64-74); in vivo exposure therapy (iVET) and augmented reality (ARET) for phobias; (Suso-Ribero et al, 2019: p.31-38) involving exposure to content containing the feared stimulus or scenario (Boeldt et al., 2019: p.2). Mostajeran et al. report on the effects of exposure to immersive videos, via an HMD (Mostajeran et al., 2021: p.11); and a review by Ionescu et al. seeks to understand the implementation of immersive 360° videos in clinical practice, viewed through an HMD (Ionescu et al., 2021: p.632). 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 (Zeng et al, 2018: p.2); and a study into virtual environments describing the use of VR in treating autism, phobias, addiction and post-traumatic stress (Haniff et al., 2014: p.1-10). 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 (Gerardi et al., 2008: p.2; Rothbaum et al., 1999).

Other studies found that as an acrophobic environment the CAVE provokes more anxiety than an HMD (Carmen Juan, Perez, 2009: p.232-248), 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

(Cordeil et al., 2017: p.448). Meyerbröker 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 (Meyerbroker et at., 2011: p.51-56). Blascovich et al. argue: '*Social psychologists have been creating virtual (i.e., synthetic) environments, even immersive ones, for decades using hard scenery, props and real people*'. They suggest that '*VEs* [Virtual Environments] *allow for action, movement and sometimes speech on the part of users*' (Blascovich et al., 2002: p.105). Banks et al. developed virtual environments to focus on recreating the auditory and visual hallucinations of patients presenting psychosis, as opposed to the currently available text-based models. Their hope was to '*result in better empathy of doctors with their patients, leading to reduced stress and alienation of patients and better patient outcomes*' (Banks et al., 2004: p.45). Gomes et al. add that '*impactful experiences'* born of immersive environment technology in research into schizophrenia have ability to '*generate emotions, contributing to the process of activation or somatic excitation that triggers links that strengthen cognitive functions'* (Gomes et al., 2019: p.1). A review of available literature regarding effectiveness of incorporating a wide range of psychiatric disorders in VR settings, with a specific focus toward exposure-based intervention for anxiety, is discussed by Maples-Keller et al. They report on uses of such technology within autism, schizophrenia, psychosis, PTSD, anxiety and panic disorder amongst others, noting:

> *The first study using virtual reality to treat a psychological disorder was published in 1995 [by Rothbaum et al.]…Virtual reality has emerged has emerged as a viable tool to help in a number of disorders…meta-analyses have indicated that VR is an efficacious tool, compares favorably to comparison conditions, and has lasting effects that generalize to the real world*

> (Maples Keller et al., 2017: p.14).

As a VR system the IIVE has reached a point where it is easily configurable in a range of locations but can be more costly and less off-the-shelf than devices that attach to the body, such as HMDs. A systematic review of evidence conducted by Valmaggia et al. only included studies comparing immersive virtual reality to a control condition and predicts that by adapting therapy to new forms of media will ensure more people can access the therapeutic process in order to establish which factors play a role in the

onset of mental health challenges being faced (Valmaggia, 2016: p.194). Authors Rizzo, Wiederhold and Buckwalter suggest that with thoughtful system design targeting clinical applications, the use of VR as a rehabilitation tool will continue to grow in acceptance (Wiederhold, Buckwalter, 1998: p.21-42). This hints towards an intersection where a range of additional technologies can be trialed independently or used within an IIVE as supportive tools in a single, surrounding setting. In envisioning this, the thesis now considers how this can be theoretically framed and applied.

3.4 The language of enactivism: making sense of concepts

To enable an enactive approach through the design of systems adopting immersive technologies in trauma mental healthcare, this thesis now unpacks terminologies that represent what this philosophical view embraces. Because trauma is experienced by the whole physiological system of an individual, not solely as brain-related, therapeutic practice has potential to shift beyond the biomedical approach to one that views a person as being interconnected within the environment generally perceived as surrounding them. This would suggest that therapeutic language adopt enactive terms, as a means of fetching concepts into working, everyday practice. Humanity is stood at an intersection where language previously not regarded – Tik Tok, Metaverse, Instagram, Artificial Intelligence, is becoming commonly accepted as linguistic norms. Within this language exists Extended Reality (XR) as an umbrella term covering Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR). Similarly, where cognitive science is an interdisciplinary field, the language contains concepts only on a verge of being acknowledged outside of expert views from those engaged in discussions often born within academia. This brings about a challenge in designing fresh approaches based on novel insights, for example, in mental healthcare, where emerging concepts can be applied. In Table 4, the thesis visualizes how initial thoughts that manifest in discussion can be embraced initially at a micro level, if at all, before then embarking on a journey to become what are recognised as legitimately supported contributions, in any given field:

Table 4: The influence of language in relation to emerging of paradigms (Author)

Thought	Language (as an expressed thought)	Concept	Shared concept	Concept embraced at micro and macro level	Paradigm

This thesis considers the development, from linguistic origins, of an embodied, enactive, holistic, integrative approach in the delivery of therapies linked to the psy-sciences. The everyday layperson is unlikely to state that they are attending an enactive experience in replace of conventional therapy, yet what could emerge here is a practice where human being are viewed not as subjects or patients, but as equal partners in a process of exploring multi-faceted, relational issues that have impacted their lives. A challenge, however, is the time it takes for a basic idea to emerge as research and then into any form of implementation within clinical practice. Morris, Wooding and Grant describe a process of '*translation*', as being the conversion of a basic science such as the beginning of a research study, to a point where this evolves as patient benefit. An analysis across different domains in health research suggests 17 years (Morris, Wooding and Grant, 2011: p. 511-518). These authors offer a conceptual model of such a journey in Figure 8:
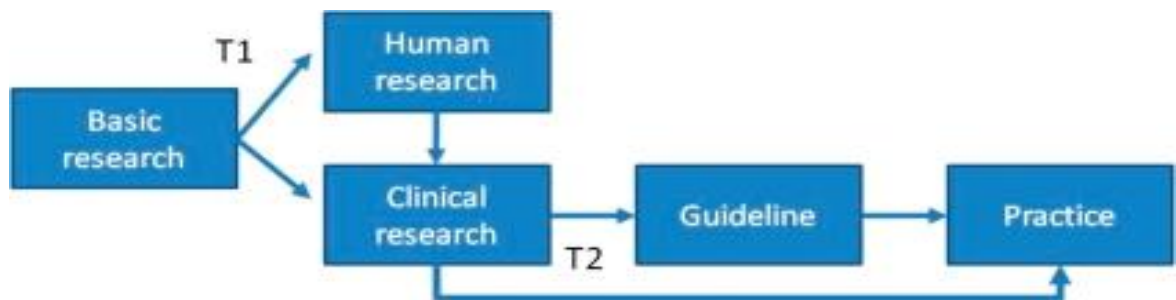
Figure 8: A summary of the translation process. A conceptual model of the journey of health (biomedical) research from research into benefit, as derived from the literature (Morris, Wooding and Grant, 2011: 512)

Where a typical mental healthcare intervention might involve a person sitting down and receiving care, an IIVE, as a particular type of technology, could offer a standing approach, whereby features of the setting itself become utilised. What is arguably required here, in the context of this thesis, is a shift from what a model of therapy can achieve as administered to the patient, towards an understanding of what the environment has potential to offer, where a user-participant has control over a process – ultimately what this thesis is building towards. This implies that language that leads to behavior that leads to decisions that leads to practice, could alter, in building toward a system that takes into account a person's experiences, neurophysiology, socio

cultural and existential elements, at the touch of a sensor. By applying concepts from within the enactivist domain, this can result in viewing mental healthcare practice in a new light. Some of these concepts are now broken down, to introduce how a new approach might become realized.

Agency

Both ecological psychologists and enactive philosophies are in agreement that agency, as an action resulting in a particular effect, can be explained via focus on the relation between organism and environment. As Varela, Thompson and Rosch describe: '*Agents and agencies are not, therefore, entities or material processes; they are abstract processes or functions*' (Varela, Thompson, Rosch, 1991: p.106). People can be viewed as entities, or living systems here, as an organization of parts and processes. In designing what is essentially a step towards building an enactive system, for participants presenting trauma engaging with their body, agency is ascribed here to a level of felt, or sensed interaction, for example whereby a therapeutic intervention is concerned less about discussion about a problem, more about a physically moving through a process and adapting to an environment in order to solve it. Jëkely, Godfrey-Smith and Keijzer discuss that a person's body-self has a particular form of organization involving both the parts and sensing. Early sensing is what they call '*reafferent*' and describe how brains:

> …*are not the sole locus or even the centre of this self, but a part of the body that is characterized by this self. The body-self enables the organism to sense and act as a single unit, and thus a self that separates itself from the rest of the world*

> (Jëkely, Godfrey-Smith and Keijzer. 2020: p.3).

People, as self-individuating systems formed of senses, parts and sensorimotor (of nerves and their actions) functionalities, have ability to connect to varying forms of reality in a way that sees them co-joined, For example, taking a walk through a supermarket, plunging headfirst into a river. In the enactivist domain, this type of interconnectivity is known as coupling.

Coupling

Coupling is concerned with the maintaining of the relationship between how people assemble and then interact with what this is, as an end result (Dourish, 2004:144), made possible via sensorimotor functions that enable action. According to Di Paolo and De Jaegher (2022: 246) a minimal agent is both coupled to the processes of reality and can also modulate, affecting the relationship or level of interactivity between what could be conceptualised as two (agent and environment), but what enactivism acknowledges as one. De Haan talks of '*bodily, reflexive beings, interacting with a socioculturally-shaped world*' (de Haan: 2020: p.195) and so, in summary, coupling relates to an assumption that bodily involvement and an agentive, spatial presence, form a system.

Sense-Making

In mental healthcare and within a current, continuous crisis point reached within services at a global level (as a leading cause of morbidity by 2030), people display a variety of reasons why they are accessing support. This could range, for example, from a person experiencing anxiety and stress at work, to someone feeling suicidal brought on by an endured trauma they feel has been an emotional burden since childhood. People access mental healthcare services for a variety of reasons that link to their cognition, whether this relates to a dysfunction in a neurological sense, or one that affects the body schema. On the enactive view a physiology of human organisms implies a capacity for sense-making, as a reciprocal process between an organism and its environment. Where this breaks down, or is over-sensitive, or blurred, or at a point of disparity, an inability to rationalise with the event can achieve a point where a person seeks or requires support. While the enactive view is a philosophical one and only empirical studies can become a measure of such a perspective in practice, Lakoff and Johnson write: '*Cognitive science needs a corresponding openness – an openness to all those vital human concerns traditionally studies by philosophers*' (Lakoff, Johnson, 1992: p.21). What this implies, is that philosophical reasoning can be a first and arguably crucial step towards determining what may or may not be useful towards a scientific practice, across any field or discipline.

An enactivist paradigm sees psy-challenges as linked to sensemaking, through a meaning that a person enacts via interaction with environment - an agent-organism bringing about reality through its actions. Stilwell and Harman advocate not to isolate

a single part in attempting to explain experience, but, for example when conducting healthcare research with strong subjective elements, look at both the individual and the environment, for example, talk to both the patient-participant and clinician (Stilwell, Harman, 2021: p.6) – as described in this thesis in Chapter 8 and Chapter 10 - Results. In other words, for sense making to become realised in practice, enactivism considers a variety of angles of inquiry and self- inquiry, inclusive of understanding how a human physically interacts within the world. In a context of mental healthcare this can take a step towards achieving a potentially robust understanding of how a human is coping as part of the environment it is attached to, for example, at an undeniable cellular level.

Autonomy

A human organism, as a system of component parts and processes, is autonomous in that it has ability to generate and then maintain its own identity, as connected yet visibly distinct from its surrounding environment, at least to other humans. A term *autopoiesis* relates to a self-producing aspect as a basic type of autonomy, such as within a cell. Wynter contends that the human order is an '*autopoietic, autonomously functioning, languaging, living system* (Wynter, 2015: p.32). In a context of digital technologies presenting or encouraging a therapeutic experience, autonomy relates to an opportunity for self-governance and for a person to experience sensorimotor control over this type of process. From this view, a self-directed form of intervention in mental healthcare suggests that a user has autonomy within the system as they actively engage, where cognitive structures emerge from the guided action. Perception here is '*not simply embedded within and constrained by the surrounding world; it also contributes to the enactment of this surrounding world*' (Varela, Thompson, Rosch, 1991: p.174).

From a perspective of a human having biological versus cognitive autonomy, Barandiaran and Moreno advocate a biology $\neq$ cognition thesis in exploring a distinction between a neurophysiology of how a cognitive agent works, versus what makes something cognitive (Barandiaran and Moreno, 2006: p.171). This is important, whereby a biomedical approach in mental healthcare practice can focus on perceived workings of a biological brain, but where the thought-mind-consciousness, if these exist at all, could be conceptually understood as being located, literally, anywhere else. Likewise, again in a context of trauma, it can be asked how trauma actually impacts

an individual and what makes an experience traumatic, by considering where the trauma is, if at all, in the person themselves. In the next and final sub-section of this chapter, Van der Kolk talks of people who have faced and endured trauma taking measured steps to master themselves, less via talking, more via active, physical experiences. The current study prefers the term experience over therapy, as it offers that a user-person-agent is involved in an autonomous doing of their own volition, rather than a receiving. In a further example of a seminal work, Being There: Putting Brain, Body and World Together Again, Clark, an advocate for new tools of investigation where humans can interface with a range of media, writes:

> *Ours are not the brains of disembodied spirits conveniently glued into ambulant, corporeal shells of flesh and blood. Rather, they are essentially the brains of embodied cognitive agents capable of creating and exploiting structure in the world…And we need new tools with which to investigate effects that span multiple time scales, involve multiple individuals, and incorporate complex environmental interactions*

(Clark, 2004(b): p.220-221).

In order to exploit structure in the world, to have something to pin this on, or locate it in, could be a useful start point; similar to the previous consideration around a holistic, integrative concepts becoming realised in practice. Some form of system or a framework, as a model, is required and the final sub-section in this thesis describes how this might be possible, inclusive of dynamic systems that attempts to explain behaviors as part of a self-organizing, consistently adapting motion.

3.5 Applying enactivism to the design of enactive systems, for trauma

In a context of mental healthcare, the concept of a human being as an autonomous system within a system, arriving at its own agentive, existential reckoning of self, seems a long way from a human being sat in a room and observed in a way that inspects their behavior, as an object of expert opinion and prognosis. The current study recognises that enactivism, as a philosophical lens, can be applied in many ways, exploring a notion of zero-separation between humans and their situated realities, including digital ones. Nam observes:

As human life is increasingly entangled with technologies, human cognition is inseparable from digital data and artificial intelligence…On the one hand human cognition is seamlessly integrated with machine cognition, on the other hand digital technology is a new layer of worlds humans constantly interact with

(Nam 2021: p.1).

An enactive ontology when applied to a human-centric methodology in HCI towards the design of an interactive system, blends concepts and lends perspectives from a range of multi-disciplines, including neurophysiology, biomedical-science, psychology and physics. In gaining insight into the use of an immersive technology as an approach exploring people's experiences in this type of reality, authors Rubio-Tamayo, Barrio and Garcia support the suggestion of a multidisciplinary approach:

Immersive and interactive technologies such as Virtual Reality (VR), are a new milestone in the way we interact with our environment, and even how we conceive new approaches in our relationship with reality…new ways to design information, new narratives and storytelling…many questions emerge related to the virtual reality and immersive environments phenomena. These questions are the next steps in research in the field, and should be approached by disciplines such as neuroscience (and cognitive science), ergonomics, life science or even formal sciences such as systems or decision theories, as well as theoretical aspects of computer science, among others

*(*Rubio-Tamayo, Barrio and Garcia, 2017: p.1-15).

In the current thesis, an understanding of reality combines with how this applies to a person's experience of technology in an immersive, interactive environment, with theoretical underpinning drawing from an enactivist view. Conceptually, person and world form a system here, where cognition is more an engagement of perception coupled with action, not consigned to a mental representation on the part of a perceiver alone, as in Figure 9. This could be particularly supportive to a person who experiences trauma, as now discussed. Also, where cognition itself might arguably be understood as sensory and motor functionality, any form of intervention claiming to be cognitive by nature could include a persons access to a full range of senses and movement combined.
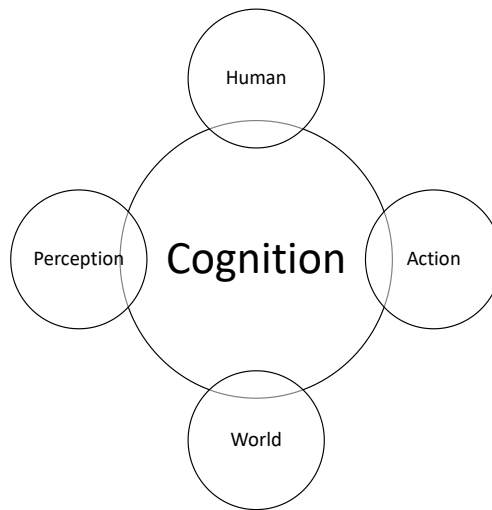
Figure 9: Cognition as resulting from perception and action

As established, trauma can impact psychosomatically, applying also to a person's senses, including their sense of self, leaving what can be described as both mental and physical representations (Lanius, Terpou, McKinnon, 2020: p.2). Acknowledging this, the current study considers whether a verbal, seated discussion is enough, or whether a multi-sensory, physically engaging experience, might resonate in some way at a level more conducive to need, particularly where environments containing digital tools can be used purposively as systems. To adopt an analogy of traditional versus virtual fishing, for example, each pursuit can result in their own experience, combining person, world and tools for interaction, as a system.

In HCI research, enactive concepts are embraced via what some researchers describe as: "*models for enaction*", where '*the enactive viewpoint emphasizes the strong supportive roles that can be played by the co-ordinated affordance of action and perception in interactive systems* (Visell, 2008: p.38). More recent research talks further of "*enactive systems*" (Arpetti and Baranauskas, 2016: p.1621); and an "*enactivist approach*" (Peeters and Segundo-Ortin, 2019: p:1). The concepts from enactivism lend themselves to the development of systems that combine agents with sensorimotor capabilities with a process of autonomous re-organisation, where enactive, interactive systems permit a transfer of knowledge obtained through action, grounded through perception and action in the environment. An enactive interface should make it possible for users to obtain information about the affordances of both

the interface and the overall system (Stoffregen, Bardy, Mantel, 2006: p.4). Further research suggests that technology can accompany sense-making, via bodily intervention and spatial presence (Kaipainen et al.,2011: p.433-437), opening opportunities where interactions with technology involves physical movement.

This thesis presents an argument towards a use of IIVEs, as a specific classification of immersive technology, made available in a way that explores concepts through an enactivist ontology, as a world view. Here, within this setting, a person, as an agent, can interact with features, as affordances of an environment, engaging via sensorimotor abilities, as coupled to what can be described as an enactive system. What can take place and unfold in these types of settings, are ways to realise and reveal something more akin to an integrative model of psychotherapeutic intervention in practice, involving what Gallagher refers to as '*a holistic conception of cognition*' (Gallagher, 2017: p.21). As Froese et al. point out: *The enactive approach provides a novel framework, for the understanding of human beings' use of technology, based on a distinctive understanding of the biological foundations of agency* (Froese et al. 2012: p.373).

To conclude this literature review chapter, this thesis proposes a step towards a merging of organisms and environments, agents and systems, people and spaces, toward a purpose of a person making sense of what has arguably become a disorganised mental health challenge they are being faced with. In an enactive system, the physiological, sociocultural and existential dimensions of a person's being can be self or co-examined, akin to an integrative practice via agent and system interacting through a process in order to achieve a designated outcome. This challenges the co-dependent element of a conventional therapeutic approach containing a facilitating agent, where via digital simulation it becomes possible for a participant to use technology that helps formulate and respond to their own questions. Towards achieving new, physical experience in mental healthcare, Van Der Kolk posits:

How can people gain control over the residue of past trauma and return to being masters of their own ship? Talking, understanding, and human connections help, and drugs can dampen hyperactive alarm systems. But we will also see that the imprints from the past can be transformed by having physical experiences that directly contradict the helplessness, rage, and collapse that are part of trauma, and thereby regaining self-mastery

(Van Der Kolk, 2014: p.4).

The sensorimotor experience in an IIVE begins as physiologically experienced sensations involving atoms and cells as part of a human system, then extending and projecting into a digital technology. Within this, a reciprocated process permits response as feedback – for example a participant reaches out and touches a sensor and illuminates a simulated image of a door. This connects people as soft-tissue, biological systems with technological, hard-wired systems and as an experience-centered technology provides potential for the participant to understand themselves in a novel way, as compared to a process involving no movement or no interactivity with technology at all. No distinction exists here, between where the biological body ends and the technology begins, and vice versa, where '*enaction is specifically designed to be a middle way between dualism and monism*' (Varela, Thompson, Rosch, 1991: p.202). This moves part-way to a system that offers real-time connectivity, presenting an extension of human cognition that offers an affordance of sense-making without excluding the human as a dynamic agent. Control is at the reach of fingertips here and autonomy an achievable goal by taking action in the world and being there, in the room – a person meeting the environment in a way they choose to. Villalobos and Dewhurst describe '*sensorimotor circularity*', whereby a person's central nervous system:

…responds to the dynamics of its sensory organs by using its motor organs to establish a new environmental orientation…The organism moves in its environment according to what it senses, and what it senses is determined by how it moves in its environment

(Villalobos, Dewhurst, 2017: p.1898).

Arguably from a mental healthcare view this offers possibilities in reimagining what interventions look like and, in particular, what settings might resemble that they

are situated in. What society might perceive as separation between person and world, because molecules and atoms are not visible in everyday reality, is in fact co-joined. An enacted reality is one where: *…organism and environment enfold into eachother and unfold from one another in the fundamental circularity that is life itself* (Varela, Thompson, Rosch, 1991: p.217). This presents novel uses of an existing technology in a sector where, critically, the leveraging of digital, complimentary approaches is voiced as being essential. What this can achieve, is to offer a physiological, multisensory approach to a process that conventionally will exclude such a range of interactivity. From the enactivist perspective an approach that conceptualizes people and environments as coupled systems provides a space where philosophical assumptions can become tried and tested facts, reverting back perhaps to an innate understanding of human selves being more incorporated into a tapestry of reality, less removed.

3.6 Summary and reflection

Through Chapter 3 this thesis has looked at the origins of a particular classification of immersive interactive technology and learned of ways this is less prevalent than those worn on the body, such as head mounted displays. The chapter has shown that digital technologies are used broadly across mental healthcare, including engagement in schizophrenia, phobias and in post-traumatic stress. In considering how enactivism, as a perspective from within the cognitive sciences, applies to a study focus in HCI, the thesis has looked at concepts influenced by the language of this philosophical view, then how enactive systems have potential to become realized, via the coupling of people and technologies in purposeful ways. The study will now demonstrate the design, build and testing of a technology, whereby 24 participants across two separate studies provide their views, as attitudes toward a system that offers potential for a different take on mental healthcare interventions. This affords possibilities for society to motion closer to an integrative approach in the delivery of mental healthcare, where a participant in therapy can be led or lead themselves through a process that places them at the centre of their recovery pathway, as an equal partner.

PART III

CHAPTER 4: ETHICS

4.1 Ethics in HCI

Overall, this thesis reports on a study that obtained ethical approval in two ways:

    i.   Via university ethics approval

   ii.   Via IRAS ethics approval

This section relates to ethics and in particular, ethics in HCI. Designing a system based on users presenting trauma accessing and trialing this in a clinical setting arrives with some certain considerations around ethics. The Association for Computing Machinery (ACM) Code of Ethics and Professional Conduct offers that actions taken by computing professionals have ability to change the world and to act responsibly, the wider impacts of work should be taken into account (ACM, 2018). Ethics generally relate to an unwritten set of value principles used in a particular context. Because participants who take part in research have both moral and legal rights, it is important that researchers do not abuse these. Codes of research ethics can build to good scientific practice. Warnock, writing in 1911, describes:

> *At the beginning of the twentieth century ethics was predominantly metaphysical. The most important writers on moral philosophy explicitly linked their discussion of morals with views about the nature of the universe as a whole, and man's place in the universe. A system of ethics was what such philosophers aimed to set out, and this meant a total explanation of the way things are, which contained as part of itself an explanation of the demands and the requirements of ethical behavior* (Warnock, 1911: p.1)

Ethics in HCI covers topics such as: the welfare of human beings, trust, autonomy, ownership, privacy, informed consent. There are two studies described within this thesis and ethical approval was gained for each of these:

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

Study 2 received university ethics and Health Research Authority (HRA) Integrated Research Application System (IRAS) approvals. A protocol document is included [Appendix 8] together with an IRAS Checklist [Appendix 9]. As part of a screening process each participant completed: *Impact of Events Scale – Revised* (IES-

R) – see example from Participant 013 [Appendix 10]. 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.

4.2 Ethics, Vulnerability and Pragmatism in HCI

The ethical concerns related to participants who were providing their views towards a system, by observing a video prototype in one instance and trialing the system in another. From the design of the interactive system there were two phases of data collection activity overall:

> Phase 1: Semi structured interviews (conducted remotely via Zoom) based around video-prototyping sessions with health professionals as "Experts by Profession" viewing the IIVE setting and *The Timeline*

> Phase 2: Semi-structured interviewing conducted in-situ at James Cook Hospital as a pilot evaluation of *The Timeline*

A consistent communication channel maintained with the Director and senior lead for mental health at Alliance Psychological Services, as the main recruitment partner. This is a company who engages more than 10,000 children, young people and families per annum, in services linked to supporting mental healthcare. The participants, as Experts by Profession, had considerable background in front-line mental healthcare delivery and by profession their expert views were valuable to the study. The Alliance Psychological Services staff are employed on a weekly basis to engage with "caseloads" of clients who are affected by mental health traumas through both work-place programmes and via Primary Care. As Experts by Experience the views of these participants made it possible to learn what a human-centered interactive design approach could offer, from a user-perspective as involved in the initial planning stages of designing a mental health intervention within an IIVE.

The research study set out to create opportunities to test ideas with potential users and to gain feedback and understanding of experiences of this immersive technology. The anticipated users assisted in the process of bringing the concepts to life, in that their contribution informed in a meaningful way, based on their own expertise and life

experience. The opposite of this would be that the design process was not informed in any way by the proposed end-users, that was not the case in this study. In addition to this the study adopted a phenomenological epistemology within its Research Framework, fitting with the objectives of examining reality based on direct human experience and human participants making sense of reality via *their own* experiences, with an intended emphasis on this subjective factor.

In addressing the engaging of people with lived experience of trauma, the study considered the vulnerability of a participatory sample group. It was emphasized that by taking in the study, participants were potentially improving a mental healthcare service. By acknowledging the participants as experts, any notion of regarding the participants as vulnerable, or to regard stigma, became more a case of establishing a mutual trust and understanding that they were informants, not subjects. Guillemin and Gillam describe that '*ethical dilemmas and concerns are part of the everyday practice of doing research*' and that tensions can be resolved where '*subjects of the research take up the goals of the research as their own…in making the research their own project jointly with the researchers, they become participants in the research rather than subjects* (Guillemin and Gillam 2004: p.262-271). By obtaining both consent from each participant, as well as fully explaining their role, it became clear, again from a pragmatist view, that this extended to participatory views actually affecting the design and implementation a system for use in mental healthcare. To re-emphasize, all participants in this study were regarded as being part of a process as informants with important life-knowledge and regardless of whether trauma had impacted 12 of these, this was regarded as supportive insight from the study's view, as opposed to seeing participants at any point as being vulnerable. The introduction of the Impact of Events Revised (IoE-R) scale was included to ascertain whether a participant had moved through their trauma. From a perspective of ethics, this measure became a choice in recognising that each participant was aware of the individual trauma and had already contributed to working through and past this.

4.3 Ethical judgement in relation to this research

There were 24 participants throughout two studies, the latter of which involved a vulnerable population with lived experience of trauma. The reason for involving 12 therapists in Study 1 was to inform the design of a hi-fidelity prototype to be used in Study 2. Alliance Psychological Services, as the main recruitment partner were

involved in many discussions. Records of these discussions were made and it was decided during these that participants recruited into the study would be individuals who had pre-experience of services, in that they had been in therapy and completed this. This said, together with the Impact of Events scale, the participatory information and consent from each of the participants, it was agreed that any understanding of vulnerability was at a minimum. Additionally, as part of the lead up to interviewing the participants, each gained an understanding through Alliance Psychological Services that the study was exploratory, where any insight gained into the use of a digital environment such as an IIVE and The Timeline as an interactive tool, could be useful for ongoing research in this area. Overall, each participant who was met with described how they were themselves appreciative to take part in the research. In the results chapter of this thesis these views will support this.

CHAPTER 5: METHODOLOGY

5.1 Introduction

Methodological approach 2019-2020

Before discussing how the research problem was investigated through the applied methods of inquiry, this thesis points out where the author, as researcher, was positioned, between starting the PhD in 2019, through to the closing months of 2020. As neither a designer by profession nor savvy with the ways a doctoral study unfolds from its foundation, the author was, throughout the first year, guided by a first supervisor to look at a range of design-ways to explore. At this stage of the research journey, the study title was: *Toward An Embodied Immersive Approach In Human Interactive Design And Mental Healthcare*. An early overarching research question was: *How might interventions in immersive virtual environments be experienced by people presenting mental health challenges*? Important to note perhaps, is that The Timeline at this stage, as a concept, had also been described as Immersive Resilience, Straight Line Therapy and Digital Narrative Therapy. This thesis points to this as relevant because the author has already pointed out in the introductory section that timelines are used in a therapeutic context, but the reason for opting toward this naming of the proposed intervention is simply because it made sense to do so, intuitively during the rapid prototype stage; also due to the chronological nature of the design inside the IIVE at lo-fidelity prototype stage. Between 2019-2020 the design focus of the research was to explore ways that generative design toolkits could be used, toward a purpose of discussing the concept of The Timeline in an IIVE, without actually entering the CAVE-style system at all. This led to a positioning paper (Bruce, 2019) and the author gaining valuable insight into an until then unfamiliar design approach. The research at this stage was intended as a two-phase study following an action research design in defining and clarifying a need and to develop practice and IIVE design to alleviate this need (Phase 1). In Phase 2 the intention was to pilot-evaluate the emergent intervention via a combination of single-case design and complexity methodology, using qualitative comparative analysis.

2020-2021

From 2021, the research became what the thesis considers as more HCI focused, where a new supervisor advised to re-enter the IIVE and, from the Study 1 data collection

that took place in this year, build the hi-fidelity prototype. This led to looking at two main literature works, amongst others, that influenced the research:

- Designing With The Body: Somaesthetic Interaction Design (Höök, 2018);

- Interaction Design: Beyond Human Computer Interaction (Rogers, Sharp, Preece, 2011).

Insights from Höök's work are mentioned in sub-section 8.5 in this thesis. In the preface of this literature the author writes: *A successful interactive tool will invite the user to become a sort of centaur, engaging in a smooth, embodied interaction, creating an intimate correspondence between users' actions and system response* (Höök, 2018: p. xvi). During the study that built towards this thesis, Höök's views such as the above-mentioned, very much aligned with the thesis discussion on enactivism. In particular Höök's description of a person and horse become adjoined as one body, very much built with relevance into a narrative that supports people and systems combining, as one body. However, this literature wasn't considered in the literature until late in 2021 and a decision was already made by this point where the design of a digital intervention involving users interacting within an IIVE, was matched to interaction design. The research problem was understood at this point, together with identifying what methods suited an approach to investigate this. As Dalsgaard describes:

> *In design processes, problems and solutions co-evolve as the designer acts not only to resolve known issues, but to explore the nature of the problem…Design is experimental…Designers employ tools and techniques that are essential to their work*

> (Dalsgaard (2014: p.145).

In this thesis, what emerged was the author as researcher exploring ways to meet a known demand for additional services in mental healthcare, from day one. What wasn't clear at this point, was the choice of vehicle to drive a proposed solution forward. However, after stepping into the IIVE and then applying the rapid prototype design to this digital setting, it became clear that the original prototype room could be mapped directly onto the immersive one. From this point forward, the literature became one methodological tool, with reading into interaction design stemming from

this. Importantly, there was greater emphasis from this point as a doctoral study, that it was firmly situated in the field of HCI.

5.2 How did the literature review inform the design thinking and the analysis?

In the literature review chapters 2-3 this thesis inquired into ontological assumptions relating to mental healthcare models of delivery, together with how leveraging of technologies and embracing emerging philosophical concepts in a new era might offer platforms to meet the demand of a critical social problem. In viewing through an enactive lens, the study has assumed that people and the environments they inhabit have potential to be understood as co-joined, whereby the environment itself can offer potential to be utilized, offering opportunity to interact.

From an HCI viewpoint this is important because to understand how people interpret and seek to utilize systems, as with any form of technology, links to their user-psychology and the ways their behavior applies. In their seminal work: *The Psychology of Human-Computer Interaction*, Card, Moran and Newell posit that the system designer be the main agent to apply psychology. As '*the possessor of the relevant applied psychology of human-computer interfaces*' it will become possible to trade human behavioral considerations against the technicalities of system configuration and implementation (Card, Moran, Newell, 1983: p.12).

In line with a study that has set out to understand the phenomenological experiences of people within an IIVE as a system, the methodological approach in this thesis is defined as inductive, qualitative exploratory research and fits the parameters of human or user-centered, interaction design. This is achieved through the iterative development of storyboarding, video prototyping and the process of qualitative, semi-structured interviewing; leading to an in-situ evaluation of a proposed sense-making tool in IIVEs. In total, the thesis research framework highlights:

- an enactive ontology;

- a phenomenological epistemology;

- a pragmatist paradigm of inquiry

The environment in this thesis is regarded as inclusive to and not excluded from the intervention process. In [Appendix 6] a description of the epistemological approach is documented.

5.3 Epistemology: Investigating Interactive Systems in HCI

The current thesis is, as pre-described, situated in HCI, as an interdisciplinary field that analyses with a view to improve interactive processes between users, digital information and environment (Rubio-Tamayo, Barrio, Garcia, 2017: p.1-15). An intention was to design and develop a user-oriented system, as a process to assist what McCarthy and Wright describe as an experience of technology with ability to extend to the sense people make of themselves in their lives, (McCarthy and Wright 2004: p.42). This theme of sense-making became a prominent one throughout the current study. Four threads of technical developments between the 1960-70s resulted in a foundation that allowed HCI to see rapid growth as an interdisciplinary program:

- prototyping and other iterative development in software engineering;

- software psychology and human factors of computing systems;

- user interface software from computer graphics;

- models, theories and frameworks from cognitive science

The concerns that evoked and merged these remain underlying forces within HCI today. A fundamental mission of HCI was and is, to bring multi-sciences such as psychology and sociology to bear upon design (Carroll, 2002: xxvii-3), where methods of usability have drawn upon psychological processes (Olson, Olson, 2003: p.491). In the current study, by applying an enactive underpinning, what this has aimed at is to apply concepts from within the cognitive sciences, to offer insight into the ways that people and systems combine. From a viewpoint of evaluating systems, this aligns closely with an area of work in HCI extending beyond but applicable to the design itself.

5.4 User-centered interaction design

The methodology, as a system of investigative methods, accounts for the role of the participant, as a user of a system in mental healthcare and also as an informant. Experts by Profession inform the design of a prototype, as described in Chapter 7 in relation to Study 1, then tested in-situ by Experts by Experience as described in Chapter 10 in relation to Study 2. The design approach that became central as applied

to this process was interaction design, where the research participants were inclusive and very central to what the research wanted to achieve. As Jerald describes:

> *Human centered interaction design focuses on the human side of communication between user and machine – the interface from the user's point of view...Intuitiveness is in the mind of the user, but the designer can help form this intuitiveness by conveying through the world and interface itself concepts that support the creation of a mental model* (Jerald, 2016: p.277).

Interaction Design has a focus towards user experiences that have a bearing on how they interact and from a viewpoint of contributing academic disciplines that overlap with interaction design, HCI is seen one of many, as shown in Figure 10. Rogers, Sharp and Preece describe that interaction design involves the user experience as central, in terms of '*how a product behaves and is used by people in the real world*' (Rogers, Sharp, Preece, 2011: p.13). In the current study this aspect of real-world application was motivation from day one, even without the application of an immediate interaction design focus.
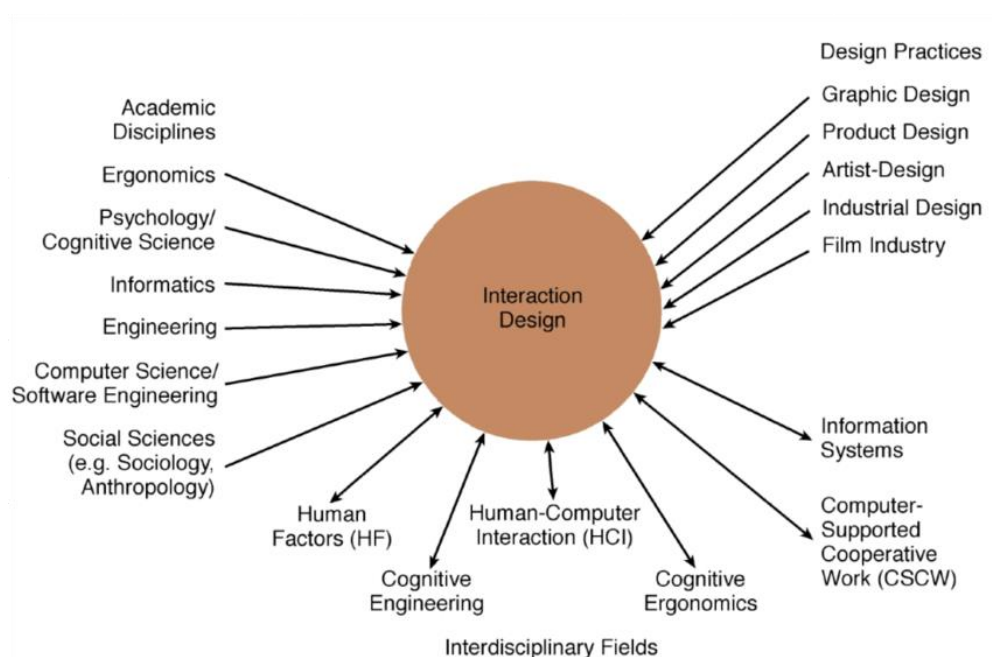
Figure 10: The transdisciplinary nature of interaction design
(Rogers, Sharp, Preece, 2011: 10)

With user-experience at the core of this approach, Dix et al. stress the importance of a user being first priority in the design of systems that present interactive affordances. These authors highlight that information is received and responses given via a range of input and output channels, including visual, auditory, haptic (touch) and movement (Dix et al., 1993: p.9). In the context of this thesis, such a view provides encouragement towards the design, development, implementation, test and evaluation of a system that offers a human participant, or user, an opportunity to engage via as many of the pre-mentioned channels as possible. Explicitly, what the IIVE has ability to incorporate and offer a user, is a multisensory experience appealing to the sense of hearing, seeing, touch and through smell and taste, although these latter two senses do not feature in the system design as applicable to this thesis.

5.5 Methods of Investigation: Hunch, Storyboards, Prototyping

The interactive system was developed through interaction design methods using the following steps:

1. Building on a hunch

2. Storyboarding

3. Prototyping

The Hunch

Ensuring the focus of a product is appropriate is very much at the heart of interaction design, through evaluating what is built and involving users throughout the process. There are different ways to achieve this, and the process can view participants as co-designers (Rogers, Sharp, Preece, 2011: p.15). In this thesis, the design-journey began from an initial "hunch", mapping to a tool called Verplanck's Spiral (Figure 11). Holmquist describes Verplanck's model, where a project starts out with a vague notion of what to do and how this builds from the hunch to what is referred to as a hack, as a form of primitive, technical demonstration (Holmquist, 2012: p.18).
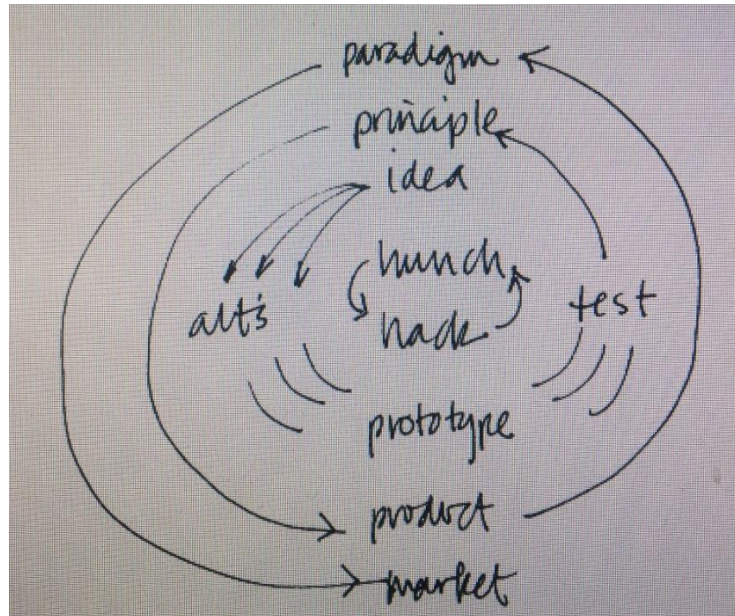
Figure 11: Verplanck's Spiral

Verplanck's Spiral was created by designer and researcher William Verplanck, who is one of the pioneers of interaction design and describes a basic design process as being '*cyclic or iterative, with distinct phases or modes*' (Verplanck, 2009: p.4). Within this process ideas emerge that generate alternatives, prototypes and tests. From the initial rapid dining room prototype, as discussed in the backstory, the hunch led to an emerging of some basic design requirements:

1. The participant was requested to remain stood up from entering the room. What is suggested here is that the participant knows that trauma has already been registered in the body, so by remaining stood up offers a sense of agency and control where they are physically taking part in a process they are leading, not where something is delivered at or to them, as an objectified subject

2. The participant and facilitator stand side by side, implying to the effect of: *I'm in this with you and we are equal partners in this process*

3. With the 'epochs' already mapped out across the three walls, the architecture of the room suggests that the process in leading in a direction other than backwards; by physically moving through a process from past to future

4. By presenting the 'deep past' first, a participant will describe the 'event' at the beginning of the process, leaving physical room to step away from this as the intervention continues

Altogether, the basic hunch led organically through the stages Verplanck sets out in his spiral and from these initial steps built towards a realization of prototypes.

Prototyping

Prototypes provide a means to evaluate solutions based on the examining of design problems, where '*even prototypes made of cardboard are very useful for user testing*' (Houde, Hill, 1997: 368). In the current study three stages of prototypes were adopted:

    i.   Rapid

    ii.   Lo-fidelity

    iii.   Hi-fidelity

The rapid prototype made use of sheets of paper, cardboard and post-it notes, as tools to represent and support (Carroll, 2002: p.223) what then became the hardware in the lo-fi model. As Rogers, Sharp and Preece describe, '*...prototypes involve compromises: the intention is to produce something quickly to test an aspect of the product*' (Rogers, Sharp, Preece, 2011: p.396). Finally, in the hi-fidelity model, this was designed by incorporating the feedback from informants in Study 1, to develop a system with functionality as close as could be achieved through the limitations of a three-year research study. Benyon, Turner and Turner describe: '*...hi-fi prototypes can be used in usability studies to establish whether people can learn to use the system...generally developed fairly well into the project when ideas are beginning to firm up*' (Benyon, Turner, Turner, 2005: p.254). Chapter 6 shows visually how the Rapid, Lo-Fidelity and Hi-Fidelity prototypes were developed and used in the current study.

Storyboarding: People, Objects, Actions

Storyboarding is a technique commonly used in HCI, where users need to see and understand the context, including the physical embodiment of a system, the environment and user interactions to system elements (Truong, Hayes, Abowd, 2006: p.12). There were two descriptions of storyboards used in the current study:

Type 1: These were hand-drawn and informed the design of the rapid and lo-fidelity prototype – see Figure 12

Type 2: These were created in Microsoft Word. This became a useful tool to create the more elaborate storyboards as shown in Chapter 9.
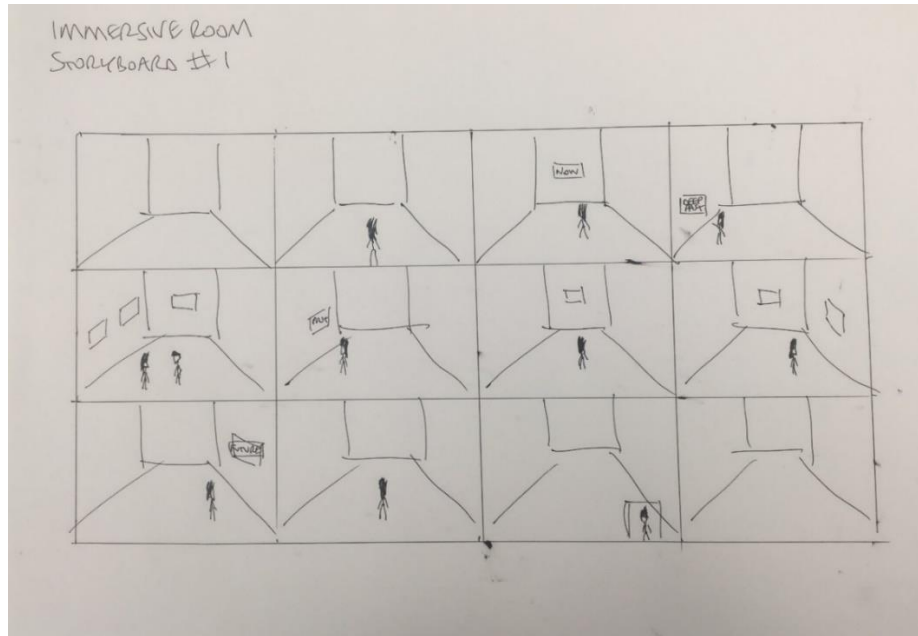
Figure 12: Original Storyboard from Rapid Prototype

Storyboards are effective because they result in expanding initial thoughts onto paper, where from a visual perspective the designer of a system, as an example from the current study, can see ideas emerge in a way that offers chronology through a process. In the context of the study's system and the original prototype being based in a basic room (see sub-section 6.1) what this provided at a glance was an initial view of how a participant as an end user might move through the technology. Elements you might require in a storyboard include people, objects and actions Rogers, Sharp and Preece, 2011: p.393). Translated into this study's enactive system this correlates to: participants, features, affordances, interactive usability.

5.6 Collecting the data: Video Prototyping; Interviewing; Transcribing; Analysis

In Section 7 and Section 10 this thesis will describe the respective study designs in relation to the methods adopted during the data collection and analysis. Due to a global pandemic and subsequent lock-down of facilities, what was intended as an in-situ trial of the IIVE technology with both study groups, was restricted in Study 1. In this first

study with Experts by Profession a shooting schedule was created [Appendix 7]. This was a detailed description of a scene by scene walkthrough of the IIVE technology and The Timeline. It was developed by the lead researcher (the author of this thesis) to enable a first discussion with a filmmaker. This led to further discussions back and forth until an agreed schedule was created. Although The Timeline in its lo-fidelity form was first uploaded as a functional prototype to the IIVE system itself, the use of video, as an eleven-minute video prototype, was created in support of the interviews in Study 1, to permit a virtual means of participants accessing the IIVE and seeing The Timeline in use, without actually stepping inside.

Video Prototyping

As a design decision, it was agreed that the medium of video offered an effective end-result where participants would be able to absorb the objectives of the design at a glance. This was motivated by the fact that video is already an established tool for user interface prototyping and evaluation, where video prototypes can be arranged as scenarios to illustrate how people might interact with a future technology, Vertelney offers: '*Video is useful for specifying user interfaces for technologies which do not yet exist and can emulate the mechanics of real systems without actually having to build them*' (Vertelney, 1989: p.61). The video prototype displayed five scenes, showing: (i) a technician powering up the IIVE; (ii) a participant experiencing features of the technology; (iii) a participant experiencing The Timeline alone; (iv) a participant with facilitator experiencing The Timeline; (v) a participant and facilitator viewing the Scotia Medical Observation and Training System (SMOTS) camera footage as a therapeutic reflective exercise. The footage shows features of the technology as brought to life; how the features of the technology can be experienced; how The Timeline can function both with and independent of the presence of a therapeutic facilitator. This latter feature indicates that users of The Timeline could access independently. Views relating to this being welcomed or otherwise in therapeutic practice are discussed in the results section in Chapters 8 and 11. The video presented opportunity for interviewees to determine what stood out to them and what a more refined prototype might involve. The video prototype showed the technology being powered up in the initial scene to permit the viewer an experience of the full range of functionality, as though stepping into the room for the first time. As Mackay point out:

> *Video prototyping also allows designers to create both interactive and non-interactive demonstrations of software that has not yet been designed. Video is not a replacement for other kinds of information, but it certainly enhances the range of communication possible* (Mackay, 1988: p.2).

Overall and against original intention, this meant that each interview participant in phase one, provided feedback in relation to an impression of, rather than an experience of the technology. Interestingly, what both storyboards and video prototypes as visual assists achieved, was to support therapists as co-designers, as potential end users making sense of a system whilst still in an iterative process of development. As an experimental process in HCI, prototyping overall can adopt a range of tools, from paper-based sketches through to models of a system in varying degrees of fidelity to capture and test concepts. To support the design iterations of the current system in the context of this thesis, what the video prototype permitted was to involve experts in a process as informants, to enable ongoing design decisions to be made from a view of having inside knowledge from within mental healthcare.

Qualitative Interviewing; Transcribing; Analysis

In both Study 1 and 2 the data collection formed part of a qualitative approach, via the use of semi-structured interviewing. The process involved coding the data and developing themes. Williams and Moser describe processes that:

> *'...locate the genesis of a phenomenon, explore possible reasons for its occurrence, codify what the experience of the phenomenon meant to those involved, and determine if the experience created a theoretical frame or conceptual understanding associated with the phenomenon'* (Williams, Moser, 2019: p.45).

In both Study 1 and Study 2 the process involved manually transcribing the audio files from each of the 24 interviews. The data was arranged into individual tables from each of the participant's files. From this point the process involved:

- Open Coding: Single words and short sequences of words to identify concepts and themes to categorize the data

- Axial Coding: Further refines and categorizes themes

- Selective Coding: Enabling the researcher to work towards thematic specificity

Table 5 shows the interview questions in each study group, together with examples from the data management including number of initial codes used to construct what became the final themes. In coding the data the process began by ordering the transcripts in a systematic way and reducing the information to small codes of meaning. These codes were based on fragments of the data that were formed inductively and not established prior to the study. Table 6 shows how the codes developed into a succinct theme.

Table 5: Data Management

RESEARCH QUESTIONS	
Study 1	**Study 2**
How might an IIVE act as a suitable space to conduct mental health interventions?	*How do participants with lived experience of trauma as Experts by Experience interpret their experience of The Timeline situated in an IIVE?*
Interviews x 12 Experts by Profession	Interviews x 12 Experts by Experience
CODING	
First Stage Codes = 468	First Stage Codes = 382
THEMES	
Multisensory Affordances in VR Environments	Active Participation in Therapy
Apprehension to Intrigue to Control	Participatory Control and Choice
Human versus Digital Facilitation	Therapeutic Relationship Dynamics
Environment as a Therapeutic Tool	Sense-Making of Trauma

Table 6: From Codes to Themes

CODES TO THEMES		
Open Codes	**Axial Categories**	**Themes**
Interactive	Technology Impressions	Multisensory Affordances in an IIVE
Supportive		
Welcoming		
Visualizing	Sensory Impact	
Kinesthetic		
Carried you		
Click onto things	Physical Interaction	
Moved you through		
Stepping forward		
Closing the door	Personalization	
Doing the action		
More in control		

5.7 In-situ user-study to evaluate the system

An intention from the beginning of the study was to implement the system in a real-world healthcare setting. To achieve this required discussion with the Health Research Authority and completion of the Integrated Research Application System (IRAS), as a single system for applying for permissions to carry out health research in the UK. This also led to working closely with the Research Governance Team at Durham Tees Valley Research Alliance. Each participant (P013-P024) with lived experience of trauma was scheduled to visit the hospital with 30-minute slots to trial The Timeline. During the visit each participant entered the IIVE and was asked to touch activate the system. This involved them approaching the main facing wall in the IIVE and pressing the initial command. This, in turn, activated a voice that described the purpose of the system and its use in a trauma context. The visits were scheduled across two days.

Key to the study's overall evaluation of The Timeline, as an intervention situated in an IIVE, was that each participant experienced the actual system, as situated in a clinical setting. This supported a study aim in developing a real-world solution to a social problem. What is also permitted was for each participant to visit a clinical healthcare environment and engage with the IIVE and The Timeline in as-close-to-real scenario as possible. The value of in-situ studies are described by Rogers et al. as being good at demonstrating how participants appropriate technologies, but where this can lead to financial cost and difficulty in setting up. The authors offer that in-situ studies can play an important role in the design and evaluation process (Rogers et al. 2007:336). What was fundamental to the overall research process in this study was the enactive concepts being viewed in an actual environment. For example, human participants being engaged in a sense-making process as coupled to their environment became visible due to situating Study 2 in an actual setting. Without this, the concept of an enactive system could not be realized in such a way.

5.8 The author's role in designing the system

Explicitly, the author in this study was involved alone throughout the rapid prototype stage in what could be understood as a call to action. This related to a response outside of academia, where the author then explored, pragmatically, routes to further develop what was begun. More than a year of attempts to bring the initial concept to life

throughout meeting potential supporters of the concept, then led to engaging with an industrial partner, then to academia within the university. Chapter 6 provides insight into how each prototype stage developed.

CHAPTER 6: BUILDING THE PROTOTYPES

6.1 Lo-Fidelity Prototype

In the introductory chapter this thesis describes how the original rapid prototype was developed. In this section the next iteration as a lo-fidelity prototype and the final iteration as a hi-fidelity prototype will be described. The iterative design stages in the study started out from a basic hunch (Table 7), as described in the methodology, based on iterative prototyping stages involved in adapting an IIVE and incorporating: *The Timeline*.

Table 7: Adapted from Verplanck's Spiral, as featured in Grounded Innovation: Strategies for Creating Digital Products (Holmquist, 2012)

STAGE	DEVELOPMENT PROCESS
Paradigm	If product is successful, it could become integrated in reality, or return to any other stage
Enhancing	The product is fine-tuned
Plans	Specific enough to be used for production of actual products
Principles	Principles arise from the tests, as fundamental truths to support a belief system, or on-going behavior, or chain of reasoning
Test	The prototype is tested
Prototypes	Working instantiations (actual examples) of the design which can be tested
Designs	Several alternative avenues present themselves, opening potential for more than one design
A workable idea	The original idea can now be verbalized as a hypothesis as a potential
Hack	First, primitive demonstration (functioning) which validates the hunch
Self-validate the hunch	Prior to the hack, the innovator validates the hunch for themselves – self-validation
Doubt the hunch	The innovator doubts and as a result several days/weeks pass whilst the hunch 'internally develops
Hunch	Basic notion

From this point forward the initial concept was refined, involving the human perspective throughout the process. As an example, while the origins of the study are regarded as non-academic, this still followed a rigorous process in terms of requesting and obtaining consent from first stage participants. A user test of the basic rapid prototype model led to building on what was referred to as building on an effectiveness trial and gathering some early data as participatory responses outside of academia. What became possible in involving therapists, as experts by profession, during the lo-fidelity prototype stage, was in:

- Considering user experience from a therapist view and the clients they engage;

- Improving user experience;

- Reducing fear or discomfort within the system's use;

- Developing insight into what a hi-fi prototype could resemble and to account for the data response.

The lo-fidelity prototype was designed, as inferred previously, entirely by the author of this thesis, taking 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 a VR system in 3D. As a first step a series of Post-it notes (Figure 13) 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*. The available Unity software was used 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. JPEG, MP3 and MP4 files were uploaded 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 space for self-reflection with lesser felt demands and a calming influence upon the person experiencing these. Figure 14 and Figure 15 show two versions of a cardboard shoe-box prototype used to initially imagine movement inside of the immersive space.
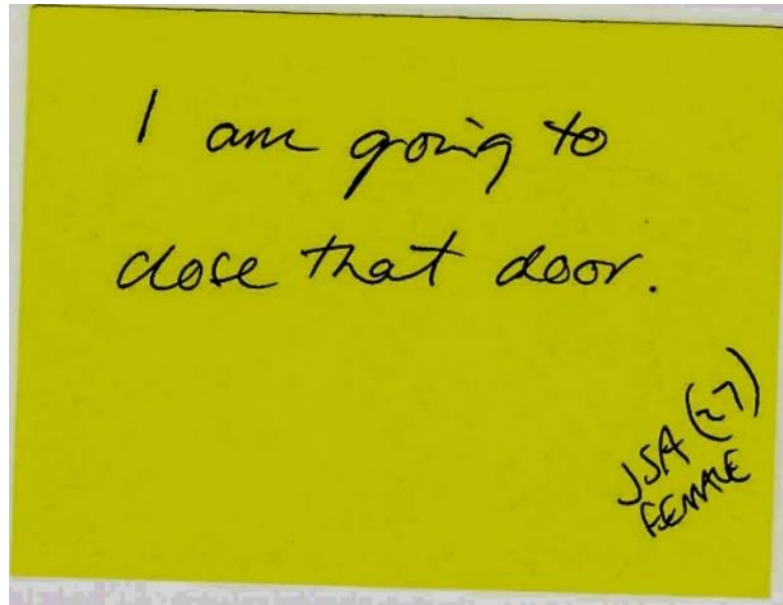
Figure 13: A Jpeg scan of a Post-It note
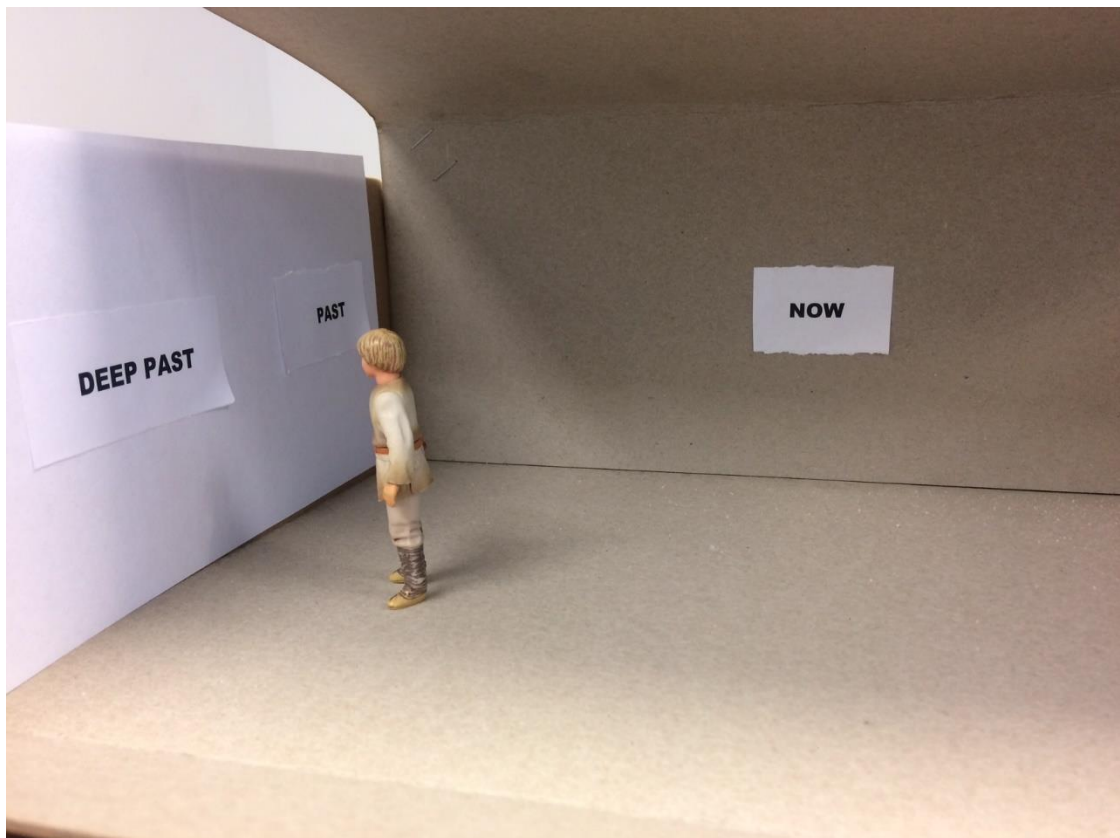
Figure 14: Lo-fidelity prototype model from cardboard show box and plastic figure
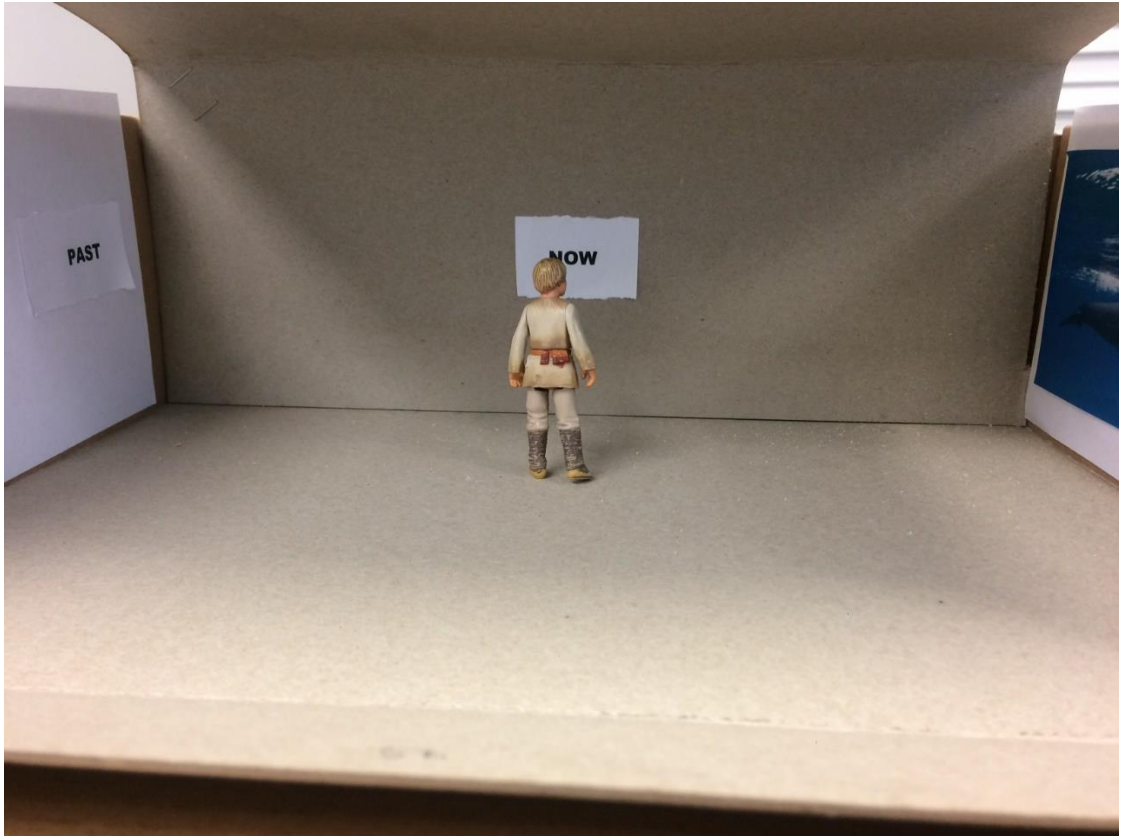
Figure 15: Lo-fidelity prototype model from cardboard show box and plastic figure

An IIVE of the type described in this thesis is installed bespoke to each setting, typically in a room ranging between 3-8m²; 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 the 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 is user-ready a technician commissions the system involving adjustment of the projector outputs to each wall, calibrating the sensors and balancing the audio, as in Figure 16. In Figure 17 and Figure 18 there are two examples of the calibrated system in use.

Figure 16: Technician using a grid layout of squares to ensure each wall is balanced

Figure 17: Actor interacting with the content created using Unity software

Figure 18: Actor interacting with a panoramic 270 degree video file

In total, the rapid and lo-fidelity prototypes became a platform for discussion. These also offered freedom to be in the IIVE and to try out uploads via a range of still, moving and interactive media. From a perspective of ensuring safety within the IIVE and considering what The Timeline might offer as a proposed digital therapy, the author, as designer, as researcher, became the first trial participant.

CHAPTER 7: STUDY DESIGN 1: EXPERTS BY PROFESSION

7.1 Main Objective

The research question we responded to in Study 1 was: *How might an IIVE be viewed by Experts by Profession 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 or to reflect on the design'* (Leiva et al, 2020: p.3). 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* (Bardram et al, 2002: p.177). The video prototype was useful in responding to many questions, mainly due to the fact that the thesis author was present in the video itself and had to step through each stage of The Timeline as a process. This led to questions being answered around the order of scenes, then supported by the data response from participants in Study 1.

7.2 Participants, Recruitment and Sampling Strategy

The main recruitment in Study 1 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 UK. 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. Each participant received Participatory Information [Appendix 11] provided consent via a Consent Form [Appendix 12] for audio-recorded interviews. All respondents were recruited in the North-East of England and, due to accessibility, were recruited as a convenience sample group. As a first-stage academic study recruiting a relatively small number as representative of a target population,

convenience sampling is used as a means of developing objectives for use in more rigorous research studies (Stratton, 2021). From a pragmatist view, the target population might meet factors as straightforward as showing a willingness or availability at a given time. In the current study, an aim was to gather responses as data from people with lived experiences of working with or living with mental health challenges. Etikan, Musa, Alkassim suggest that with convenience sampling as an approach: '*It is compulsory for the researcher to describe how the sample would differ from the one that was randomly selected and to describe subjects who may be excluded or overrepresented*' (Etikan, Musa, Alkassim, 2016: p.2).

In the recent study two types of experts were recruited, first by profession and then in the latter study by experience of trauma. In both instances the 'qualities' the participant possesses was taken into account and a dedicated level of discussion with the research partner. In preparation for Study 1, the partnering company was visited on several occasions as this was their first involvement with an academic research study. From the 12 participants the was clear that each has varying levels of experience in mental healthcare related work at a professional level. What could have been more represented were therapists who engaged directly with mental health traumas and if a random sample was recruited, this could have been inclusive of a broader representation in higher numbers. Because the study was interdisciplinary, this offered potential to recruit from the Health and Life Sciences faculty, whereas a study that might have been only HCI-based would not have had this freedom and this could have resulted in recruiting non-experts. Section 9.2 elaborates further on the selection choices across each of the two studies.

7.3 Inclusion Criteria, Schematic Overview

It was initially intended to engage with participants throughout the process where all interviews would take place in-situ, inside of an immersive room at Coach Lane's Clinical Skills facility within Northumbria University. When the study secured a working partnership with Alliance Psychological Services, it became clear that interviews would take place in the Teeside geographical region. The thesis' author considered each study, 1 and 2, where an appropriate strategy was involved in approaching data collection in a way that suited the participants as well as the respective studies themselves. Hence, whilst the study's interviewing process in Study

1 was conducted remotely, as pandemic restrictions were lifted, the focus in Study 2 was to gather interview responses from an initial demonstration and testing of the immersive interactive technology, in-situ. As a schematic overview of the study, Table 8 represents the study's design across both Study 1 and Study 2. Note, as a screening method the Impact of Events Scale was only used in Study 2, when engaging individuals with lived experience of trauma. Additionally, the video prototype was only used in Study 1, where in-situ contact could not be made with the participants.

Table 8: Schematic Overview

PROCEDURE	THE TIMELINE			
	Screening	Baseline	Study 1	Study 2
Inclusion Exclusion Criteria	X			
Participatory PIS	X			
Consent Form	X			
Impact of Events (IES-R)	X			X
Video Prototype			X	
Phone Interview			X	X
In-Situ Demonstration				X
Participant Notes Template		X		
In-Situ Trial				X
Phone Interview			X	X
Debrief			X	X

7.4 Interviewing

The interviews – see Interview Template [Appendix 13] ran from January to February, 2021. Participants were coded for anonymity (P001-P012) and initially asked about their current employed role. We trialled 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.

7.5 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 six-step guide involving: reading and re-reading the transcripts, semantic and latent coding, cohering themes and arranging the data (Braun and Clarke, 2006: 77-101). 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 (Maguire, Delahunt: 2017: p.1-14). 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.

The next table (Table 9) is adapted from Braun and Clarke's thematic analysis and, pragmatically, the process involved creating an A3 table where responses could be logged and initially analysed. There were options to use software such as NVivo but the researcher found the manual method supported an ability to lay out the coded sheets on a table and systematically work through each item. Table 9 shows each stage as it applied to the process broken down.

Table 9: Adaptation of Thematic Analysis Steps

PHASE	DESCRIPTION
Familiarise	Familiarising with data via listening to each audio-recording and transcribing it, verbatim;
Capture	Creating an A3 table to capture each individual interview responses alongside the interview discussion point
Highlighting	Highlighting small chunks of data with relevance from each individual response
Grouping	Grouping the individual chunks of data with all interviews combined
Inferences	As the data is being analysed inferences are statements, more akin to sentences, that can be used later when formulating a research paper
Single words	Single words from the data when collated can become a powerful visual, or a table
Generate Codes	Generating codes (Study 1 = 468; Study 2 = 382)
First stage themes (Semantic)	Themes in relation to the codes; Themes in relation to the entire data set; Explicit and surface meanings based on what data provides
Next stage themes (Latent)	Themes that may be underlying and require more interpretative, conceptual orientation of data
Report	Work the study's themes into a format where these become engaging text, for example in a research paper or thesis chapter

Particularly, the approach described in the table permits different ways of using the data after the analytical process and in this way builds into further tasks that were undertaken as part of the current study, such as a continued, year-by-year, attempt at publishing research papers.

CHAPTER 8: THE HI-FI PROTOTYPE

[1]

8.1 Storyboarding, Design Aims

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 and who sponsored the PhD as a doctoral study. The thesis' author met with the team and discussed the design aims. Initially, components of the original and lo-fidelity prototypes were discussed, then a scene-by-scene storyboard (Figure 19) and a script were compiled. This was a process that lasted several months, whereby because the thesis author had self-designed both the rapid and lo-fidelity prototypes and interviewed the participants in Study 1, all of this was fed into the hi-fidelity prototype design.
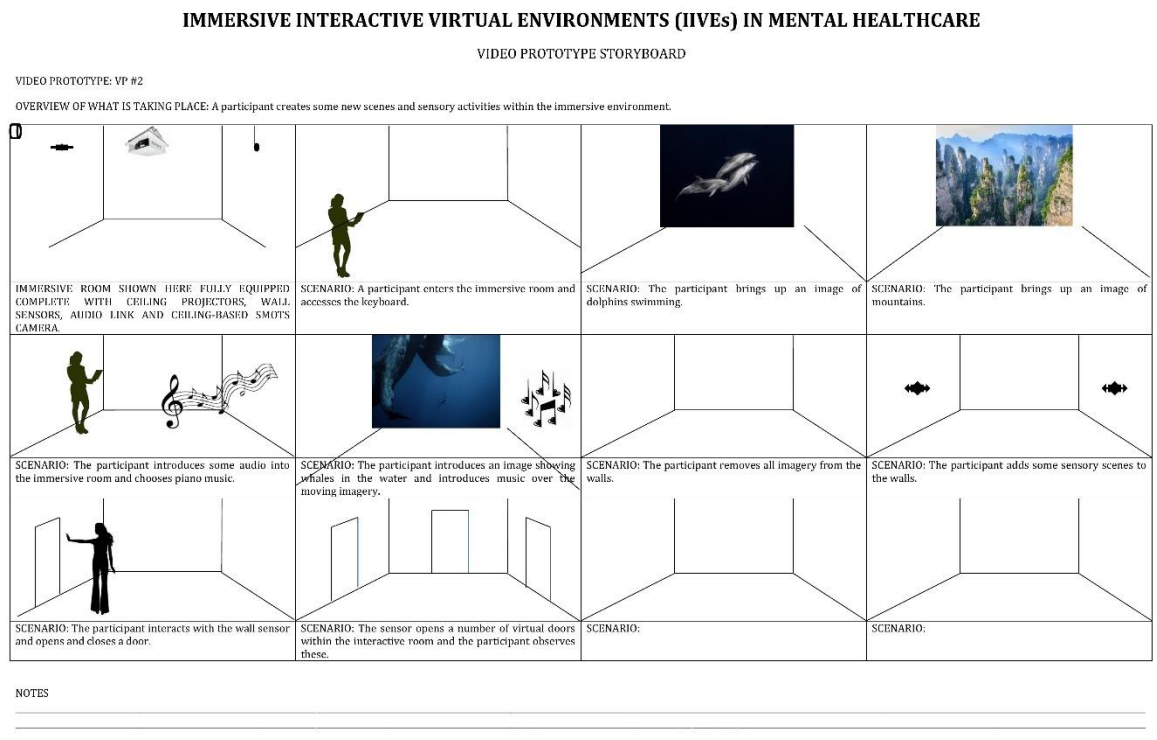
Figure 19: Storyboard (Hi-fidelity model)

The storyboarding process was valuable as while the in-situ designing was very much within the IIVE as a technology, the storyboards permitted room to step back and consider how a user might navigate the system step by step, or frame by frame.

8.2 Scripting, Wireframing the experience

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 Document for the experience and then a wireframe prototype using Adobe XD, to develop an interactive mock-up (Figure 20) – see also [Appendix 14; Appendix 15]. Figure 20 shows the main backdrop when a system-user enters the room; then and image of the types of virtual reality doors entered as users' journey through The Timeline as a therapeutic process. The final two images in the sequence show a tree image used in The Metaphor Room (see Chapter 9 table and footnotes) and then an open highway, used as part of a user's focus toward their future. What was incredible from a design viewpoint, at least to the author of this thesis, was the way that 2D imagery could be brought to life inside the IIVE. This visual content, as well as the Unity software offering the ability to see the imagery move, very much supported a concept of immersion. The images shown in Figure 20 have very feint blue lines running vertically, splitting each image into thirds. This indicates how the images are presented across three walls inside the IIVE.
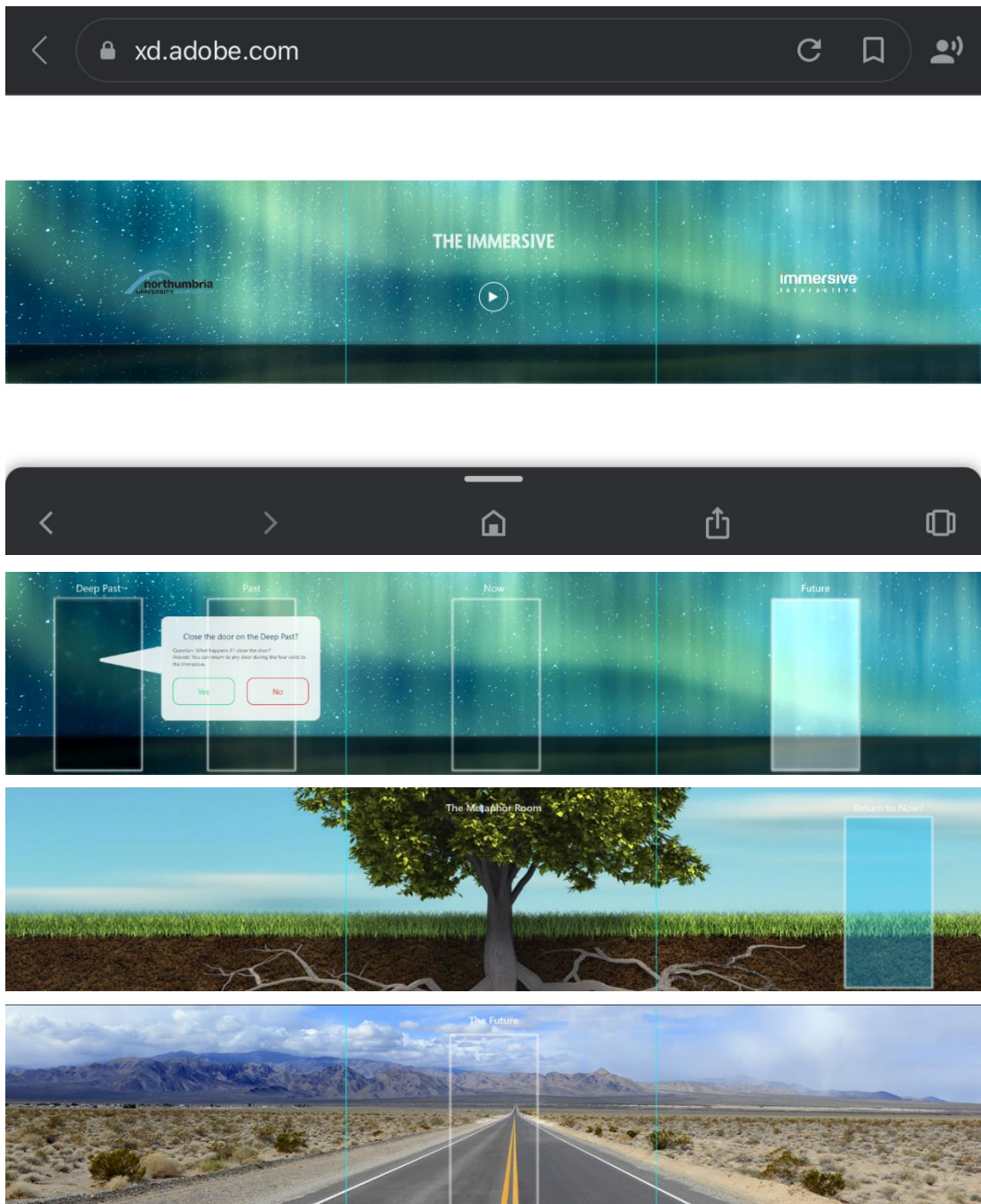
Figure 20: Wireframe imagery created using Adobe XD

Table 11 and Table 12 show the step-by-step build of *The Timeline*, together with an example of the audio script. This is included to show the level of multidisciplinary effort that goes into creating content. The lo-fi prototype content was more straightforward and whilst labor-intensive, lacked the finesse of the hi-fi model. Careful attention was paid to details and in a real way the content creators are very much digital artists. The audio script in Table 12 was used during the design

discussions in considering how it might be possible to deliver audio throughout The Timeline as a process, without a facilitator. This was not included in the final build, but was a useful process to explore what could become a fully automated system.

Table 11: Step by Step Building The Timeline

ITEM	DESCRIPTION OF STEPS
1	Initial concept discussed between Lead Researcher and Content Creation specialists
2	Determine the design aims for the technology
3	Information gathering
4	Review what has already been done already – what exists?
5	Create a scripted, step-by-step overview, scene by scene
6	Hub and Spoke Format: plot out a diagram for how it all fits together
7	Sourcing of visuals and sounds for the feel of the experience – colour palettes
8	Online programme called Confluence – used to create the Design Document for the experience
9	A wireframe prototype is created using Adobe XD – as an interactive mock-up of the experience
10	Revision with client for revisions of the wireframes
11	Saved the wireframes as "locked" and then development
12	Sourcing the final assets required to build the experience, MP3 and MP4 and Jpegs, sound effects, the voice-over, background imagery and video, sourcing 3D assets, e.g. sourced from the Unity Asset Store; Subscription to a Stock Image website. The Timeline is running immersive software – eventually Immersive Studio.
13	We create in-house graphic design user interface graphics
14	Now all assets are here to build the experience and it goes
15	Experience Creators (Arron) who pieces it all together in Unity
16	A Test Build in the actual environment, full scale
17	The Project Manager and Designer pass on feedback and changes made
18	Fully functional experience goes to the client
19	Secondary interaction
20	Ethics
21	IRAS Approval
22	Trial in hospital
23	Evaluate

IMMERSIVE INTERACTIVE VIRTUAL ENVIRONMENT
AUDIO SCRIPT

SPEAKER	COMMAND
SYSTEM VOICE	Hello. Welcome to the Immersive Interactive Virtual Environment. We also call this the IIVE. Please say: Okay, when you want to move to the next command.
VISITOR	Okay.
SYSTEM VOICE	The IIVE offers a multisensory space and a responsive environment. If you want to proceed say: Okay.
VISITOR	Okay.
SYSTEM VOICE	The IIVE is used in different ways, for example in education or in training or in healthcare. It can present images and video and sounds and you can interact with these in a safe and accessible way. If you would like to see some example say: Okay.
VISITOR	Okay.
SYSTEM VOICE	The IIVE offers content and programmes. I will show you some content and then we can try out a programme used in mental healthcare. You have already completed some paperwork so we will use this soon. If this is okay then say: Okay?
VISITOR	Okay.
SYSTEM VOICE	Here are some visual images. These can cover one wall or all three walls. Now we will look at some videos. When you've seen enough, say: Okay.
VISITOR	Okay.
SYSTEM VOICE	I will now show you a programme. This one is used in mental healthcare. If you want to proceed say: Okay.
VISITOR	Okay.
SYSTEM VOICE	The programmes in mental health cover: Anxiety; Depression; Phobia; Trauma. Today we will look at trauma. After you've pressed this say: Okay.
VISITOR	Okay.
SYSTEM VOICE	We are now entering: The Timeline. We will experience this first by ourselves, then we will be joined by a facilitator. If this sounds okay, the say: Okay.
VISITOR	Okay.
SYSTEM VOICE	The Timeline offers a journey from the Deep Past through to the Future. You have already created a Timeline. If we can now show this on the wall say: Okay.
VISITOR	Okay.
SYSTEM VOICE	Here is the Timeline you completed. Now we will upload this to I270. Is that okay?
VISITOR	Okay.
SYSTEM VOICE	The 1270 is a multisensory, responsive, intuitive environment. Could you begin by clicking the icon on the Now wall. Can you then think of something positive in your life right now and focus on this. The facilitator will then join you. Thank you, it's been a pleasure to meet you.

Table 12: Audio Script

8.3 The Final Assets

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.

In total, the hi-fi prototype design was influenced by data-responses from P001-P012 from Study 1, 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 wall-triggers 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, holistic 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 in relation to a conceptual whole – where brain, body and environment can be arguably acknowledged as a singular system.

With consent from three of the study participants the study was able to take still imagery from the SMOTS camera footage as shown on the next page (Figure 21; Figure 22). This footage was from a direct recording of The Timeline being tested as with the images in Figure 23 and Figure 24.

Figure 21: Participant at James Cook Hospital entering The Timeline
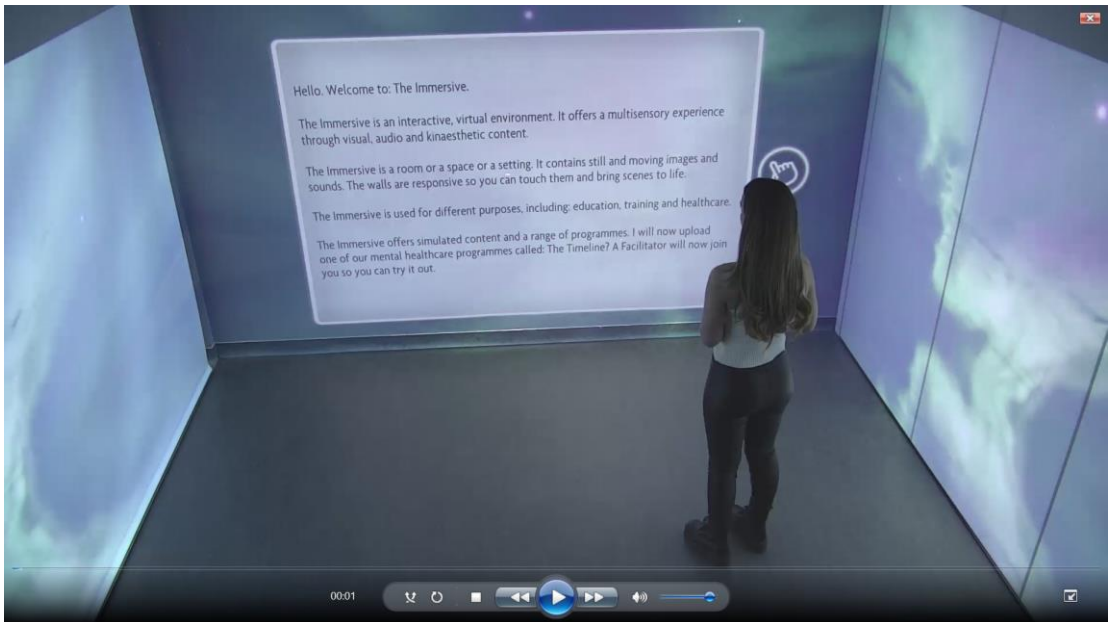
Figure 22: Participant at James Cook Hospital listening to audio instructions

Figure 23: Participant at James Cook Hospital inside of The Metaphor Room

Figure 24: Participant at James Cook Hospital considering The Future

8.4 What is The Timeline and why is it useful?

The physiological system of an individual, brain and body, can become compromised with trauma. This being the case, a multisensory response is accompanied by a system that permits physical touch and interaction. In designing a lo-fidelity prototype and repurposing an existing technology, the study gained response from expert clinicians in mental healthcare via semi-structured interviews. Additionally, during the few months of shaping the initial rapid prototype, while

observing participants including participant J as described in the introductory section inside of the space, the following observation notes were made:

"The participants are actors[29], in a worn costume, within a rectangular box. The lines they instruct themselves to absorb and embody, become a refreshed narrative and thus, a metamorphosis begins, from the traumatised human construct they'd believed was themselves, into the transformed image they then embrace, via a lesser traditionally-rigid cognitive architecture. That they step away into the wings, empowered and with renewed autonomy; moving less hunched by weight of their deep past, seems no trivial matter."

Observation Notes (2018)

A theory, unsupported by any literature at this point, was: If the human body and the immediate setting can become inclusive to and not disregarded from psychotherapy, then a person presenting trauma who is in the process of experiencing an intervention, has enhanced potential to overcome what is regarded as a cognitive challenge, engaging in embodied ways with multisensory affordances of the environment as sense-making tools. Table 13 provides a summarized, step-by- step insight into what each participant engaged in. Table 14 offers some of the component parts of the system and their function.

---

[29] Section 2.5 refers to this.

Table 13: 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 voice30 welcomes and describes purpose of the system
3	Approach and press illuminated touch sensor point reading: The Timeline
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 door31 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[32], Metaphor Room[33], Cognition Room[34]
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

[30] 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.

[31] 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.

[32] Word Room contains a series of changeable words that act as discussion points for the participant or between the participant and facilitator.

[33] 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.

[34] 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.

Table 14: Component parts and functionality of the system

ITEMS	DESCRIPTION OF WHAT AN IIVE CAN OFFER?
Space	A user-participant enters space
Experience	An experience begins
Auditory	A voice speaks and describes the setting
Visual	Visual cues appear as directions through the experience
Kinaesthetic	The user-participant engages
Externalisation	Conceptually, the user-participant externalises their narrative
Chronology	The Timeline presents a chronological from Deep Past to Future
Metaphor	The Timeline; An Open Road; A Tree; A Cognition Room
Agency	Action, producing a particular effect
Affordances	The environment offers the user-participant action-possibilities
Coupling	User-participant and environment are paired
Soma	The body is engaged
Sensorimotor	Sensory nerve and motor function potential
Cognition room	Experiential; Neurophysiological; Sociocultural; Existential
Environment	Collectively, the whole system is an environment
Dynamic Feedback	Human response to features of the setting
Positive Feedback Loop	Ongoing relationship with where output of action has an eventual effect on the user-participant (Roberts, 1978: p.1)
Self-adapting	The system doesn't do the work. It is the user-participant and the system that adapt together towards a goal of closing a door down on the deep past and re-imagining a future

Whereas Table 13 provides insight into what a system-user does in working through *The Timeline* step by step, Table 14 describes the system functionality and its range of uses. In a context of mental healthcare, while the data from participatory trial offers insight into how users perceive the IIVE, Table 14 suggests that, as a system, it promotes the adoption of an environment as inclusive, not disregarded in practice. How the hi-fidelity prototype evolved beyond the two previous iterations can be described step by step. When a participant enters the IIVE, they are welcomed by an audio voice describing what the system is capable of. This audio is described here:

Hello and welcome to The Immersive. The Immersive is an interactive, virtual environment. It offers a multisensory experience through visual audio and kinaesthetic content. The Immersive is a room or a space or a setting. It contains still and moving images and sounds. The walls are responsive so you can touch them and bring scenes to life. The Immersive is used for different purposes, including: education, training and healthcare. The Immersive offers simulated content and a range of programmes. I will now upload one of our mental healthcare programmes called: The Timeline? A Facilitator will now join you so you can try it out.

From this point forward the participant is joined by a facilitator and invited to press a command on the wall, reading the word: *Trauma*. Alternatively, the command could read: Anxiety, Depression, Suicide Ideation and these commands were also built into the system, but not made active on the wall. At this stage three of the walls in the IIVE are lit up and contain a series of virtual reality doors: *Deep Past, Past, Now, Future*. The participant is asked to approach the door reading: Deep Past. When the participant interacts by touching this door an image of two post-it notes appears. These read: *Person and Event*. The participant is then asked to describe a person or an event, or both, that impacted their Deep Past. At this stage of the process, or what could be called an experience, the participant speaks to the facilitator, who may be stood directly beside them, or behind them. The facilitator-participant dynamic here is intended to be stood side by side, as this was considered during the design process and from Study 1 data to be potentially supportive to a user. From the discussion at this point the participant is asked if they want to close down the door on the Deep Past and proceed to the next door. This process continues, as listed in Table 13. What becomes additional is what can be achieved inside each of the virtual rooms. For example, the discussion inside of the Cognition Room might involve a person discussing their socio-cultural history, or some of their life experiences that have build towards influencing the current point. Additionally, when a participant stands facing the future wall in the IIVE, a choice must be made as to whether the participant wants to return to any particular part of The Timeline, or move on. In the Study 2 results in Chapter 11, participants who are related to as Experts by Experience, who have a lived understanding of trauma, journey through the motions of trialing the IIVE technology in situ. What this offers to the thesis are insights from users relating to how they envisage the hi-fidelity prototype as a functioning, working model.

CHAPTER 9: STUDY DESIGN 2: EXPERTS BY EXPERIENCE

9.1 Main Objective and Protocol

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 in relation to 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 the protocol 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 (NHS, 2022). Author 1 met participants on site and was present throughout each of the 12 trials.

9.2 Participants, Recruitment and Sampling Strategy

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. Study 2 adopted a convenience sampling strategy with the sampling number based on an anticipated number required, before repetition of the same data-response (as a saturation point) is reached. Guest, Bunce and Johnson found 12 interviews enough to achieve saturation within a homogenous group (Guest, Bunce, Johnson, 2006). 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 conclude that the agreed upon sample number depends on multiple factors (Baker and Edwards, 2012). This thesis acknowledges that a recruitment sample could have achieved greater diversity, for example containing multi-gender participants. Additionally, the sampling strategy could have involved specifics, such as only involving individuals with experience of sexual assault. As was the case, there was no indication that the recruited participants would be all-female and no indication as to the diversity of the trauma. What the research in this thesis wanted to explore, was the views of people with lived experience of trauma, which the study achieved. The thesis acknowledges limitations of a convenience sample where maximum variants could have been achieved by recruiting from a multiple range of recruitment partners. The "convenience" in convenience sample is not implying that it was easy to get the participants, but rather that is was the sample group that was (made) available.

A non-convenience sample in this case may have screened for example 100 people with trauma, and from these picked e.g. 10 male, 10 female, with a specified impact score (see 9.3), and compared the results of the different properties of the subjects. This is what a clinical study might look like but the current study did not have the possibility to allow this so the study "took what it was offered" by the research partner, therefore highlighting the convenience factor. While it was not "convenient" to get these subjects, this is the correct term unless a more elaborate selection of participants was made.

9.3 Impact of Events Revised (IoE-R) Scale

Each participant taking part in Study 2 completed the Impact of Events (IES) scale, originally titled the Impact of Event (singular) Scale as a simple report measure (Weiss, 2007: p.219). This involved the thesis' author telephoning each of the study participants and asking a series of questions, as listed in the. The IES-R was developed in 1997 by Daniel Weiss and Charles Marmar to reflect the DSM-IV criteria for post-traumatic stress disorder (PTSD). The original Impact of Events Scale (IES) predated the adoption of PTSD as a legitimate diagnosis in the DSM-III of 1980 and measured two of the four DSM-IV criteria for PTSD; specifically re-experiencing, intrusion, avoidance numbing (Weiss, Marmar, 1997: p.399-411). The IES-R was designed to also assess hyperarousal. Other criteria include exposure to a traumatic event, duration of symptoms and impairment due to symptoms.

The maximum mean score on each of the three subscales is '4', therefore the maximum 'total mean' IES-R score is 12. A total IES-R score of 33 or over from a theoretical maximum of 88 signifies the likely presence of PTSD. This scale was provided to each participant taking part in Study 2 and the scores discussed with Alliance Psychological Services. In the event of a participant scoring 33 or over their participation in Study 2 was discussed with Alliance Psychological Services, as shown in two cases with P017 And P020. Each Impact of Events Scale was recorded, as in Table 15 and combined with the Inclusion Criteria, as shown in Table 16. It is noted here the scores were highly variable in that one participant scored 0 and two others 61 and 79. All participants met the inclusion requirement having been through varying experiences of counselling and all consented to take part as demonstrating no current risk. A voiced description of why two scores were so high linked to one participant

disclosing that her relationship break-up was still continuing and the other voiced that the memories wouldn't go away.

Table 15: Impact of Events Scale scores

PARTICIPANT	IMPACT OF EVENTS SCORE
013	4
014	0
015	6
016	1
017	61
018	31
019	18
020	79
021	3
022	18
023	8
024	14

Table 16: Inclusion-Exclusion Criteria

INCLUSION	EXCLUSION
▪ Participant is male, female or transgender and is age 18 or above ▪ Will adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Has identified some form of trauma from their past ▪ Has agreed to sign a Consent Form having received full research study information via Participatory Information PIS sheet ▪ Is not currently a drug user or excessive alcohol ▪ Client has received two or more blocks of counselling, e.g. CBT/EMDR/IPT through Alliance Psychological Services and is no longer receiving therapy ▪ Client is demonstrating no current risk ▪ Has been made fully aware of all ethical considerations ▪ Has agreed to complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Has agreed to discuss Impact of Events Scale with gatekeeper at Alliance Psychological Services	▪ Is under 18 years of age ▪ Will not adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Participant who does not identify some form of past trauma ▪ Participant will not sign a Consent Form or read to Participatory Information PIS sheet ▪ Is a current persistent user of drugs or alcohol ▪ Has not received counselling through Alliance Psychological Services or discussed the study with this company ▪ Demonstrates current risk ▪ Has not been made fully aware of all ethical considerations ▪ There is no contractual arrangement between the Researcher (Northumbria University document) and the participant ▪ Will not complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Will not agree to visit James Cook Hospital and take part in demonstration of technology

▪ All ethical considerations are explained ▪ Clear contractual agreements between the client and the research study ▪ Has agreed to visit James Cook Hospital and take part in demonstration of technology ▪ Able to comply with the study requirements	▪ Will not comply with the study requirements

9.4 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 [Appendix 16] each participant as part of a convenience sample confirmed having lived experience of trauma and provided their own definition. Interview questions can be seen at [Appendix 17].

9.5 Data Collection, Analysis and Measure

The transcripts were used for the basis of a thematic analysis and followed Braun and Clarke's six step guide (Braun and Clarke, 2006). The use of qualitative interviewing to obtain perspectives from potential future adopters of VR therapy follows other research such as (Dilgul et al., 2021); (Kip et al., 2019). When interpreting data, we were mindful of any subjective bias that might form, with Galdas reporting on the need to employ mechanisms to minimize this (Galdas, 2017). 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 (Morse et al., 2002) to establish validity.

CHAPTER 10: RESULTS STUDY 1

The Timeline is conducive to different therapies and modalities and creates a potentially improved outcome to verbal, seated therapy. The interface facilitates change as a vehicle containing empowering tools for change. The process Tor has designed and developed in the immersive room actually enhances and speeds up connection, fast-paced. It recreates events that are impossible to achieve conventionally and offers massive support for people with traumas making sense of where they've been, where they are at and a life they want to build towards.

Leanda Kane-Fidgeon, Director, Alliance Psychological Services

10.1 Introduction

Study 1 was conducted as part of an iterative process to inform Study 2. This chapter will describe the results and then present what emerged as a meta theme from Study 1. All participants were provided with a video prototype showing the range of functions of the IIVE, through to a participant experiencing: *The Timeline*, both independently and accompanied by a facilitator. 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 and will be discussed in Chapter 11.

In building initial rapport with each of the experts in study one and to establish an understanding of some of their general or more broad views, relating to the study, an initial background discussion point was based on their view of mental illness. This resulted in Table 10:

Table 10: Experts by Profession: Views of Mental Illness as a Term

PARTICIPANT	VIEW
001	*"It is a spiritual crisis; exasperated by social inequalities."*
002	*"I think diagnosis and giving people labels is detrimental."*
003	*"I think there's a lot of stigma around the words mental illness and I think the words don't help with that stigma."*
004	*"I like to compare it with physical illness."*
005	*"It can be a chemical imbalance; It can be environment."*
006	*"It's a good kind of catch all in terms of when we are talking about when our mental health is not helping us."*
007	*"You could describe it as mental disturbance or mental uncalmness."*
008	*"I don't like the term. My primary modality is a humanistic view."*
009	*"I would term mental illness as difficulties in managing some of the symptoms that come with distress or upset."*
010	*"I think it's really hard to define a mental illness. For me it's about mental health."*
011	*"A spectrum."*
012	*"I don't believe it exists. There's no such thing as a mental illness other than a few organic conditions such as dementia and head injury."*

It was encouraging to gain insight that respondents held majority views advancing beyond a biomedical, brain-related view of mental illness, to one that highlighted a potential importance of viewing a person's challenges as being connected to "social" (P001); "environment" (P005); "organic conditions" (P012). This implies a more broad context with regard the challenges people face who access mental healthcare services. Also, in relation to P002 and P003s comments around detrimental labels and stigma, authors Stutterheim and Ratcliffe (2021) suggest: *Stigmatization is a socially and culturally constructed process by which a person can become devalued*. The authors describe the importance of qualitative studies, whereby qualitative research is required that '*promotes agency and empowerment*' resulting in '*stigma reduction*' (Stutterheim and Ratcliffe, 2021: p.8-16). With this understanding this thesis has understood that qualitative inquiry in general can play an important role where people taking part in research studies can make use of their participation and become informed whilst informing a process.

10.2 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 [...] quite traditional stuff*". P012 worked with psychosis, personality disorders and trauma and had "*quite a bit of exposure to Tele-health […] also computerized CBT programs.*" Relating to online platforms, as became prevalent on a global scale throughout the current study, P005 described: "*Microsoft Teams Video Calling and if I've asked someone to visit a particular site via their computer*" and P006: "*[…] interactive training programmes [...] video recordings [...] video conferencing is a new one for me*".

The interviews presented useful contrasts between a typical setting and the use of technologies in a mental healthcare context and the capabilities of an IIVE, for example in a conventional environment: "*if you are talking about within an institution its usually either in a day room or in a bedroom or in a room where you can get some privacy…which is quite stark…it's not always conducive to what you might want to do in the therapeutic manner*" (P002); "*It's usually in a room with two people, one to one. There would be, two chairs, possibly a desk with a computer; privacy; maybe a flipchart. It's always been the same*"; [P005]; *Usually face-to-face in a room provided by my employer*" [P007]; versus:

> *[…] very tactile, it gets you to sort of engage with it… I would like to be walking around and touching and grabbing and you know, like really trying to sort of engage with the environment* (P006)
>
> *[…] 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]; visually it was amazing for you to be in that immersive room because "*it could really feel like*

you were in that spot [...] more intensely than just looking at a sort of 2D image in front of you because it almost feels like you could be in a 3D image [...] potentially easier for people to access if they are struggling with trauma and consequently struggling with disassociation (P009). 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 (Pozzi, Pigni, Vitari: 2014). 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:

10.2.1 Auditory

"*I think its good to hear a human voice* […] it is a new experience, a new environment (P001); *It was lovely because it was in my dialect. It was very basic, it wasn't threatening... it comes across as being something like them* (P005); […] *it perhaps it just kind of personalizes or humanizes the room a bit… somehow feels more interactive in a way that you can have a conversation*" (P011).

10.2.2 Visual

"*I thought it was fantastic… you know you could be doing this kind of in a built-up inner city and have as good an access to nature as possible [...] I loved the snow, you know when you can sort of interact with the snow[...] I loved the one with the mountain as well, you know like when you are looking out over the tops of the mountains you've got the clouds there any everything [...] I wanted to like stand there and actually experience it*" (P003); "[…] *really liked it when the image sort of encompasses the entire room [...] there was sort of the forest scene where it was just sort of a lot of dense trees, I really, really liked that; and it felt quite calming*" (P006*); "I preferred it when it was entirely surrounded by it [...] My favorite one was definitely the trees one it was just you could almost smell it*" (P012).

10.2.3 Kinaesthetic

"*[…] it would be great to get in and touch and do depending on the clients*" (P004); "*[…] that sweeping movement was actually quite comforting [...] the actual movement of sort of sweeping something away [...] It was a mixture of doing something physical to get rid of something*" (P007); "*[…] absolutely key for this to be used as an*

immersive room in mental health because it gives control to the clients as well and actually, ownership of some of the difficulties" (P010).

This was highly encouraging to indicate that an end user might feel attuned to this type of digital setting in a range of ways. Particularly, from a view of a participant having agency and being coupled to a setting, the responses indicated that through listening, seeing and touching, as forms of interaction, this held possibilities for an enhanced experience.

10.3 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*

145

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.

10.4 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 and P010 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).

> *I would say it would be better working in the field of mental health with the patients at the levels of distress at the times that they come to us that it's actually important that there's a facilitator there […] but then if you can see the benefits of something like Silver Cloud, where it is accessible at home, where it is accessible to them at a time when they are comfortable and they want to look at that information on their own and process it, then I think it does have some benefits* (P010).

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: "*Some people would feel happier having someone by their side…other people would feel happier just being on their own so they could sort of take it all in and kind of be alone*

with their thoughts and then just have the voice sort of speaking to them… I think it depends on the individual” (P003). “*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).

10.5 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*' (Hook, 2018). 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 Chapter 11 this thesis 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.*"

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 stigmatized if it's a better setting"
(P010).

In summary, participants in this study were not familiar with IIVE technology and generally regarded typical environments in mental healthcare as seated spaces. Findings from the interviews suggested that engaging with the environment as part of a therapeutic intervention was favoured, especially with trauma, where multisensory affordances of such a setting could play a role in the recovery process. Participants responded well to the visual, audio and kinaesthetic elements of the system and whilst apprehensive initially, this built to a view that the IIVE as a setting could offer control where a user could take action in making things happen. In relation to participants accessing the technology by themselves or with a facilitator, it was voiced from the data that facilitation or some form of human-connectivity was valued. The notion of physical movement within the space was also commented upon as a positive feature, whereby the movement itself could form part of an overall therapeutic experience. Building on these responses this thesis 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.

The first study gave 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. This extends beyond what is offered in a mainstream context by healthcare services and highlights what interview participants responded to as valuing both the assigned space as well as features of this with freedom to move around and explore.

10.6 Meta theme 1: Active participation in therapy

Analysis from Study 1 indicates 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 and becoming familiar with the system, but that current mental healthcare settings

could be limited from a viewpoint of being actively engaged in therapy beyond a face-to-face discussion. For example:

Again, it depends on your experience and where you've been working. I think, well, community based is going to be generally people's homes so that's going to be the preferred way of working for a lot of people because its their domain, it's a safe environment, you're going to be invited there on their terms and conditions, erm and it seems to be a much more comfortable and fluid way for people to interact because they can, they are much more in control, perceptually, because it's their space and I think that's really important. Then, obviously, you've got other environments that are restricted by the fact that they might be in-patient environments, but, they might be beautifully set out, they might be very erm, aesthetically pleasing, they might be set up in a way that is best part trying to be as comfortable as possible and inviting as possible. But equally I've been in environments that have been very erm restrictive and they look very restrictive you know by the space and the size, of the corridors the rooms, the building kind of almost represents the restriction and the kind of restriction that person has in relation to their mental health (P001).

A lot of work is carried out in the community now, so it would be in the person's kind of own habitat or in their own homes or wherever they would want to be with a mental health nurse or a practitioner…but if you are talking about within an institution its usually either in a day room or in a bedroom or in a room where you can get some privacy…which is quite stark…it's not always conducive to what you might want to do in the therapeutic manner (P002).

Terms such as "*restrictive*" (POO1) and "*stark*" (P002) create an impression that conventional settings in mental healthcare can be problematic and not necessarily ideal as a place to host therapy. By contrast, other impressions discussed therapies hosted in a natural external space, where movement can become part of the intervention itself:

However, I do know of some coaches who are helping people, you know, with things like anxiety and you know perhaps mild depression and so on. I know coaches who do their sessions outdoors. So one of my friends, he erm, lives in Wales near the Brecon Beacons […] I think that's right […] he lives near some

mountains and some hills. He will often take his clients out for a two hour walk and they will walk and talk and do the therapy that way (P003).

From the twelve initial interviews with Experts by Profession, there was a sensing of a latent, underlying narrative, where participation in therapy was, generally, confined to a seated discussion. By contrast it was voiced that with interactivity arrives potential for a sustained sense of participatory control, with IIVEs 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 P012 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.

CHAPTER 11: RESULTS STUDY II

...if we want to get a grip on mental disorders, we should see the 'mental' in its proper context. From an enactive perspective, notions like 'mental, 'mind', and 'cognition' are best understood in terms of sense-making: the embodied and embedded activity of organisms or persons who evaluatively orient themselves in their environments or worlds.

(de Haan, 2020: p.195).

11.1 Introduction

All participants were provided with an initial video, to provide a glimpse of what to expect in the IIVE, prior to entering in person. A total of 12 participants with an age range: 21-72 were interviewed. The mean age was 42 and mean interview 27 minutes. 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 17 shows:

Table 17: 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"*

Analysis of the data led to constructing four themes*: Active Participation in Therapy; Participatory control and choice; Therapeutic relationship dynamics; Sense-making of trauma*. [Appendix 28]. 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 this chapter. 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, Hi-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.

11.2 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.*"

Participants described their initial impression of the environment and used comparisons from television through to describing that the setting had ability to evoke an emotional response:

> *At first I said it was like an episode of 'Black Mirror' because I was like "oh this is different", the fact you could touch the walls and it was all like, interactive, but I liked it 'cause it felt like safe and you were away from everything outside…and the fact that like you were going through these things as like, I don't know from inside your head to process things and dig it out in an environment that's away from everything. So it's not like your just sitting face to face talking to someone* (P017).

It was quite calming…it felt instantly that you'd stepped into a different place (P022).

Just to be surrounded by an environment, because I'm just thinking back to when I walked into that room…there was music playing, so it was, the impact on the senses…so it was hearing the music, it was, erm, I think it was like a kind of sky scene, with stars…it was just, erm, I was walking into a room but I walking into a really spacious place. It was a very immediate response that I had to it, emotional and physical. Very evocative, that's the word I would use (P023).

This feedback was supportive in understanding that participants were not threatened by a new environment and ultimately a novel way to engage in a therapeutic intervention. 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's response related directly to the use of an IIVE as an approach to shift therapy past talking:

I think each room for what it was able to do would open up more conversations, maybe at a greater depth and it just brought different dimensions to therapy […] the writing on the wall, the words and some people struggle to find the right words and maybe that just might just help introduce an area…in my little notes here I've

155

put you can extend from talking…it just might stimulate and help, in different ways (P024)

11.3 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 stepped in, they were welcomed by background music and simulation content based on the *Aurora Borealis*. As such, while "*vulnerable*", "*cold*" and "*apprehensive*" was expressed by P016, P020 and P024 respectively this could have related to the clinical setting itself. 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 choosing, 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 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 thought it was really good and it gets the client to look forward…like I said that moving past the trauma and choosing your destination you sort of had different directions that you could go, you had the future door and then the big road and there was the mountains up ahead…I thought it was really useful to be able to sort of say that the options are open, that the future is wherever you want to go (P016).

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?[…] I liked the visuals around it where it was literally that one big, long road, I really liked that […] I just like the idea of the fact that it's a big, long road because I think when you've been constantly re-living trauma in your head it can feel like no matter how far, far away you're pushing yourself to go, like you're stuck in the past in a way and like people will be like, you are going around in circles and it's like I'm not I'm trying my fucking best (P017).

I think I liked that part the best because that was the road, erm, I sat looking at it for quite some time…and I liked again how it was moving but there was like normal things in the background like a little, it was like a vehicle or something on the left, and it was nice just to look down that long, empty road…I think especially when you've had a trauma it can put you at a crossroad and you've got decisions to make. I felt like I just wanted to get a backpack and go on it. I honestly could have just walked down it and just find out what was

there. Because it is and it's a lonely road but it didn't feel that lonely, even though you were just in a box of a room it didn't feel lonely because of the movement (P020).

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.

11.4 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).

Erm, probably comforting having somebody else in the room with me because like I said it was a little bit feeling of vulnerable, not knowing what was going to happen next, erm, it is all around you so you're looking at every bit of the wall all the space around you […] I definitely think guiding a client through that experience would be more helpful […] I think it would be quite daunting for a client to go in there without some sort of support or guidance on how to use the equipment even (P016).

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).

Yeah, I think that, again, it's very important. How I experienced that when I was in there...you were there, you were there [...] you weren't intruding in the room or on my experience, but you were just there and I think it's very reassuring actually (P023).

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).

11.5 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. In working towards the concluding chapters in this thesis it is pointed out that 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 a 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).

In Study 2, an overarching meta theme was: *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.

11.6 Meta theme 2: Participatory autonomy in therapy

In Study 2, 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 and even anxiety in traditional, seated approaches in a clinical setting. For example, from the results:

I like that because me personally I get really, really anxious, so like I tend to like shake, or like I'll be like holding something, like whether it be like my car keys, or like I'll be squeezing like my fingers or something like that, playing with my hair as well. I don't like being sat I don't like eye contact like I just feel on the spot, so like being able to walk about and focus on like visuals and like engaging things that way, it felt more natural to have the conversation with you than to sit face to face and speak about stuff without anything going on around you. I don't know, I get quite awkward or anxious…it just gives you that freedom (P017).

I thought it was a really, really good idea. To just walk in the room I thought there was no clinical-ness about it at all, I thought it was very relaxed…it was

almost sort of a spa-type experience with the music and the lighting and it was warm…not at all clinical that you would expect and not unagreeable at all, nice, friendly, warm, welcoming. I didn't feel apprehensive walking in (P019).

Participants 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, with an additional layer of interactivity compared to typical mental healthcare therapies. This promotes autonomy in a way that decision-making throughout each step of the process is evident, as key to what WHO describes as the *personhood* (WHO, 2022: 88) of an individual. *The Timeline* breaks down a person's life experiences 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. As an example:

I think it kind of puts it into perspective doesn't it? For me I'm really visual so if I can see it and then it all links to how, if it's all linked out in front of me then it would make more sense in my brain, erm, as to why certain things have happened…that's why I thought them doors and stuff were brilliant […] I just felt like the headings were good like the deep past…and it just meant that you could separate them into different categories and then just go back into them if you wanted to but then come back out if you didn't (P021).

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 shift from past to future in a single space; (iv) overall, sense-making possibilities exist in an IIVE for

participants with lived experience of trauma, where multisensory interaction engages the user in an intervention they experience, rather than receive via lesser multisensory interactivity.

11.7 Summary

In summary, as a majority, participants with lived experience of trauma described conventional mental healthcare interventions as seated discussions where movement and making use of the environment was excluded. Initial impressions of the IIVE were evocative and provided a sense of being away from reality, in a different type of space. Participants felt that The Timeline presented options and features that permitted room to plan a way to move forward in life towards a future. The data showed that participants valued having ability to physically step away from trauma, where facilitation was necessary but was described as a more equal partnership rather than being led. The Timeline, as an intervention, as a process, offered structure to participants and the features could be used as prompts, where one physical action leads to another as part of a sense-making journey.

The idea of an IIVE as a technological system being 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 that no separation is apparent. To the enactivist view, this type of 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 one. In this type of reality the user is constantly involved in sensemaking and in a way steps into the role of a therapist themselves.

PART IV

CHAPTER 12: DISCUSSION

12.1 Introduction

This chapter will interpret and explain the meaning of the analysed results in relation to the research questions, objectives and how they fit into the existing literature. It will explore the meaning of the results through each of the identified themes, to identify their significance and importance. In doing so it will unveil meanings and implications and define how the study's results helped answer the research questions. This chapter will offer:

- Restate the research problem, objectives and questions

- Summarize the key findings – Reporting on themes

- Interpret the results

- Provide discussion based on the research framework and enactivism

- Reflection on the choice of interview and design methods

- Reflection on phenomenological observations

- Transferability of findings

- Learnings from the research journey and theoretical considerations
- An emphasis on motion

12.2 Restating research problem, objectives and questions

Research problem

In restating the research problem the current study set out to leverage large-scale immersive multimedia and through analysis of data investigated how experts acknowledged and experienced a digital therapeutic intervention called *The Timeline*. The study has taken what is typically a static, lesser-interactive treatment and stood it up, where conventional therapeutic interventions might pay less attention to include the setting in a therapeutic context. By positioning The Timeline in an IIVE this enables a multisensory, chronological, metaphorical journey from Deep Past to Future, by accessing features in an extended, virtual reality.

The data gathered from *Experts by Profession* was based on remote viewing of a lo-fidelity prototype in Study 1, informing the design of a hi-fidelity prototype used to father interview response following an in-situ trial of the technology in Study 2. 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 questioning whether outcomes from more vulnerable populations would present the same outcomes (Kitson, Prpa, Riecke, 2018). In the thesis, the initial findings were validated by conducting an in-situ trial at an NHS hospital with *Experts by Experience* who had lived with trauma.

Objectives

From synthesizing the literature and identifying a research problem, the thesis has described a process of developing storyboards and video prototypes and through three stages of prototype design in an IIVE to create a bespoke environment in an IIVE. The objective from this point was to situate a hi-fidelity system in a hospital environment and run evaluative, qualitative interview sessions to understand these experiences with participants who had lived experience of trauma.

Questions

An overarching research question is:

How can concepts from an enactive theory of mind in the cognitive sciences, be applied to the design of a digital system to support a therapeutic intervention for trauma mental healthcare?

The central research questions throughout each of the two studies in this thesis are:

Study 1: How might an IIVE be viewed by Experts by Profession as a suitable space to conduct mental health interventions?

Study 2: How do participants with lived understanding of trauma as Experts by Experience, interpret the experience of an IIVE for trauma mental healthcare?

The study now unpacks its insights to provide guidelines as an indication of a direction for researchers developing digital interventions in mental healthcare.

12.3 Summarizing the key findings – Reporting on themes

Based on the research questions applied to each study the data from Study 1 suggests the following findings that were sub-headed under four themes and one meta theme:

Study 1

Multisensory Affordances in an IIVE

The data shows that participants held limited views of technology in relation to anything akin to an immersive room and had experiences of what could be regarded as typical or conventional settings in mental healthcare. From viewing the video prototype of the technology, the interview data asserted that participants, as professionals with lived experience of working across mental healthcare settings, could identify a range of affordances, as ways the IIVE as a system could be used. They acknowledged the environment as tactile and engaging the body, as well as it displaying potential to be calming and support movement.

Specific to The Timeline as an intervention containing ways to engage via multisensory capabilities, the data provided insight into views that welcomed an auditory, human voice within the system, where this was perceived as non-threatening. The participants also valued the still and moving image projections as well as a user being able to move and touch-interact to offer them a sense of control.

Apprehension to Intrigue to Control

While participant-views ranged from intrigue and shock to being overwhelmed at first impression, the overall view of the IIVE was positive. It also related to the lo-fidelity system as a work-in-progress prototype. As professionals with experience on the delivery side of mental healthcare, the comments built an overall understanding that the words being used were conveying both a respect for the clients they engaged in a mental healthcare context, as well as looking out for their best interests. In relation to the IIVE itself as well as The Timeline as a proposed intervention, a theme of control was reinforced over and over. From a perspective of personalising mental healthcare, or at least interjecting some degree of movement away from just being seated, the data data went so far as to describe a user as having ownership over the process, as a potentially important on-going consideration.

Human versus Digital Facilitation

The data inferred that clients who access mental healthcare therapies can be highly stressed and that just by entering a technology such as an IIVE could be beneficial if a user is visiting with the support of another, human. Whilst technologies such as an IIVE, or an HMD, or a tablet, or a mobile phone, can be regarded in ways as improving lifestyles and offering some level of efficiency to tasks, it was maintained by a majority of the participants that facilitation would be necessary. However, whilst all of the participants were viewing this particular form of IIVE technology for the first time, it was also voiced that users of The Timeline could access by themselves and that this could be beneficial to do so. As discussed further in the limitations section of this thesis, from a sample of group of 12 in Study 1, it would be useful to conduct a further analysis based on a greater number as a sample group.

Environment as a Therapeutic Tool

Overall, as a majority the study participants were in favor of the IIVE as a platform to conduct therapies. The data showed that respondents acknowledged the design process in harnessing technology towards an aim of offering an alternative setting in a mental healthcare context. Also, it was inferred from the data that conventional settings in mental healthcare were based more on an available room, or a space that was provided without considering how the environment itself could be utilized as part of the process. This built into an understanding of how the actual room, setting or environment could be used and this led to data findings where the use of standing, immersion and physical expression could become possible, simply by standing what has not been traditionally viewed as a non-standing process. When responses indicated that people can become stuck in the process of therapeutic interventions, where the IIVE could offer an autonomous interaction as an experience, this led to an acknowledging that the role of the body in the likes of trauma recovery was an important, perhaps critical factor.

Meta theme 1: Active participation in therapy

Participant responses highlighted that conventional settings could actually add to discomfort on the part of the person engaging with therapy, such as a person feeling awkward sitting face to face with a therapist, where an IIVE by contrast could provide

something more akin to a participant sensing that they themselves are working towards their own solution. support an embodied view in mental healthcare, as the underpinning theory this study builds on. The idea of touch interactivity within the system, again related to user-control and autonomy within The Timeline as a process. This further established the potential for the system to both engage in a multisensory way, while the body's role could be inclusive to the process, not excluded. The suggestion that The Timeline as an intervention could offer freedom and active participation in the context of a therapeutic intervention was encouraging and indicated that a standing approach held merit in this context.

The interview participants were asked their overall view of the system and responded positively, but with caveats. It was particularly evident throughout the interviews that while the therapists were embracing of fresh approaches, the safety and wellbeing of their clients was paramount. Participants perceived that not every approach as an intervention works for everybody in a mental healthcare context. The data highlighted that whilst conventional therapies are in place, new approaches can add something different, but these have to be considered by way of both therapist and participant understanding what they are taking part in.

Study 2

Active Participation in Therapy

The data showed that participants had experienced a range of interventions in a therapeutic context. This extended beyond counselling as a face-to-face discussion to physical experience such as yoga and meditation. The responses to being physically engaged were very upbeat and it was noted that as an in-situ trial of the technology, participants were physically engaged as they entered the room. It was also repeatedly described that the setting in the IIVE was different and this built around a consideration that what was being experienced was more of an actual environment, as something unique compared to just a given room. From a viewpoint of being actively involved, the data described that system users could perform the action themselves and become involved in a process that, via conventional methods, excluded this. Other participants mentioned dimensions and that what each individual room within The Timeline in an IIVE might offer, is ability to explore by doing, rather than only talking.

Participatory control and choice

In Study 2 the participants were actively experiencing the technology and could be immediately observed as engaged within the IIVE as a system. Responses were similar to Study 1 with some participants describing the setting as cold, with apprehension, but after a few minutes all participants interacted with the features of the room and took to the digital process without very much instruction. This being said, each participant was able to follow the auditory and visual prompts and this was observed as intuitive once the initial layout of the IIVE was revealed. Responses were very assertive in participants describing how the system's use could build towards control for the user, in them achieving a tangible, physical way to engage within a process that offered choice. As a system, the IIVE offers 2D interaction, similar to any other room containing walls. However, the additional 3D aspect provides exactly what the data described, where participants could access a range of different ways to achieve what might in other types of space seem like limited options.

Therapeutic relationship dynamics

Within the IIVE a facilitator and participant as a user of the system can stand side by side. This can offer some sense of assurance to the participant and can also provide a level of being in the process together. Because the data offered that some participants felt awkward when sat face to face during therapy, or where they didn't appreciate the dynamic of having to reveal facts about themselves face to face, it was inferred that what the IIVE could bring to therapy was a different take on both therapeutic delivery and receipt. Response from the data built towards an appreciation that participants, as individual who had experienced therapy, paid considerable attention to the restrictions of conventional therapy and in doing so, spoke very favourably of a setting as an environment that offered prompts as a walk-through process.

Sense-making of trauma

It could be said that there is no sense-making of trauma, whereby an event or a person that has impacted the life of another I only there to be absorbed and never dealt with. In ma typical therapeutic scenario, a person will have opportunity to offload and talk about their trauma and in some way this can go part way to offering a sense of release,

or even resolve. One of the key features of The Timeline is a door and whether a person enters the IIVE for a single visit or several, this is one of the first features that are faced with, together with a choice to close it and move on, or remain stood in front of it. Whilst having potential to make sense of trauma can or cannot become possible in an IIVE, the data informed that the system holds potential. Within the IIVE a person and a different type of world combine. Reciprocated activity between user and machine, or user and technology, leads to an understanding that some exchange and some change is taking place. Participants voiced stepping forward in The Timeline in a way that encouraged them to move on. Participants described how the chronological nature of The Timeline as a proposed therapeutic intervention, had a natural progression, non-forced. It became clear from observing participants in the IIVE and from the interview data, that as a system where brain, body and environment became combined, the potential for sense-making was potentially greater than a seated discussion in a static room containing less ability to engage in a multisensory way.

Meta theme 2: Participatory autonomy in therapy

As discussed, user interpretation of the system as a first impression was less apprehensive than in Study 1, potentially because the participants were trialing the technology face-to-face and any uncertainty was quickly replaced by getting to grips with experiencing the technology in person. The majority view of the IIVE as a platform or a space to conduct therapeutic interventions favored the spatial qualities in that there was room to move and actively participate. As in Study 1, the data showed that participants did value the interactivity and movement within the system and this could lead to control and autonomy. Specifically, participants with lived experience of trauma described in a variety of ways how moving through an intervention process held advantages, where physical and tangible interaction were affordances containing potential to move on from trauma. The idea of a user being carried along through a process suggested that The Timeline has ability in presenting a therapeutic intervention as a type of journey, from a deep past a person no longer wants to hold onto, toward a future containing possibilities for recovery.

The data provided insight into ways that end-users, as active agents, might respond in such a way to this form of digital therapy, in a way that exceeds more static interventions containing lesser physical involvement or motion. The Experts by

Experience voiced that facilitation was a must but not necessary as a constant, as in traditional therapy. Because the IIVE is a novel setting, participants described that being alone inside of the system could trigger unwelcomed responses. Similar to the way that therapists, as Experts by Profession, were cautious about how to involve clients in a therapeutic context, likewise, Experts by Experience, who had lived with trauma, were unanimous in acknowledging the worth of a human facilitator being present in the IIVE whilst experiencing The Timeline as an intervention.

Results in relation to the objectives

In line with the objectives, the thesis has described a process of storyboarding, video prototyping and prototyping through three iterative stages to develop a digital therapeutic intervention in an IIVE. In creating a hi-fidelity system and situating this in a hospital environment, evaluative, qualitative interview sessions have sought to understand the experiences of participants as experts with experience on both a delivery and receiving end of therapy. From a viewpoint of designing technologies with real-world application, these insights suggest that a co-production focus from the beginning, involving experts, could lead to an understanding of how to factor in some important design-elements from day one. To the enactivist perspective, a human being's experience is one of consistent sense-making, as they navigate their reality. A number of responses from the interviews shared a view of The Timeline offering ability for users to externalize their narrative and view events of their lives chronologically. Additional data highlighted that The Timeline, as situated within an IIVE, did offer sense-making capabilities, arguably beyond anything on offer in a mainstream context.

For people to make sense of events that have impacted their lives and overall wellbeing, a conventional therapy will offer, generally-speaking, a discussion. In an IIVE, through a proposed digital intervention called The Timeline, the participatory element extends further than 1-1 talking and provides opportunity to engage in a multisensory experience, where the environment itself contains features to assist a person's understanding. This, as an approach, elevates a user from being passive receiver of a therapy, to active agent in taking control of their own recovery, as supported by either a facilitator or the digital system, or both.

12.4 Interpreting the results and how they compare to existing literature

The overarching research question in this thesis is: *How can concepts from an enactive theory of mind in the cognitive sciences, be applied to the design of a digital system to support a therapeutic intervention for trauma mental healthcare?* In response, this thesis considers an evolution of concepts, including the concept of mental health itself. Bertolote describes that technical references to this term as a field or a discipline were not evident prior to 1946. In the same year the International Health Conference established the World Health Organization (WHO) and a Mental Health Association was founded in London (Bertolote, 2008: p.113). Pre-dating this, the first psychology laboratory in Liepzig in Germany was established in 1879, although Wilhelm Wundt's pioneering efforts were inclusive of his ''*vehement opposition to the proposed separation of psychology and philosophy in German universities* (Toulmin, Leary, 1985: p.594-596). Hatfield describes that more contemporary thinkers believe that psychology can only remain scientific by becoming cognitive science, neuroscience, or more (Hatfield, 2002: p.207) where to discuss mental experience or mind was previously regarded as unscientific, with psychology being a natural philosophical discipline.

A Philosophy of Mind discussion has stemmed from this and since the 19th and 20th centuries, as described in Chapter 2, practices and methods have developed, involving ways for services to engage with individuals who present mental challenges, framed by a National Health Service in the UK. This has led to the creation of an IAPT experience (Clark, 2011: p.318) and the mainstream adoption of CBT. David, Cristea and Hofmann argue that whilst CBT is currently a gold standard concept and the best in the current field at the moment, there is room for further improvement, towards what these authors term an '*integrated scientific psychotherapy, with CBT serving as the foundational platform for integration*' (David, Cristea, Hoffman, 2018: p.1). From the data in this thesis it becomes clear that both Experts by Profession and Experts by Experience agree that current models adopted in healthcare have potential to be improved upon or surpassed. With The Timeline as one example of a digital intervention, situated in mental healthcare, the data showed that this has potential in offering to therapy a way to involve users where the body and environment are each taken into account and not excluded. As described in relation to trauma in the first literature review chapter, trauma affects the whole physiological system of an

individual where the stress is registered. Therefore, for a person who has experienced trauma to experience an intervention that pays attention to the role of the body, requires both therapeutic practice as well as an environment to support this. Throughout the thesis such a setting has been referred to as an IIVE.

While a vast range of technological approaches are evidenced within the second literature review chapter the thesis has also shown that expansive solutions are required. In paying explicit attention to the use of IIVEs in mental healthcare, the majority of the literature findings indicate that this classification of technology has been more commonly used with the inclusion of an HMD. A picture that does unfold is that whilst many CAVE-type systems were installed globally throughout the past twenty plus years, the demands of developing content, plus the resources required to maintain the systems, plus the level of multidisciplinary skills to fuse content into a purposeful direction, has led to the systems being used more for their simulated backdrops, less so in designing bespoke content for a specific purpose as with The Timeline. In examining results from the thesis and comparing these to previous studies, the data aligns with a steady progression of findings whereby immersive environment technology is in need of the type of thoughtful system design as voiced by Wiederhold and Buckwalter (Wiederhold and Buckwalter, 1998) and adaptation of therapy to new forms of media (Valmaggia, 2016).

Recently, a narrative systematic review by Ma et al. concludes that using immersive virtual reality and a VR technique, can impact mood and emotion regulation, as examples, but '*further controlled studies are required to compare the effectiveness of distinct levels of engagement in immersive VR*' (Ma et al., 2022: p.8). Additionally, in a systematic review of reviews Cieslik et al. describe that virtual reality may be at the forefront of a '*technological revolution*' in mental healthcare, as '*a powerful tool for individuals to acquire new learning for the benefit of their psychological well-being*'. These authors conclude that

> '*…due to the continuous development of VR hardware and software, it is essential to conduct further research in the area of psychiatric disorders, especially as no review has concluded that VR does not work*'
>
> (Cieslik et al., 2020: p.1-13).

What this shows in line with data from this thesis, is that immersive VR has potential but currently sits, as this thesis has described in earlier chapters, at an intersection in terms of uptake of this type of technology in therapeutic practice. A digital intervention has potential in offering something more, but to achieve this the enactive system as referred needs to be implemented. This said, in the next chapter on limitations and future work, shortcomings of the current thesis are picked up, where these reflect what can be understood as areas for ongoing studies to move into.

In this thesis and in particular the discussion around enactivist theory, *The Timeline*, as a further digitally-based concept in mental healthcare, has aimed to offer something novel, as a unique approach whereby a person has opportunity to stand up, but to also self-examine in an attempt to externalize facts about themselves chronologically, through the use of digital prompts. As a theoretical underpinning, enactivism provides what appear as useful concepts to attach to *The Timeline*, as situated in an IIVE as an enactive system, as described in the literature review. A participant or user who enters the enactive system is at once coupled to this environment. Through sensorimotor engagement they are immersed in a process of sense-making, whereby this thesis has considered that this approach could build more closely towards what the psy-sciences recognize as a more integrative model. What emerges here is perhaps in line with a form of practice in mental healthcare whereby brain, body and environment are viewed collectively. This holds potential to involve more than what a biomedical model offers. Simply put, in the IIVE and through the design of The Timeline, a user has more opportunity to explore a range of alternative ways to interact, than in a seated discussion. As de Haan describes:

> *From an enactive perspective, psychotherapy can be regarded as the attempt to offer optimal interactions for the patient to learn and practice new ways of sense-making in a durable way. This is in line with the traditional idea of therapy as a 'practice-relationship': within the safe environment of the therapeutic setting, patients can try out a broad range of behaviors, thoughts, and feelings, and thereby practice different ways of relating and sense-making* (de Haan, 2020: p.261).

As one participant voiced, the IIVE and The Timeline as a process become the "*interactive therapist*" (P019). If this is possible, then by combining technology with

capabilities if visual, audio and kinesthetic display such as an IIVE, potential exists to form a person-world, what this study relates to as an enactive system.

12.5 Closing the circle: Discussion based on the Research Framework and Enactivism

In supporting a research framework adopted throughout this study, what is highlighted is an enactivist ontological perspective, with a phenomenological epistemological approach. What this has encouraged in relation to the use of IIVEs in mental health, especially as related to enactivism, is that by putting the environment first, as with the design of prototypes as settings, this reverses what might seem a logical step, in placing the person first and then offering any given room as a setting to host an intervention. Phenomenologically, the participants in this study were observed as they experienced a particular classification of technology, with this itself acknowledged as a reality each participant was connected to, not disconnected from. Tying in with an enactivist viewpoint, as in the research framework, possibilities have emerged towards an application of concepts: agency; priorioception involving the spatial state of the physiological self; cognition and sensorimotor interactivity as a process of sensemaking.

The NHS as an institution in healthcare supports settings-based approaches with an evident use of digital technology that offer physical activity, describing a '*duty to act*' towards the adoption of new interventions (Campion, 2019:p.106-126). Theoretically then, people in themselves within the surrounding environment, from a cognitive viewpoint, can be conceptually viewed as forming a system. This can build into what the NHS have termed as an approach where settings can be involved. What could be perceived as an internal network of atoms and cells, arteries and veins, ligaments and tendons, neural pathways and messages, permit organs of the body such as the human brain to function. Because this is also influenced by what worldly, environmental factors happen to be at play at any given point of being, people are adjusting on a second-by-second basis as they navigate their world. As Gallagher points out:

Change any of these things and we can expect changes in neural processing, not because the brain represents such changes, but because the brain is part

of a larger embodied system that is coping with its own changing environment (Gallagher, 2017: p.163).

The above quote supports an argument where human beings are recognized less as isolated individuals with no purposeful access to environments that can support the shaping of their lives, but as embodied agents with ability to conceptualise themselves as seamlessly interconnected to component parts and affordances of a reality. Future decision-makers or visionary leaders might consider the design of enactive systems as an approach where concepts align perhaps to a more applied holistic or integrative intervention pathway. In designing, trialing and evaluating The Timeline, positioned in an IIVE, the current study has found that this could be an effective intervention tool in mental healthcare. The next sections will offer reflection on some of the decisions made.

12.6 Reflection on the choice of interview and design methods

In hindsight both Study 1 and 2 would have been conducted in a live hospital setting, with recordings of the discussions with each expert in both cases taking place *as* the technology was being experienced. This could have resulted in qualitative data reflecting the experience itself, not a video-viewing as in Study 1, or participants reflecting on their views of The Timeline, post-experience as in Study 2. The interview methods themselves took more than one year of preparation and discussion with the research partner as a company working day-to-day in the delivery of psychological services. Because of time-constraints the individual hospital visits were kept to intervals of 30-minutes each, with interviews scheduled post-visit. Additionally, Study 1 was impacted by a global pandemic and while the research continued this did affect any ability to engage in a face-to-face environment.

As pre-mentioned, a more in-depth response to the system being physically used could have been formed if all 24 participants trialled it in-situ with interviews carried out there and then as each participant experienced the technology, also perhaps a follow-up discussion at, say, six months, where each participant could describe any ongoing effect of *The Timeline* as a therapeutic experience. In terms of the approach to qualitative interviewing and in line with the phenomenological epistemology as defined in the research framework, a more robust approach would have been to engage with an in-depth and unstructured method, such as a phenomenological design

(Thomas, 2020), with an aim of gathering more acute accounts of the experience as it was unfolding.

As described in Section 5.1 the choice of interaction design as a methodology could have been replaced by Somaesthetic Design. This latter approach could have introduced what Hook et al. propose as a '*strong concept*' called Somaesthetic Appreciation and discuss a world where people are acting with their bodies in the physical environment, not separated from it (Hook et al., 2016: p.3131). To combine a more defined method of phenomenological inquiry with application to Somaesthetic Design principles could have permitted a variety of different questions asked in-situ. For example: What it like to engage with the walls? What is it like to move in the immersive space? What is happening to trauma as you walk around the room? The body could be recognised as a tool in itself here and in many ways some of the emerging research building on the current thesis seems to be in this direction.

12.7 Reflection on phenomenological observations

The participants were observed in Study 2 in the live hospital setting, but only notes were taken and only the interviews made use of as data. As an example, two participants showed tears when experiencing the reflection part of *The Timeline* as a process and comments were made linked to their never having externalised their trauma in such a way prior to this experience. Similarly, other participants described as they experienced how different it was to walk around the junctions of past, present, future as opposed to sitting down and talking about it.

The participants were left to experience the technology without facilitation, but the facilitator (myself) was present and at certain points stood beside each participant. While the trial was not content driven in that the participant was requested to trial the technology not divulge their trauma, it was evident that memory processing was taking place. Some participants described that *The Timeline* would have made sense to them when they first experienced trauma.

A process in EMDR called the "Blind To Therapist" technique (Blore et al., 2013) was devised to work with clients who cannot or won't discuss the traumatic memory, for example because of shame, or where they want to protect the facilitator from vicarious trauma. In *The Timeline* a participant can continuously be in a blind to therapist state, where the interactivity with the system itself has potential to support an intervention without any additional person in the room. However, as the data

showed, participants were unanimous in describing how they valued the presence of another human being. In the trials of the technology with each of the 12 participants who were Experts by Experience, their trauma was not described and yet the data has evidenced ways that participants automatically accepted they were journeying through epochs of their lives. That the room itself and the process inside of it were merely presented here, without very much content to influence any participatory understanding, builds further into what is discussed in 12.10.

12.8   Transferability of findings

Central findings from this study highlight the importance of environment in a mental healthcare context, where, typically, a given room is made available to this purpose, but where features and affordances of the setting are of a lesser regard. This thesis has indicated that the settings where mental healthcare interventions take place have potential to involve user-participants to a level where they can become self-directed agents of change. What was data infers as important, as emerging from the qualitative themes, was that study participants acknowledged control throughout the process and where movement within The Timeline as a proposed therapeutic intervention was an important factor. The Timeline as an intervention involves a participant taking action, in that they enter the room standing up and remain standing up, until the end of a typical session where they might choose to be seated. If this approach is applied conceptually to other existing forms of treatment involving people seeking to make sense of events that have shaped their lives as challenges, the IIVE as an environment can include as many tools as information allows. However, The Timeline as described in this thesis cannot be regarded as just some content presented digitally in an immersive room, as many hours were spent defining and refining the content. What is highly transferable though, is the process, of what might be related to as The Timeline as a standalone intervention. The reason for such a level of transferability, as this thesis offers, is that all it asks for by way of design, is for a space where a person can stand up and move around.

12.9   Learnings from the research journey and theoretical considerations

This study was first conducted in its initial stages not by an academic, but by a layperson without knowledge of how research can be carried out, when steered by

supervisors from within a university as an academic institution. What emerged from joining academia was greater insight into what had existed previously, through a vast literature search and studies that adopted digital technologies toward a purpose of seeking to improve people's ability to reason with or cope with challenges they are faced with. Theoretically, as an example Hase et al. present EMDR for PTSD with an Adaptive Information Processing (AIP) model and discuss patients who experience limited success via psychotherapeutic treatment as usual, suggesting possibilities in targeting and reprocessing pathogenic memories (Hase et al. 2017: p.4). However, as discussed in Section 2.4, where the AIP model posits that trauma can be stuck in the brains neural network, i.e. as an '*information processing system*' (Shapiro, Laliotis, 2011: p.191) the enactive perspective conceptualises the location of trauma in being distributed in some way across brain, body and environment. The thesis here recognizes that a model such as AIP could be adapted or enhanced by engaging with non-representationalist views. In information processing terms this suggests that such challenges as dysfunctional beliefs or disruptions with interacting can be shared with the externally recognized environment by engaging it in the process of therapeutic change. A progressive example is a novel intervention called Multi-Modular Motion assisted Memory Desensitization and Reconsolidation (3MDR), combining both movement and virtual reality, as well as auditory and visual stimuli. This was tested with military veterans with results indicating further research required with a more broad sample of data to determine efficacy and optimal delivery (Bisson et al., 2020), showing promise in a simulation-style setting as an emerging possibility to engage with PTSD, on the more cutting edge of treatments that are pushing boundaries to investigate problems in different and potentially complimentary ways. When applied to *The Timeline*, as a proposed digital therapeutiuc intervention, from an AIP viewpoint this puts EMDR in motion in real-time and in Section 12.10 the significance will be discussed.

The theory the study set out to gain insight into and build on can be summarized as:

1. Applying an interactive design methodology to the developing of a healthcare intervention

2. The repurposing of an existing technology in the exploratory field of HCI

3. A real-world application of philosophical assumptions and concepts based on the enactivist view as part of a Philosophy of Mind discussion

Or:

If concepts from an enactivist philosophical framework are applied to the design of an interactive, therapeutic activity in a mental healthcare context, then possibilities emerge to imagine a human physiological system, coupled as part of a reciprocated process between participant and technology; engaging in sense-making through sensorimotor activity where a consistent loop of experiencing emerges between agent and environment. When merged, these build towards what the study now recognizes as a type of system and when additional component parts are added it looks something like what is shown in Figure 25 of the concluding section in Chapter 14. In brief, to reiterate earlier points, what *The Timeline* can permit, is a re-establishing of person-world dynamics where in a typical therapy scenario, the woldly-interaction can become reduced to a discussion. What *The Timeline* emphasizes, is the relationship between a person in the world and offers an accessible, tangible, interactable space where ongoing studies might look more acutely at what is unfolding through movement and being as an experience in such a setting from a phenomenological view. The question relates less here to what could have been done better and is reframed by: *What can become next*?

Before discussing both limitations to the study a potential future work, the thesis injects one final point.

12.10 An emphasis on motion – no space to dwell

As evident via the initial 'dining room' prototype, only basic, available items were introduced and yet the setting could still be related to as having potential for a person to feel *immersed*. This suggests that *The Timeline* could be recreated across a range of settings where what becomes introduced as "technology" is based on what is felt to be appropriate and fitting to the task. In the current study, what the technology added to was a level of realism, for example when a participant opted to close a door on their past, then digital content within the immersive room presented a visual image that could be both seen and interacted with.

Perhaps a key reflection to ongoing studies that could transfer out, is one that emphasizes motion or movement in a therapeutic context. Even when lay still and silent, the physiological system of a human being is engaged in its functions: breathing, thinking, sensing. As this thesis has described, trauma is generally understood as an event that impacts a person to such a point that they cannot shake it off; it imprints, takes over, as something that's experienced as felt throughout the whole being. Therefore, to remain still and endure this for an individual, or to go further and attempt to describe what the event is, could be understood as something entirely different to seeking to move *through* or *away* from this type of personal challenge.

An emphasis here then is not towards what a person is thinking or chooses to discursively describe, but about how they are going to explore a range of possibilities from an initial knowing that they are their trauma are already embodied. It could be argued here that while the trauma will likely always remain, motion itself is key to continuously providing the trauma with no space to dwell and get too comfortable. From this thesis' viewpoint, the technology could then be removed from the digital environment, powering everything down to a point where all that exists is a person in a space. What could then unfold, is to introduce only the features or tools a person requests. Perhaps some users wouldn't require anything at all, just agency and the freedom to move around. If we compare even such a basic model to mainstream mental healthcare delivery, then a start point would be to ask: *How would you feel if we stand up*? This is how the first stages of *The Timeline* began.

13. LIMITATIONS AND FUTURE WORK

13.1 Introduction

There are both strengths and limitations identified through the current study. Arean and Cuijpers suggest that whilst technology offers many opportunities in the MH field *'it cannot wholly replace essential features of mental health care, such as shared clinical decision making or the therapeutic relationship that helps motivate consumers to change when their depression or anxiety interferes with their motivation'* (2017: p.480). In response to this quote, the data suggests also that technology cannot replace the human element and as such, The Timeline was designed to include the role of a facilitator. However, what technology can respond to, is an inability for human facilitation to offer a number of the capabilities offered by the IIVE as a system. Further examples of limitations are highlighted by Garrett et al. who consider: *'As VR is essentially a technology meditated phenomenon, this lack of theoretical distinction, between what actually constitutes a VR experience, at the least, makes meaningful comparisons between clinical studies complex'* (2018: p.3). From this limitation the study highlights that what constitutes, or has constituted a VR experience, is supported via the theoretical underpinning that is the embodied-enactive view. The study highlights a number of limitations and these in themselves build towards what could become areas for future work. In this chapter each limitation will be provided, together with areas that future work might build on these.

13.2 The choice of technology including space and cost

Limitation: The study opted towards an IIVE. As a room-based system this requires financial resources to install, technically approve and maintain. As discussed by Moghe et al., the CAVE-type system has additional limitations including space allocation and energy consumption (Moghe et al., 2018: 443). In the current study the university the lo-fidelity prototype system was installed in has its own IIVE, so this did not hinder the progress of the study.

Future Work: Future work might explore the use of other technologies that could build towards developing a mental healthcare intervention, such as a phone, desk-top computer or a head-mounted display. Further studies could weigh up both the costs

and efficacy of an approach such as *The Timeline*, versus more traditional treatment pathways.

13.3 Mental healthcare commissioning

Limitation: Because IIVEs are not commonly adopted across mental healthcare, there is limited understanding of this type of technology in practice. Therefore, using digital technology to design and deliver improvements to services relies upon tested models and currently the most supported practice is the established talking therapy, aligned with the biomedical model. What was discovered through the current study, was that for mental healthcare services to adopt a digital intervention such as The Timeline, more rigorous testing would have to be approved and while this study has attempted to pursue inroads leading to this, the path is slow.

Future Work: Researchers could aim as a start point to situate a study in a setting such as a hospital, with clinical support from Day One. If aligned to a GP practice, as an example for recruitment, this could succeed in a route towards gaining uptake of a technology with commissioning support from the beginning.

13.4 Content Creation

Limitation: The modern-day IIVE systems rely on a suite of pre-installed still and moving imagery, but otherwise require either a person to design and upload their own content, as in this study's case via the lo-fi prototype, or through a team of content creators, as with the hi-fi prototype. While this thesis finds IIVE-type systems across multiple university settings and within hospitals, care and education facilities, to carry out ambitious activities in these spaces in terms of outstanding content, will require skills such as Adobe XD or Unity. Additionally, within the content creation itself, additional design features to The Timeline as a process could have included, for example, a reverse button

Future Work: On-going studies that draft in the required expertise from day one, such as Unity experience or other software developers, could permit content that extends as widely as the imagination will go.

13.5 Multidisciplinary partnerships

Limitation: The thesis documents a study that involved a full year of dedicated networking and building rapport with an industry partner at Immersive Interactive and a recruitment partner at Alliance Psychological Services. Also, it took six months to establish the required understanding in gaining access at James Cook Hospital where the in-situ study trials were hosted. Multidisciplinary partnership building may be a time and labor-intensive process, particularly, as we encountered, when seeking to position a study in an NHS setting.

Future Work: An ongoing study might seek to establish access to a hospital or any clinical setting from day one. In seeking to align with a recruitment partner and a technical partner, future work might be mindful of having these partnerships in place prior to beginning the design process.

13.6 Participants as co-producers

Limitation: In the current study, the rapid-prototype was already formed from grassroots engagement with participants in a community-based setting. This meant that the prototype adopted in the study had design-thinking already applied from its conception.

Future Work: By involving experts as co-producers of a digital intervention from day one, this could decrease or increase the challenges. Future studies could also, for example, examine the effects of higher order cognitive functioning, such as reflective thinking.

13.7 Sample size and Homogeneity

Limitation: The sample size in this study was N=24. This was deemed substantial for this study and because the study recruited participants with lived experience, this was regarded as supportive in gathering useful data.

Future Work: A future study might include an increased sample above the reaches of a convenience sample to generalize the results to a more broad population. Additionally, a future study could be more diverse in gender, in socio-economic factors. By having 12 female participants this did not represent a diverse sample group, but was how the recruitment process developed. These were however, representative

of a female majority at the recruitment partner in terms of the gender most likely to access services as related to trauma.

13.8 Controlled Study

Limitation: The PhD was restricted in terms of the type of study it permitted to be conducted, where a study more akin to a controlled trial was not an option.

Future Work: A future study could, by design, be more akin to a controlled trial where specific mixed methods data could be extracted. To explore the efficacy of a digital environment in a mental healthcare context, a more robust study design could have been implemented.

13.9 A non-digital immersion

Limitation: The current study adopted a particular type of technology, where participants became immersed in a digital setting as an actual room.

Future Work: A future study could be conducted in a natural surrounding, for example a forest. A length of string could be tied between trees and the epochs of deep past, past, now, future, represented by the trees themselves. However, whether a forest might appear as too vast, or if a participant would experience immersion and a sense of control, would be questions to ask.

13.10 Summary

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 co-producers 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 elicit more multi-sensory responses and ways to interact, future studies might investigate and compare the benefits of a lo-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.

CHAPTER 14: CONCLUSION

14.1 Introduction

In total, the research presented in this thesis has explored both short term objectives and longer-term aims as outcomes, as distinct but related intentions toward evaluating the suitability of an enactive system in the context of mental healthcare. This comprised a bespoke digital intervention called The Timeline, as an interactive treatment modality, situated in an IIVE. In fulfilling these objectives and aims and driving toward the anticipated outcomes, the study has developed a digital intervention from the ground up, sought NHS IRAS approvals to situate the intervention in a clinical hospital setting and both trialled and evaluated this, arguing that The Timeline could be introduced as a complimentary healthcare solution, where an evidenced global need exists to leverage technologies in this context and support them in practice through multidisciplinary focus.

By examining what exists through the literature the study has understood that while some authors propose a paradigm shift in the research of what are labelled as disorders in mental health, conventional focus favours therapies that involve more discussion and less interactivity between the body and environment. From a viewpoint of trauma in mental healthcare, implicating the whole physiological self and seeing it play a role in therapy, is arguably a critical factor for recovery. The research in this thesis has embraced an emerging enactivist view from within the cognitive sciences and this in itself presents both fruitful insights as well as challenges. Healthcare systems can be based on what is known or understood at a particular societal juncture and what is currently regarded as working, where embracing fresh concepts can suggest reluctantly learning a new language and different ways to conceptualise, particularly where already installed systems are .

This thesis has taken careful steps in an attempt to offer insight into a way that authors, through the literature, view the world via their own phenomenological, embodied, enactive lens, concluding that where different settings can affect people's abilities, the potential for a person to make sense of what is going on in their lives is enhanced where brain, body and environment are understood as an interconnected whole. What society seems to be talking about, in mental healthcare, is a prognosis based on what a person is viewed to be thinking. Up to this point in the 21st century

this has had more to do with face-to-face unravelling of a person's conceptual psyche via a chat, less so relating to observing the person and the person observing themselves, where the environment is regarded as part of the psychotherapeutic process. Examples of authors have been given and these, plus those now mentioned, provide a succession of opinions that in many ways support the notion of The Timeline, as a narrative tool, as a new way to approach self-challenges, self-examination, self-reflection, self-motivation and generally to interact and navigate multiple realities in varied guided or self-guided autonomous ways. Such insights include: '*Freedom does not mean escape from the world; it means transformation of our entire way of being, our mode of embodiment, within the lived world itself*' (Varela, Thompson, Rosch, 1991: p.234); '*We should indeed view the brain as a complex system whose adaptive processes emerge only relative to a crucial backdrop of bodily and environmental structures and processes*' (Clark, 1997(c): p.130); '*Embodiment is about engaged action rather than disembodied cognition; it is about the particular rather than the abstract, practice rather than theory, directness rather than disconnection* (Dourish, 2004:p.189); '*Cognitive science, enactivist or otherwise, cannot afford to disregard the question of how the subject of experience emerges from sensorimotor interactions and how it operates according to the norms that such interactions bring forth. Autonomist sensorimotor enactivism provides a research agenda to address these pressing questions*' (Barandiaran, 2017:p427); *...to conceptualize an organism as grounded in and explained by its participation in sub-personally characterized, causally looping dynamics of environmental exchange, is a step in the right direction* (Noë, 2021: p.969). What this three decades and more of thoughts amount to is a suggestion that we should not deny reality as a complex, co-joined system, wherein exists the possibilities to achieve our demise as a species, or to flourish.

What an enactivist view permits is something akin to what Buddhism relates to a concept of no-mind, where through the action of being alone, a paradoxical realm of all and nothing is simultaneously achieved. When applied to The Timeline, what exists is a space where people facing their challenges can enter and, should they choose do very little more than experience. Perhaps then this is a key to a future in mental healthcare simulations as therapies, as interventions, whereby the effort is on the part of the system, or where interaction on the part of the human is only where they choose to interact. No words, actions alone.

The study formed its own version of an environment and adopted an existing technology known as an IIVE. Here, through dedicated storyboarding and prototype stages, a series of simulated realities were created and these acted as a platform where users could experience a novel form of therapeutic intervention. What emerged here, was a way to effectively embed concepts from an enactive philosophical view, where these could be trialled in-situ, leading to the data responses from participants with lived experience.

14.2 Contribution – What did the research find and why is it valuable?

As an interdisciplinary thesis the current research has contributed to the field of HCI and the cognitive sciences. This thesis successfully implemented its digital product and in doing so was effective in presenting and publishing its findings globally. As a qualitative study, the research has also involved a research partner at Alliance Psychological Services, together with 24 study participants who have lived experienced of mental healthcare delivery, and trauma. The overall contributions to knowledge can be summarised as:

Study 1

We found that therapists held supportive views of new digital approaches in mental healthcare, with potential to support participants with trauma. However only where certain caveats were introduced such as understanding what could be regarded as trigger points or situations where a person might not understand the use of the technology. This is valuable because the literature indicates that new approaches do require exploration and where technologies are available in the current climate, these can be leveraged - *How do mental healthcare professionals view the adoption of an IIVE as a platform to conduct a digital therapeutic experience?*

We found that standing and movement in the IIVE encouraged a sense of freedom and control for the participants. It was also evident that participants felt that they were moving through a process. This is valuable because as the literature points out, mainstream services tend to provide a seated environment with no room to physically explore in a therapeutic context. Whereas, what the IIVE and The Timeline offer, is a way to engage the physical body and multi-senses, potentially critical in a context of

trauma recovery - *What are the effects of standing a mental healthcare intervention up and incorporating the environment?*

From an Interaction Design perspective we found that by incorporating audio, visual and kinaesthetic content to a digital intervention such as The Timeline, this can result in a whole-body interaction where an experience is achieved with appeal to multiple senses. This is valuable because, again from a mainstream services viewpoint in mental healthcare, therapy tends to offer discussion but not involve features that appeal in a variety of other ways - *What features can be incorporated to a system to involve a whole body, multisensory participation?*

We found that the IIVE as a setting could be supportive in supporting people with a range of mental healthcare challenges but some careful considerations would have to be made in relation to what the content is and how this is experienced by the user. This was valuable because it supported an understanding of both pros and cons, whereby the IIVE as a platform could be supportive, but from a perspective of creating a user-interactive system, further in-situ trials would be required and with a more broad range of participants, to ensure the IIVE as an appropriate environment in a context of mental healthcare - *How conducive is an IIVE for engaging participants with mental healthcare challenges and what are the barriers?*

Study 2

We found that experts in this study who had lived experience of trauma intuitively navigated The Timeline, as situated within an IIVE. The participants were supportive of what appealed to them as a different type of setting with ability to offer something additional to conventional therapy. This was valuable because from a user-centered design viewpoint it offered useful insights into how the IIVE could be used, as well as encouragement that The Timeline contained features that could be supportive in the context of trauma in mental healthcare - *How do users with lived experience of trauma interpret the use of an IIVE as a platform to conduct a digital therapeutic experience?*

We found that movement offers a sense of a user moving through the system and when coupled with links and prompts within the system, the IIVE as a therapeutic environment does offer a new way to experience mental healthcare interventions. This was valuable because it provide insight into user-behaviour in the IIVE and by trialling

The Timeline in-situ showed directly how the range of movement and multisensory interaction in the space could be explored. The data offered a range of ways for future research to develop from this point in terms of the application of The Timeline across a range of modalities for treatment in a context of mental healthcare - *Could movement or multisensory engagement within the IIVE bring anything novel in a therapeutic context?*

We found that users very much value human connectivity and that facilitation in addition to the technology was essential, although in certain ways a user could access and experience the process independently. We found that the therapeutic dynamic between participant and therapist was altered in an IIVE, whereby the nature of non-seated facilitation brought about an enhanced level of control on the part of the participant as a user. This was valuable because the data offered views that The Timeline could be accessed independently with further design-thinking applied, but was also encouraging that from a user-perspective human beings value human beings - *Are therapeutic relationships different in an IIVE than in conventional therapy?*

We found that users were both indirectly and directly involved in an experience of sense-making. Through interacting with features of The Timeline, each user can attempt to make chronological sense of their trauma narrative, by closing down certain features and accessing doors and a variety of virtual reality rooms. By being present in the IIVE and navigating the technology, generally-speaking as an environment, a sense-making process was unfolding through the combining of user and the setting. This was valuable because from a literature viewpoint in line with enactivist theory as underpinning the thesis, the data indicated that people and environments can form a system. Whether or not the language an concepts from enactivism would be embraced or otherwise poses further research questions and studies, but the data has indicated that people, plus the IIVE, navigating The Timeline, has led to potential for sense-making for participants as active users - *How might users relate to a process encouraging active participatory involvement toward sense-making?*

The prototypes developed throughout this study were not comparing to one another, but were designed to offer the potential for an alternative, or complimentary mental healthcare intervention, to build on what currently exists. A major contribution then,

is that the study has designed a completely unique digital mental healthcare intervention, both tested and evaluated.

14.3 Laying down a path toward a solution

As presented in the introductory chapter of this thesis, it is assumed that complex and unaddressed problems in mental healthcare, as a global issue, can be linked to a range of factors, including biological, interpersonal, socioeconomic, geo-political or environmental. To state that mental healthcare sits in a complex landscape is an understatement, arguably because anything pertaining to what is termed as *mental*, is an integral part of a landscape that human beings have endeavoured to form and shape throughout their evolution as a species. Challenges associated with mental health or mental illness could not be anything new, because it is evidenced that, as organisms, humans have forever been problem solvers and have not achieved any description of long-term rest from attempting to harmonise with the settings they occupy and the constructed reality they have managed to imprint upon by way of their own design.

What was developed throughout the course of this doctoral study, was in response to what is termed a social challenge. Explicitly, what the researcher has aimed towards is more than just the prototyping of a digital therapeutic intervention, but to understand how this might function as posited as an enactive system, to indulge in a philosophy of mind discussion and seek to understand how embodied approaches to cognition, emphasize the important of environment, particularly one that contains features as affordances as links and prompts as tools, for people to interact with, in an attempt to make sense of what is going on in their lives.

The current study considers HCI as an applied science and builds on an assumption that brain, body and environment seamlessly interconnect and what unfolds here is a unification of both the experience and the experiencer, as a system; with the setting itself recognizably and purposely playing an important role. Consecutive authors have voiced that cognitive science and human experience can align toward an enactive approach, where a view of cognition as embodied action warrants an approach in engaging with mental healthcare that involves participants in a physical way. Varela, Thompson and Rosch describe that embodied action specifies '*paths that must be tread or laid down for their solution*' (Varela, Thompson, Rosch, 1991: p.205), inferring that only by walking the walk and testing new approaches, can

society gain insight into ways to approach potentially old problems with a new or novel outlook. In the IIVE a person takes action towards their outcome, by stepping up and taking control. This physical action shifts approaches in mental healthcare beyond what is currently available (Bruce, Rebair, Holmquist, 2022) but to fetch about this new world, the environment in mental healthcare might take a more central role. As a contribution to trauma treatment the study posits a movement-based approach, one where the narrative a human being carries conceptually inside of them can be both externalised and examined directly within reach infront of them. Furthermore, the data response this potential future treatment approach indicates that participants with lived experience of trauma, have ability within *The Timeline* to move through and away from the problem, with both agency and control. From a viewpoint of transferability, for example if other modalities of therapeutic treatment were applied to a similar setting as an IIVE, the affordances of an IIVE and components of *The Timeline*, could be equally trialed and evaluated.

14.4 An enactive user-experience

There were three stages of prototyping involved with this study, as distinct effort was made to engage with and understand a social problem, first from a grassroots level, then as an industry-sponsored study situated in academia. This distinction seems important to mention, because the social problem itself exists outside of an institutional focus, where on daily basis people face personal challenges and often seek past healthcare systems to remedy the problems they face. The prototype stages were:

i.   Rapid prototype

ii.   Lo-fidelity prototype

iii.   Hi-fidelity prototype

The study has found that the rapid prototype succeeded in engaging people who were facing mental healthcare challenges, but lacked affordances of a digitized system, whereby the experience in the latter became more personalized and inclusive of multisensory, three-dimensional features not permittable in the rapid-prototype environment. The lo-hi fidelity models were able to offer features that appealed to multi-senses, due to the nature of digital media comprising audio, visual, haptic. What became possible through plugging the rapid prototype in to an IIVE, was, initially,

post-it notes becoming touch interactive and expanding when pressed; facilitator voices becoming amplified as an audio feature that came to life as a person entered the room; still and moving images containing a level of virtual reality, altering how a user experienced a sense of presence, in being in the room as they engaged with The Timeline.

The thesis has documented dedicated efforts to design, develop, trial and evaluate a digital therapy in offering a new way for people to engage with an in-person, therapeutic pathway. This has potential in offering support to those identifying chronologically with events that have led to a personal, impactful crisis. This thesis offers Figure 25, also shown to A3 size in [Appendix 19] as an indication of how this system is understood.
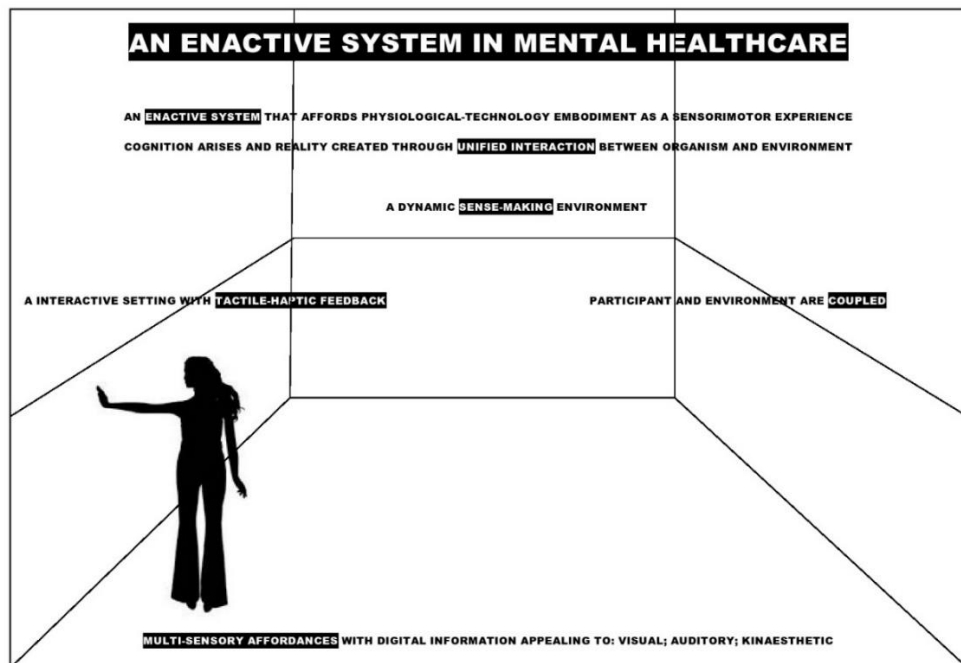
Figure 25: An enactive system

In the approach a person becomes less a passive recipient of a static treatment, closer to an active agent as part of a more engaged, interactive, holistic experience – as opposed to a more traditionally rigid neuro-reductionist view. 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. Finally, human beings have forever been inseparable from their environment, as this permits all life to both survive and flourish. It would seem a plausible argument, to suggest that by excluding the environment in something as critical as mental healthcare, services are potentially depriving their patients of a most integral component to assist recovery.

14.5 A recipe for disruption

In *The Invisible Computer*, Norman describes technologies that have ability to alter paradigms, even '*changing the entire course of the industry*' (Norman, 1999: p.232). In chapter 2, this thesis related to a steady line of thinkers, whose beliefs, has grown into the concepts embraced in current mental healthcare. One example is the way that a biomedical model supports an assumption that a state of human health can be defined by the absence of illness, as biologically-based brain diseases or disorders (Deacon, 2013: p.847). As a technology, the CAVE-style IIVE system is nothing novel, but where fresh content is added, together with applied assumptions that human beings do not exist in isolated states but could also be, in complex ways, connected to and influenced by the reality they inhabit, what emerges here is potential.

If we combine all of the ingredients of this thesis as a proposal: upright posture, movement, the use of hands, adding the ability to listen, to see and to feel, together with the concepts from enactivism in Chapter 2, mapped to evolutionary theory[35] (Gallagher, 2017: p.164), we can visibly acknowledge an intervention such as The Timeline, situated in afforded space such a human occupying an IIVE, as more than just a digital tool. What we might be seeing here, regarded explicitly, is a new way for mental healthcare practice to advance. *In Enactivist Interventions: Rethinking The Mind*, Gallagher devotes an entire chapter, entitled: *The Upright Posture*. He concludes this by saying:

---

[35] Evolutionary theory highlights an adaptive value of within-species variability. In a human context this can relate to upright posture and the use of hands as mechanical devices to complete tasks

Once we recognize that human hands are what they are, and do what they do because they are freed up to do such things by the attainment of the upright posture, then we need to look at environments and manipulatory areas, and to think in terms of organism-environment couplings

(Gallagher, 2017: p.186).

Whilst it could be a far-reaching statement to conclude this thesis, what was brought together throughout the course of three years was described throughout meetings with the National Institute for Health Research (NIHR) as "*fascinating and valuable research*" (NIHR: March, 2020) by the Academic Health Science Network (AHSN) as "*enabling*" and "*disruptive*" (AHSN: September, 2021). From a perspective of affecting paradigms, technologies such as IIVEs and digital interventions such as The Timeline have a way to go, as outlined in the limitations and future work, as well as the discussion and from within data from the findings. However, as with all paradigms that become eventually embraced, these must begin somewhere, and by standing a conventionally seated therapy up on its feet, encouraging neuroplasticity and new ways to behave in a different environment, inclusive of interactivity via touch, this might well be a place to start and one that, unavoidably, will make sense.

REFERENCES

Agabi, Christine E., John P. Wilson (2005) Trauma, Vilence & Abuse, Vol 6, No. 3, 195-216, Sage Publications. Available: https://journals.sagepub.com/doi/pdf/10.1177/1524838005277438

Arpetti, Allessandro, Maria Cecilia C. Baranaukas (2016) Enactive Systems & Computing Mapping the Terrain for Human Computer Interaction Research. SEMISH - 43º Seminário Integrado de Software e Hardware, p.1621. Available: https://sol.sbc.org.br/index.php/semish/article/view/9513/9411

Allemang, Brooke, Kathleen Sitter, Gina Dimitropoulos (2021) Pragmatism as a paradigm for patient-oriented research. Health Expectations. John Wiley and Son Ltd. Available: https://onlinelibrary.wiley.com/doi/epdf/10.1111/hex.13384

Antonuccio, D. O., Danton, W. G., & McClanahan, T. M. (2003). Psychology in the prescription era: Building a firewall between marketing and science. American Psychologist, 58, 1028–1043. Available: DOI: 10.1037/0003-066X.58.12.1028

Arabski, Janusz, Adam Wojtaszek (2010) Neurolonguistic and Psycholinguistic Perspectives on Second Language Acquisition. Multilingual Matters, Bristol. Available: http://lanlib.alzahra.ac.ir/multiMediaFile/2232291-4-1.pdf#page=108

Association for Computing Machinery (2018) The Code. ACM Code of Ethics and Professional Conduct. Available: https://www.acm.org/binaries/content/assets/membership/images2/fac-stu-poster-code.pdf

Bandura, Albert (1994) Self-efficacy. In V.S. Ramachaudran (Ed.) Encyclopedia of human behaviour (Vol. 4, pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman [Ed.]. Encyclopedia of mental health. San Diego: Academic Press, 1998) [Online] Available: https://pdfs.semanticscholar.org/63c0/16b24e575bc19f58710a3ed49838878560f8.pdf

Banks, J., Eriksson, G., Ivermee, S., Burrage, K., Yellowless, P., Tichon, J. (2004) A Virtual Environment to Re-Create the Auditory and Visual Hallucinations of Psychosis. Associattion of Computer Machinery, Inc. [Online] Available: https://dl.acm.org/doi/pdf/10.1145/1044588.1044596?download=true

Barandiaran. Xabier E. (2017) Autonomy and Enactivism: Towards a Theory of Sensorimotor Autonomous Agency. Available: DOI: 10.1007/s11245-016-9365-4

Barandiaran, Xabier E. (2017) Autonomy and Enactivism: Towards a Theory of Sensorimotor Autonomous Agency. Topoi, 36: 409-430. Available: https://link.springer.com/content/pdf/10.1007/s11245-016-9365-4.pdf

Barandiaran, Xabier E., Alvaro Moreno (2006) On What Makes Certain Dynamical Systems Cognitive: A Minimally Cognitive Organization Program. International Society for Adaptive Behavior. Available: https://journals.sagepub.com/doi/pdf/10.1177/105971230601400208

Bardram, Jakob, Claus Bossen, Andreas Lykke-Olesen, Rune Nielsen, Kim Halskov Madsen (2002) Virtual video prototyping of pervasive healthcare systems. DIS '02: Proceedings of the 4th conference on Designing Interactive System: processes, practices, methods, and techniques, p.177. Available: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.83.4914

Barsalou, Lawrence W. (2010) Grounded Cognition: Past, Present, and Future. Topics in Cognitive Science, 716-724. Available: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1086.458&rep=rep1&type=pdf

Baggs, Edward Anthony, Chemero (2018a) Radical embodiment in two directions [Online] Available: https:doi.org/10.1007/s11229-018-02020-9

Baggs, Edward, Chemero, Anthony (2018b) Radical embodiment in two directions [Online] Available: https:doi.org/10.1007/s11229-018-02020-9

Baggs, Edward, Chemero, Anthony (2018c) Radical embodiment in two directions [Online] Available: https:doi.org/10.1007/s11229-018-02020-9

Baker, Sarah Elsie, Edwards, Rosalind (2012) How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National Centre for Research Methods. Available: https://eprints.ncrm.ac.uk/id/eprint/2273/4/how_many_interviews.pdf

Beck, J. Gayle, Demond, M. Grant, Jennifer P. Read, Joshua, D. Clapp, Scott F. Coffey, Luana, M. Miller, Sarah A. Palyo, 2008. The Impact of Events Scale – Revised: Psychometric properties in a sample of motor vehicle accident survivors. Journal of Anxiety Disorders. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2259224/pdf/nihms39777.pdf

Beidel, Deborah C., B. Christopher Frueh, Sandra M. Neer, Clint A. Bowers, Benjamin Trachik, Thomas W. Uhde, Anouk Grubaugh. 2017. Trauma management therapy with virtual reality exposure therapy for combat-related PTSD: A randomised controlled trial. Journal of Anxiety Disorders. Available: https://doi.org/10.1016/j.janxdis.2017.08.005

Bennett, Dan, Alan Dix, Parisa Eslambolchilar, Feng Feng, Tom Froese, Vassilis Kostakos, Sebastien Lerique, Niels van Berkel (2021) Emergent Interaction: Complexity, Dynamics, and Enaction in HCI. ACM CHI Extended Abstracts. Available: https://emergentinteraction.github.io/assets/complexity_chi.pdf

Benyon, David Phil Turner, Susan Turner (2005) Designing Interactive Systems. Pearson Education Limited

Bertolote, Jose M. (2008) The roots of the concept of mental health. Mental health policy. World Psychiatry, 7: 113-116. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2408392/

Bisson JI, van Deursen R, Hannigan B, Kitchiner N, Barawi K, Jones K, Pickles T, Skipper J, Young C, Abbott LR, van Gelderen M, Nijdam MJ, Vermetten E. (2020) Randomized controlled trial of multimodular motion-assisted memory desensitization and reconsolidation (3MDR) for male military veterans with treatment-resistant posttraumatic stress disorder. Acta Psychiatrica Scandinavica. Available: https://orca.cardiff.ac.uk/id/eprint/132173/3/acps.13200.pdf

Blascovich, Jim, Jack Loomis, Andrew C. Beall, Kimberly R. Swinth, Crystal L. Hoyt, Jeremy N. Bailenson (2002) Immersive Virtual Environment Technology as a Methodological Tool for Social Psychology. Psychological Inquiry, Vol. 13, No. 2 [Online] Available: https://vhil.stanford.edu/mm/2002/blascovich-IVET.pdf

Blore, David, C., Holmshaw, Manda, E., Swift, Ann, Standard, Sally, Fish, Deborah, M. (2013) The Development and Uses of the "Blind to Therapist" EMDR Protocol. Journal of EMDR Practice and Research, Volume 7, Number 2. Available: https://connect.springerpub.com/content/sgremdr/7/2/95.full.pdf

Boeldt, Debra, Elizabeth McMahon, Mimi McFaul, Walter Greenleaf. 2019. Using Virtual Reality Exposure Therapy to Enhance Treatment of Anxiety Disorders: Identifying Areas of Clinical Adoption and Potential Obstacles. Frontiers in Psychiatry, p.2. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6823515/pdf/fpsyt-10-00773.pdf

Braun, Virginia, Clarke, Victoria (2006) Using thematic analysis in psychology. Qualitative Research in Psychology 3, 2 (2006), 77–101. Available: DOI: https://doi.org/10.1191/1478088706qp063oa

Braun, Virginia, Clarke, Victoria (2006) Using thematic analysis in psychology. Qualitative Research in Psychology 3, 2 (2006), 77–101. Available: DOI: https://doi.org/10.1191/1478088706qp063oa

Bremner, James Douglas (2006) Traumatic Stress: effects on the brain. Clinical Research. Dialogues in Clinical Neuroscience. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181836/pdf/DialoguesClinNeurosci-8-445.pdf

British Medical Association (2019) Measuring progress: Commitments to support and expand the mental health workforce in England. Available: https://www.bma.org.uk/media/2405/bma-measuring-progress-of-commitments-for-mental-health-workforce-jan-2020.pdf

British Medical Association (2020) Beyond partity of esteem – Achieving partity of resource, access and outcome for mental health in England. Available: https://www.bma.org.uk/media/2099/mental-health-parity-of-esteem-report-jan-2020-2.pdf

Bruce, Tor Alexander (2020) Enactive Approaches to Designing and Understanding Immersive Interactive Virtual Environments in Mental Healthcare. Available: https://www.scienceopen.com/hosted-document?doi=10.14236/ewic/HCI20DC.19

Bruce, Tor Alexander, Rebair, Annessa, Holmquist, Lars Erik (2022) The Timeline: A Qualitative Study Exploring Therapeutic Experiences in an Immersive Interactive Virtual Environment (IIVE) for Trauma Mental Healthcare. ICPS Proceedings, NordiCHI '22: Nordic Human-Computer Interaction Conference. Available: https://dl.acm.org/doi/10.1145/3546155.3547725

Campion, Jonathon (2019) Public mental health: Evidence, practice and commissioning. Available: https://www.rsph.org.uk/static/uploaded/b215d040-2753-410e-a39eb30ad3c8b708.pdf

Card, Stuart, Thomas Moran, Allen Newell (1983) The Psychology of Human Computer Interaction. Lawrence Erlbaum Associates, Publishers

Carmen Juan, M., David Perez (2009) Comparison of the Levels of Presence and Anxiety in an Acrophobic Environment Viewed via HMD or CAVE. Presence, Vol. 18, No. 3, June 2009, 232–248. p.241. Massachusetts Institute of Technology. Available: https://direct.mit.edu/pvar/article/18/3/232/18749/Comparison-of-the-Levels-of-Presence-and-Anxiety

Carroll, John M. (2002) Human Computer Interaction In The New Millennium. ACM Press Books. ACM-Addison-Wesley, New York

Cieslik, Blazej, Mazurek, Justyna, Rutkowski, Sebastian, Kiper, Pawel, Turolla, Andrea, Szczepanska-Gieracha, Joanna (2020) Virtual reality in psychiatric disorders: A systematic review of reviews. Complimentary Therapies in Medicine, 52. Available: https://doi.org/10.1016/j.ctim.2020.102480

Celikoz, Nadir, Yavuz Erisen, Mehmet Sahin (2019) Cognitive Lerarning Theories With Emphasis On Latent Learning, Gestalt And Information Processing Theories. Journal of Educational and Instructional Studies In The World, Volume: 9, Issue: 3. Available: https://files.eric.ed.gov/fulltext/ED598366.pdf, p.25

Clark, Andy (1997) Being There. Putting Brain, Body, and World Together Again. Massachusetts Institute of Technology

Clark, David M. (2011) Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: The IAPT experience. International Review of Psychiatry, 23: 318-327. Available: https://www.tandfonline.com/doi/pdf/10.3109/09540261.2011.606803?cookieSet=1

Chemero, Anthony (2009) Radical Embodied Cognitive Science. Massachusetts Institute of Technology, MIT Press

Constant, Axel, Andy Clark, Karl J. Friston (2021) Representation Wars: Enacting and Armistice Through Active Inference. Hypothesis and Theory. Frontiers in Psychology

Conran, Joseph (1949) The Hero With A Thousand Faces. MJF Books, Fine Communications, p.58, New York

Maxime Cordeil, Tim Dwyer, Karsten Klein, Bireswar Laha, Kim Marriott, Bruce H. Thomas. 2017. Immersive Collaborative Analysis of Network Connectivity: CAVE-style of Head Mounted Display? IEEE Trans Vis Comput Graph. 2017 Jan;23(1):441-450. p.448. Available: DOI: 10.1109/TVCG.2016.2599107. PMID: 27875160.

Caroline Cruz-Neira, Daniel J. Sandin, Thomas A. DeFanti (1993) Surround Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE. Association for Computing Machinery (ACM), p.135-142. Available: https://dl.acm.org/doi/pdf/10.1145/166117.166134

Caroline Cruz-Neira, Dan J. Sandin, Thomas A. DeFanti, Robert V. Kenyon, John C. Hart (1992) The CAVE: audio visual experience automatic virtual environment. Communications of the ACM, Volume 35, Issue 6 [Online] Available: https://dl.acm.org/citation.cfm?id=129892

Marek Czernuszenko, Dave Pape, Daniel Sandin, Tom DeFanti, Gregory L. Dawe, Maxine D. Brown (1997) The ImmersaDesk and InfinityWall Projection-Based Virtual Reality Displays. Computer Graphics. Available: https://www.evl.uic.edu/pape/papers/idesk.cg.may97/

Peter Dalsgaard (2014) Pragmatism and design thinking. International Journal of Design, 8 (1) 143-155. Available: https://cdn.tc-library.org/Rhizr/Files/sHzT6ngX98NEDhAP8/files/1087-6729-2-PB.pdf

Daniel David, Ioana Cristea, Stefan G. Hofmann (2018) Why Cognitive Behavioral Therapy Is The Current Gold Standard Of Psychotherapy. Frontiers in Psychiatry, Opinion. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5797481/pdf/fpsyt-09-00004.pdf

Department of Health (2017) Transforming Children and Young People's Mental Health Provision: a Green Paper [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664 855/Transforming_children_and_young_people_s_mental_health_provision.pdf

Dewey, John (1934) Art as Experience. New York: Perigee/Berkley

Dix, Alan, Janet Finlay, Gregory Abowd, Russell Beale (1993) Human-Computer Interaction. Prentice Hall International (UK) Limited

Dix, Alan, Janet Finlay, Gregory Abowd, Russell Beale (1993) Human-Computer Interaction. Prentice Hall International (UK) Limited

Deacon, Brett J., (2013) The biomedical model of mental disorder: A critical analysis of its validity, utility, and effects on psychotherapy research. Clinical Psychology Review 33, 846-861) Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.704.9127&rep=rep1&type=pdf

Deacon, Brett J., (2013). The biomedical model of mental disorder: A critical analysis of its validity, utility and effects on psychotherapy research. Clinical Psychology Review 33 846-856. Available: http:dx.doi.org/10.1016/j.cpr.2012.09.007

Deacon, Brett J., Dean McKay (2015) The Biomedical Model of Psychological Problems: A Call for Critical Dialogue. The Behaviour Therapist, 38 (7). Available: https://psycnet.apa.org/record/2015-56839-013

DeFanti, Thomas A., Daniel Acevedo, Richard A. Ainsworth, Maxine D. Brown, Steven Cutchin, Gregory Dawe, Kai-Uwe Doerr, Andrew Johnson, Chris Knox, Robert Kooima, Falko Kuester, Jason Leigh, Lance Long, Peter Otto, Vid Petrovic, Kevin Ponto, Andrew Prudhomme, Ramesh Rao, Luc Renambot, Daniel J. Sandin, Jurgen P. Schulze, Larry Smarr, Madhu Srinivasan, Philip Weber, Gregory Wickham (2011) The future of the CAVE. Central European Journal of Engineering, 1, 16-37. Available: https://link.springer.com/article/10.2478/s13531-010-0002-5

de Haan. Sanneke (2020) Enactive Psychiatry. Cambridge University Press

DeLisi, Lynn E. Kamila U. Szulc, Hilary C. Bertisch, Magda Majcher, Kyle Brown (2006) Understanding structural brain changes in schizophrenia. Dialogues in Clinical Research. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181763/pdf/DialoguesClinNeurosci-8-71.pdf

Dilgul, Merve, Lauren M. Hickling, Daniela Antonie, Stefan Priebe, Victoria J. Bird. 2021. Virtual Reality Group Therapy for the Treatment of Depression: A Qualitative Study on Stakeholder Perspectives. Frontiers in Virtual Reality. Available: https://doi.org/10.3389/frvir.2020.609545

Domingues, Diana (2013) The interfaced subject immersed in virtual spaces [Online] Available: https://www.academia.edu/501172/The_interfaced_subject_immersed_in_virtual_spaces

Dourish, Paul (2004) Where the Action Is. The Foundations of Embodied Interaction, Massachusetts Institute of Technology, MIT Press, United States of America

Ellis, Stephen R. (1991) Nature And Origins of Virtual Environments: A Bibliographical Essay. In: Computing Systems and Engineering, Volume 2, Number 4. Printed in Great Britain. Pergamon Press Plc.

Engel, George L. (1977) The Need for a New Medical Model: A Challenge for Biomedicine. Science, Vol 196, Issue 4286. Available: DOI: 10.1126/science.847460

Etikan, Ilker, Musa, Sulaiman Abubakar, Alkassim, Rukayya Sunusi (2016) Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics (5 (1): 1-4. Available: doi: 10.11648/j.ajtas.20160501.11

Farre, Albert, Tim Rapley (2017) The New Old (and Old New) Medical Model: Four Decades Navigating the Biomedical and Psychosocial Understandings of Health and Illness. Healthcare, 5, 88. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5746722/pdf/healthcare-05-00088.pdf

Febretti, Allesando, Nishimoto, Arthur, Thigpen, Terrancer, Talandis, Jonas, Long, Lance, Pirtle, J.D., Peterka, Tom, Verlo, Alan, Brown, Maxine, Plepys, Dana, Sandin, Dan, Renambot, Luc, Johnson, Andrew, Leigh, Jason (2013) CAVE2: A Hybrid Reality Environment for Immersive Simulation and Information Analysis. Available at: https://www.evl.uic.edu/documents/spie13paper-final-2.pdf

Fleming II, Mark A., Lubaina Ehsan, Sean R. Moore, Daniel E. Levin (2020) The Enteric Nervous System and Its Emerging Role as a Therapeutic Target. Gastroenterology Research and Practice, Volume 2020. Available: DOI. https://doi.org/10.1155/2020/8024171

Frank, Arthur W. (1995) The Wounded Storyteller. The University of Chicago Press, Chicago

Galdas. Paul (2017) Revisiting Bias in Qualitative Research: Reflections On Its Relationship With Funding And Impact. International Journal of Qualitative Methods. Volume 16, 2. Available: https://doi.org/10.1177/1609406917748992

Gallagher, Shaun (2017) Enactivist Interventions. Rethinking the Mind. Oxford University Press. New York

Gallagher, Shaun, Zahavi, Dan (2008) The Phenomenological Mind: An introduction to philosophy of mind and cognitive science. Routledge

Garcia, Enara (2021) Participatory Sense-Making in Therapeutic Interventions. Journal of Humanistic Psychology. Available: https://doi.org/10.1177/00221678211000210, p.1-21

Georgieva, Iva, Georgi V. Georgiev (2022) Narrative self-recreation in virtual reality. Frontiers in Virtual Reality. Available: https://www.frontiersin.org/articles/10.3389/frvir.2022.854333/full

Gerardi, Maryrose, Barbara Olasov Rothbaum, Kerry Ressler, Mary Heekin, Albert Rizzo. 2008. Virtual Reality Exposure Therapy Using a Virtual Iraq: Case Report. National Institute of Health. J Trauma Stress. 2008 April; 21(2): 209-213. Available: DOI:10.1002/jts.20331

Gibson, James J. (1979) The Ecological Approach to Visual Perception, Boston: Houghton Mifflin

Gillies, Donna, Licia Maiocchi, Abhishta P. Bhandari, Fiona Taylor, Carl Gray, Louise O'Brien (2016) Psychological therapies for children and adolescents exposed to trauma (Review). Cochrane Database of Systematic Reviews, Issue 10. Available: DOI: 10.1002/14651858.CD012371. p.6

Gomes, Paul Veloso, Antonio Marques, Javier Pereira, Joao Donga (2019) The Influence of Immersive Environments on the Empathy Construct about Schizophrenia. Proceedings (21)1, 3 [Online] Available: https://www.mdpi.com/2504-3900/21/1/3

Gomes, Paul Veloso, Antonio Marques, Javier Pereira, Joao Donga (2019) The Influence of Immersive Environments on the Empathy Construct about Schizophrenia. Proceedings (21)1, 3 [Online] Available: https://www.mdpi.com/2504-3900/21/1/3

Gov.UK (2021) Reforming the Mental Health Act: Government response to consultation. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002885/reforming-mental-health-act-consultation-response-print-ready.pdf

Grabbe, Linda, Elaine Miller-Karas (2017) The Trauma Resiliency Model: A "Bottom Up" Intervention for Trauma Psychotherapy. Journal of the American Psychiatric Association. 1-9. Available: https://www.pacesconnection.com/g/Parenting-with-ACEs/fileSendAction/fcType/0/fcOid/480528347488215112/filePointer/480528347488215138/fodoid/480246307034100746/JAPNA%2012-2017%20TRM.pdf

Grigorovici, Dan M. (2003). Persuasive effects of presence in immersive virtual environments. In G. Riva, D. Fabrizio, & W. Ijsselsteijn (Eds.), Being There: Concepts, Effects and Measurement of Consumer Presence in Synthetic Environments, (pp.192-205). IOS Press, Amsterdam, Netherlands

Guest, Greg, Arwen Bunce, Laura Johnson. 2006. How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. Field Mathods, Vol. 18, 59-82. Available: DOI: 10.1177/1525822X05279903

Guillemin, Marilys, Lynn Gillam (2004) Ethics, Reflexivity, and "Ethically Important Moments" in Research. Qualitative Inquiry. SAGE journals. Available: https://doi.org/10.1177/1077800403262360

Haniff, David, Alan Chamberlain, Louise Moody, Sara De Freitas. 2014. Virtual environments for mental health issues: A review. Journal of Metabolomics and Systems Biology. Vol. 3(1), pp. 1-10, April 2014. Available: DOI:10.5897/JMSB11.003

Hase, Michael, Balmaceda, Ute, M., Ostacoli, Luca, Liebermann, Peter, Hofmann, Arne (2017) The AIP Model of EBDR Therapy and Pathogenic Memories. Frontiers in Psychology. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2017.01578/full

Hayman, Geneveive (2016) Mirror Neurons, Husserl, and Enactivism: An Analysis of Phenomenological Compatibiliity. De Gruyter Open. Perspectives. International Postgraduate Journal of Philosophy: 6(1): 13-23. Available: https://philpapers.org/rec/HAYMNH

Hayman, Geneveive (2016) Mirror Neurons, Husserl, and Enactivism: An Analysis of Phenomenological Compatibiliity. De Gruyter Open. Perspectives. International Postgraduate Journal of Philosophy: 6(1): 13-23. Available: https://philpapers.org/rec/HAYMNH

Heilig, Morton L. (1955 [Reprinted 1992] El Cine del Futuro: The Cinema of the Future. Espacios. In Presence, Volume I, Number 3. The Massachusetts Institute of Technology. Available: https://doi.org/10.1162/pres.1992.1.3.279

Heilig, Morton L. (1955 [Reprinted 1992] El Cine del Futuro: The Cinema of the Future. Espacios. In Presence, Volume I, Number 3. The Massachusetts Institute of Technology. Available: https://doi.org/10.1162/pres.1992.1.3.279

Heilig, Morton L. (1955 [Reprinted 1992] El Cine del Futuro: The Cinema of the Future. Espacios. In Presence, Volume I, Number 3. The Massachusetts Institute of Technology. Available: https://doi.org/10.1162/pres.1992.1.3.279

Heras-Escribano, Manuel (2021) Pragmatism, enactivism, and ecological psychology: towards a unified approach to post-cognitivism. Synthese, 198 (Suppl 1). Available: https://link.springer.com/article/10.1007/s11229-019-02111-1

Holmquist, Lars Erik (2012) Grounded Innovation. Strategies For Creating Digital Products. Elsevier

Holtrop, Jodi Summers, Russel E. Glasgow (2020) Pragmatic research: an introduction for clinical practitioners. Family Practice, 424-428. Oxford. Available: https://academic.oup.com/fampra/article/37/3/424/5875565

Hook, Kristina (2018) Designing With The Body. Somaesthetic Interaction Design. The MIT Press, Cambridge Massachusetts

Hook, Kristina, Jonsson, Martin, P., Stahl, Anna, Mecurio, Johanna (2016) Somaesthetic Appreciation Design. ACM CHI. Available: http://dx.doi.org/10.1145/2858036.2858583

Houde, Stephanie, Charles Hill (1997) What do Prototypes Prototype? Handbook of Human-Computer Interaction (HCI) – Second, completely revised edition, Elsevier Science. Available: http://www.itu.dk/~malmborg/Interaktionsdesign/Kompendie/Houde-Hill-1997.pdf

Illich, Ivan (1995 [1976]) Limits To Medicine. Medical Nemesis: The Expropriation of Health. Marion Boyars Publishers Ltd., Great Britain

Ionescu, Alina, Tom Van Daele, Albert Rizzo, Carolyn Blair, Paul Best. 2021. 360° Videos for Immersive Mental Health Interventions: a Systematic Review. J. technol. behave. sci. 6, 631–651 (2021). Available: https://doi.org/10.1007/s41347-021-00221-7

Jantz, Jay, Adam Molnar, Ramses Alcaide (2017) A brain-computer interface for extended reality interfaces [Online] Available: https://dl.acm.org/citation.cfm?id=3089290

Jasanoff, Alan (2018) The Biological Mind. How Brain, Body and Environment Collaborate To Make Us Who We Are. Basic Books, New York.

Jékely, Gáspár, Peter Godfrey-Smith, Fred Keijzer (2020) Reafference and ther origin of the self in early nervous system evolution (2020) Philosophical Transactions B. Royal Society Publishing. Available: https://royalsocietypublishing.org/doi/epdf/10.1098/rstb.2019.0764

Jerald, Jason (2016) The VR Book. Human-Centered Design for Virtual Reality. Association for Computing Machinery. Morgan & Claypool

Johnson, Mark, George Lakoff (1992) Experientialist Philopsophy. Philosophy In The Age Of Cognitive Science. Available: https://georgelakoff.files.wordpress.com/2011/04/experientialist-philosophy-lakoff-and-johnson-1992.pdf

Kaipainen, Mauri, Niklas Ravaja, Pia Tikkka, Rasmus Vuori, Roberto Pugliese, Marco Rapino, Tapio Takala (2011) Enactive Systems and Enactive Media: Embodied Human-Machine Coupling Beyond Interfaces. Theoretical Perspective. Leonardo, Volume 44, Number 5, Available: https://www.jstor.org/stable/pdf/41421766.pdf

Kessler, Ronald C., Sergio Aguilar-Gaxiola, Jordi Alonso, Corina Benjet, Evelyn J. Bromet, Graça Cardoso, Louisa Degenhardt, Giovanni de Girolamo, Rumyana V. Dinolova, Finola Ferry, Silvia Florescu, Oye Gureje, Josep Maria Haro, Yueqin Huang, Elie G. Karam, Norito Kawakami, Sing Lee, Jean-Pierre Lepine, Daphna Levinson, Fernando Navarro-Mateu, Beth-Ellen Pennell, Marina Piazza, José Posada-Villa, Kate M. Scott, Dan J. Stein, Margreet Ten Have, Yolanda Torres, Maria Carmen Viana, Maria V. Petukhova, Nancy A. Sampson, Alan M. Zaslavsky & Karestan C. Koenen (2017) Trauma and PTSD in the WHO World Mental Health Surveys, European Journal of Psychotraumatology, 8:sup5. Available: 10.1080/20008198.2017.1353383

Kip, Hanneke, Saskia M. Kelders, Kirby Weerink, Ankie Kuiper, Ines Bruninghoff, Yvonne H. A. Bouman, Dirk Dijkslag, Lisette J. E. W. C. van Gemert-Pijnen. 2019. Identifying the Added Value of Virtual Reality for Treatment in Forensic Monetal Health: A Scenario-Based Qualitative Approach. Frontiers in Psychology. Available: https://doi.org/10.3389/fpsyg.2019.00406

Kirsh, David (2013) Embodied Cognition and the Magical Future of Interactive Design. ACM Trans. On Human Computer Interaction, Vol. 20, pp. 1, 4. Available: https://quote.ucsd.edu/cogs1/files/2012/09/Kirsh-Final-acm_reading.pdf

Kitson, Alexandra, Mirjana Prpa, Bernard E, Riecke. 2018. Immersive Interactive Technologies for Positive Change: A Scoping Review and Design Considerations. Frontiers in Psychology, 9:1354. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01354/full

Kleber, Rolf J. (2019) Trauma and Public Mental Health: A Focused Review. Frontiers in Psychiatry, Volume 10, Article 451. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6603306/pdf/fpsyt-10-00451.pdf

Krueger, Myron W. (1977) Responsive environments. National Computer Conference. The University of Wisconsin [Online] Available: https://www.google.com/search?q=kreugers+videoplace+milwaukee&rlz=1C1JZAP_en

Kyselo, Miriam (2016) The enactive approach and disorders of the self – the case of schizophrenia. Phenom. Cogn. Sci. 15:591-616. Available: 10.1007/s11097-015-9441-z

Lanius, Ruth A., Braden A. Terpou, Margaret C. McKinnon (2020) The sense of self in the aftermath of trauma: lessons from the default mode network in posttraumatic stress disorder, European Journal of Psychotraumatology. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7594748/pdf/ZEPT_11_1807703.pdf

Lattie, Emily G. Rachel Kornfield, Kathryn E. Ringland, Renwen Zhang, Nathan Winquist, Madhu Reddy (2020) Designing Mental Health Technologies that Support the Social Ecosystem of College Students. CHI '20. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, Pages 1-15. Available: https://doi.org/10.1145/3313831.3376362

Leichsenring, Falk, Christiane Steinert, John P.A. Ioannidis (2019) Toward a paradigm shift in treatment and research of mental disorders. Psychological Medicine, 49, 2111-2117. Available: https://doi.org/10.1017/S0033291719002265

Leichsenring, Falk, Christiane Steinert, John P.A. Ioannidis (2019) Toward a paradigm shift in treatment and research of mental disorders. Psychological Medicine, 49, 2111-2117. Available: https://doi.org/10.1017/S0033291719002265

Leiva, German, Cuong Nguyen, Rubaiat Habib Kazi, Paul Asente (2020). Pronto: Rapid Augmented Reality Video Prototyping Using Sketches and Enaction, CHI 2020, p.3. Available: https://3dvar.com/Leiva2020Pronto.pdf

Lobo, Lorena., Heras-Escribano, M., Travieso, D. (2018) The History and Philosophy of Ecological Psychology. Frontiers in Psychology. Hypothesis and Theory. Available: 10.3389/fpsyg.2018.02228

Lobo, Lorena, Manuel Heras-Escribano, David Travieso (2018) The History and Philosophy of Ecological Psychology, Front Psychol. 2018 Nov 27;9:2228. Available: 10.3389/fpsyg.2018.02228.

Loomis, Jack M., James J. Blascovich, Andrew C. Beall. 1999. Immersive virtual environment technology as a basic research tool in psychology. Behavior Research Methods, Instruments and Computers, 31 (4) p.557-564 (1999). Available: https://doi.org/10.3758/BF03200735.

Luo, Dai, Xiao-lei Deng, Ya-wei Luo, Guang-xin Wang. 2019. Design and Implementation of Virtual Examination System Based on Unity 3D. AIAM 2019: Proceedings of the 2019 International Conference on Artificial Intelligence and Advanced Manufacturing. Article No.: 73. Available: https://doi.org/10.1145/3358331.3358404. p. 1-8

Ma, Jingni, Zhao, Dongrong, Xu, Naihong, Yang, Jinmei (2022) The effectiveness of immersive virtual reality (VR) based mindfulness training on improvement mental health in adults: A narrative systematic review. Explore. Available: https://doi.org/10.1016/j.explore.2022.08.001

Mackay, Wendy E. (1988) Video Prototyping: a technique for developing hypermedia systems. Available: https://www.lri.fr/~mackay/pdffiles/CHI88.VideoPrototyping.pdf

Maguire, Moira, Brid Delahunt. 2017. Doing a Thematic Analysis: A Practical, Step-by-Step Guide for Learning and Teaching Scholars. All Ireland Journal of Higher Education, Volume 9, Number 3. Available: https://ojs.aishe.org/index.php/aishe-j/article/view/335

Maples-Keller, Jessica L., Brian E. Bunnell, Sae-Jin, Kim., Barbara O. Rothbaum (2017) The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. Harv. Rev. Psychiatry. Available: 10.1097/HRP.0000000000000138

McCarthy, John, Peter Wright (2004) Technology as experience. Interactions, Volume 11, Issue 5. Available: https://dl.acm.org/doi/10.1145/1015530.1015549

McAvoy, Jean (2014) Psy disciplines. In: Teo, Thomas ed. Encyclopedia of Critical Psychology. New York: Springer, pp. 1527-1529. Available: http://oro.open.ac.uk/40691/3/Psy%20disciplines.pdf

Merleau Ponty, Maurice (1962) Phenomenology of Perception. Translated from the French by Colin Smith. Routlkedge and Kegan Paul Ltd, London, p.230

Meyerbröker, Katharina, Nexhmedin Morina, Gerard Kerkhof, Paul M.G. Emmelkamp. 2011. Virtual Reality Exposure Treatment of Agoraphobia: a Comparison of Computer Automatic Virtual Environment and Head-Mounted Display. Studies in Health Technology and Informatics. Volume 167, p.51-56. Available: https://ebooks.iospress.nl/doi/10.3233/978-1-60750-766-6-51

Meyer, Russell, Brancazio, Nick (2022) Putting down the revolt: Enactivism as a philosophy of nature. Frontiers in Psychology p.8. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.948733/full

Miao, Xue-Rong, Qian-Bo Chen, Kai Wei, Kun-Ming Tao, Zhi-Jie Lu (2018) Posttraumatic stress disorder: from diagnosis to prevention. Military Medical Research, 5:32. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6161419/pdf/40779_2018_Article_179.pdf

Milkowski, Marcin (2018) From Computer Metaphor to Computational Modelling: The Evolution of Computationalism. Minds and Machines. 28. Available: https://link.springer.com/content/pdf/10.1007/s11023-018-9468-3.pdf

Mishra, Varun (2019) From sensing to intervention for mental and behavioural health. UbiComp/ISWC '19 Adjunct: Adjunct Proceedings of the 2019 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers. September 2019 Pages 388–392. Available: https://doi.org/10.1145/3341162.3349304.

Mostajeran, Fariba, Jessica Krzikawski, Frank Steinicke, Simone Kuhn. 2021. Effects of exposure to immersive videos and photo slideshows of forest and urban environments. Sci Rep 11, 3994. Available: https://doi.org/10.1038/s41598-021-83277-y

Moghe, Abhishek, Kevin Dass, Tapan Auti, Neha Kenche, Geeta S. Navale (2018) A Survey on CAVE Technology and its Applications. International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT) Volume 3, Issue 8. Available: https://ijsrcseit.com/CSEIT1838103

Morris, Zoë Slote, Steven Wooding, Jonathan Grant (2011) The answer is 17 years, what is the question: understanding time lags in translational research. Journal Review of Social Medicine, 104: 510-520. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3241518/pdf/JRSM-11-0180.pdf

Morse, Janice M., Michael Barrett, Maria Mayan, Karin Olson, Jude Spiers. 2002. Verification Strategies for Establishing Reliability and Validity in Qualitative Research. International Journal of Qualitative Methods. p.17. Available: https://doi.org/10.1177/160940690200100202

Nam, Su Hyun (2021) Enacted Scene. Virtual World Built Upon Experimental Cognitive Intervention. ARTECH. Available: https://dl.acm.org/doi/pdf/10.1145/3483529.3483777

National Health Service (2019) The NHS Long Term Plan. Available: https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/

Natsoulas, Thomas (2004) "To See Things Is To Perceive What They Afford": James J. Gibson's Concept of Affordance. The Journal of Mind and Behaviour, Volume 25, Number 4, 323-348. Available: https://www.jstor.org/stable/pdf/43854043.pdf

Nettleton, Sarah (2006) The Sociology of Health and Illness (2006) 2ND Edition, p.3. Polity Press

NHS (2019) The NHS Long Term Plan. Available: https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/

NHS Health Research Authority (2022) Research Passport. Available: https://www.hra.nhs.uk/planning-and-improving-research/best-practice/research-passport/

Noë, Alva (2021) The enactive approach: a briefer statement, with some remarks on "radical enactivism". Phenomenology and the Cognitive Sciences, 20: 957-970. Available: https://link.springer.com/content/pdf/10.1007/s11097-021-09754-x.pdf

Norman, Donald, J. (1999) The Invisible Computer. Why good products can fail, The personal computer is so complex, and information appliances are the solution, MIT Press

Olson, Gary M., Judith S. Olson (2003) Human Computer Interaction: Psychological Aspects of the Human Use of Computing. Annual Review of Psychology, 54: 491-516. Available: https://www.annualreviews.org/doi/epdf/10.1146/annurev.psych.54.101601.145044

Online Etymology Dictionary (2019) technology (n.) Available: https://www.etymonline.com/word/technology

Peeters, Anco, Miguel Segundo-Ortin (2019) Misplacing Menories? An enactive approach to the virtual memory palace. Consciousness and Cognition 76. Elsevier. Available: https://philpapers.org/archive/PEEMMA-2.pdf

Pietraszewski, David, Annie E.Wertz (2021) Why Evolutionary Psychology Should Abandon Modularity. Perspectives on Psychological Science, Volume 17(2). Available: https://journals.sagepub.com/doi/pdf/10.1177/1745691621997113

Poulsen, Dorthe Varning, Ulrika K. Stigsdotter, Dorthe Djernis, Ulrik Sideniu. 2016. 'Everything just seems much more right in nature': How veterans with post-traimatic stress disorder experience nature-based activities in a forest therapy garden. Health Psychology Open, 1-14. SAGE. Available: 10.1177/2055102916637090

Pozzi, Giulia, Federico Pigni, Claudio Vitari. Affordance Theory in the IS Discipline: a Review and Synthesis of the Literature. 2014. ACMIS 2014 Proceedings, Savannah, United States. Available: https://halshs.archives-ouvertes.fr/halshs-01923663

Prema, K.N., Roopa, B.S. (2018) Virtual Reality: A survey. International Research Journal of Engineering and Technology (IRJET) Available: https://www.irjet.net/archives/V5/i7/IRJET-V5I7281.pdf

Rimkeviciene, Jurgita, O'Gorman, John, Hawgood, Jacinta, De Leo, Diego (2016) Timelines for difficult times: use of visual timelines in interviewing suicide attempters. Qualitative research in Psychology, 13: 3, 231.245. Available: https://doi.org/10.1080/14780887.2016.1170913

Rizzo, Albert A., Mark Wiederhold, J. G. Buckwalter (1998) Basic Issues In The Use Of Virtual Environments For Mental Health Applications. Virtual Environments in Clinical Psychology and Neuroscience. Available: https://psycnet.apa.org/record/1999-02203-001

Rizzo, Albert A., Gerard Jounghyun Kim (2005) A SWOT Analysis of the Field of Virtual Reality Rehabilitation and Therapy. Presence. Available: https://www.brainline.org/sites/default/files/SWOT_Analysis_VR_Rizzo.pdf

Roberts, Nancy (1978) Teaching Dynamic Feedback Systems Thinking: An Elementary View. Volume 24, Number 8. Management Science. Available: http://static.clexchange.org/ftp/documents/implementation/IM1993-01TeachingFeedbackST.pdf

Rocha, Marcio (2012) Cognitive, Embodied or Enacted? Contemporary Perspectives for HCI and Interaction. Transtechnology Research [Online] Available: http://www.trans-techresearch.net/wp-content/uploads/2015/05/TTReader2011_012_Rocha-01.pdf

Rogers, Yvonne, Sharp, Helen, Preece, Jenny (2011) Interaction Design. Beyond Human Computer Interaction. John Wiley & Sons Limited

Rogers, Yvonne, Kay Connelly, Lenore Tedesco, William Hazlewood, Andrew Kurtz, Robert E. Hall, Josh Hursey, Tammy Toscos (2007). Why It's Worth the Hassle: The Value of In-Situ Studies When Designing Ubicomp. In: Krumm, J., Abowd, G.D., Seneviratne, A., Strang, T. (eds) UbiComp 2007: Ubiquitous Computing. UbiComp 2007. Lecture Notes in Computer Science, vol 4717. Springer, Berlin, Heidelberg. Available: https://doi.org/10.1007/978-3-540-74853-3_20

Rohani, Darius A., Nanna Tuxen, Andrea Quemada Lopategui, Maria Faurholt-Jepsen, Lars V. Kessing, Jakob E. Bardram (2019) Personalizing Mental Health: A Feasibility Study of a Mobile Behavioral Activation Tool for Depressed Patients. PervasiveHealth'19: Proceedings of the 13th EAI International Conference on Pervasive Computing Technologies for Healthcare. May 2019 Pages 282–291. Available: https://doi.org/10.1145/3329189.3329214

Rothbaum, Barbara Olasov, L. Hodges, R. Alarcon, D. Ready, F. Shahar, K. Graap, J. Pair, P. Hebert, D. Gotz, B. Wills, D. Baltzell. 1999. Virtual Reality Exposure Therapy for PTSD Vietnam Veterans: A Case Study. Journal of Traumatic Stress, Vol.12, No 2. Available: 10.1023/A:1024772308758.

Rowlands, Mark (2013) The New Science of the Mind. From Extended Mind to Embodied Phenomenology, The MIT Press

Royal College of Psychiatrists (2021) Workforce shortages in mental health cause 'painfully' long waits for treatment. Available: https://www.rcpsych.ac.uk/news-and-features/latest-news/detail/2021/10/06/workforce-shortages-in-mental-health-cause-painfully-long-waits-for-treatment

Rubio-Tamayo, Jose Luis, Manuel Gertrudix Barrio, Francisco Garcia Garcia (2017) Immersive Environments and Virtual Reality: Systematic Review and Advances in Communication, Interaction and Simulation. Multimodal Technologies and Interaction. Available at: https://www.mdpi.com/2414-4088/1/4/21

Rubio-Tamayo, Jose Luis, Manuel Gertrudix Barrio, Francisco Garcia Garcia (2017) Immersive Environments and Virtual Reality: Systematic Review and Advances in Communication, Interaction and Simulation. Multimodal Technologies and Interaction [Online] Available: https://www.mdpi.com/2414-4088/1/4/21

Rubio-Tamayo, Jose Luis, Manuel Gertrudix Barrio, Francisco Garcia Garcia (2017) Immersive Environments and Virtual Reality: Systematic Review and Advances in Communication, Interaction and Simulation. Multimodal Technologies and Interaction [Online] Available: https://www.mdpi.com/2414-4088/1/4/21

Rudd, Brittany N., Rinad S Beidas (2020) Digital Mental Health: The Answer to the Global nMental Health Crisis? JMIR Mental Health. Available: https://mental.jmir.org/2020/6/e18472/PDF

Schreiber-Willnow, Karin, Klaus-Peter Seidler (2013) Therapy goals and treatment results in body psychotherapy: Experience with the concentrative movement therapy evaluation form. Body, Movement and Dance in Psychotherapy. Taylor & Francis. Available: https://www.tandfonline.com/doi/pdf/10.1080/17432979.2013.834847?needAccess=true

Shapiro, Francine, Laliotis, Deany (2011) EMDR and the Adaptive Information Processing Model: Integrative Treatment and Cse Conceptualization. Clinical Social Work Journal. Springer. Available: file:///C:/Users/MJVT8/Downloads/s10615-010-0300-7.pdf

Soosalu, Grant, Henwood, Suzanne, Deo, Arun (2019) Head, Heart, and Gut in Decision Making: Development of a Multiple Brain Preference Questionnaire. SAGE Open. p.2. Available: https://journals.sagepub.com/doi/pdf/10.1177/2158244019837439

Stendera, Marilyn, (2015) being-in-the-world, temporality and autopoiesis. Parrhesia: A journal of Critical Philosophy [Online] Available: https://philpapers.org/rec/STEBTA

Stilwell, Peter, Katherine Harman (2021) Phenomenological Research Needs to be Renewed: Time to Integrate Enactivism as a Flexible Resource. International Journal of Qualitative Methods, Volume 20: 1-15. Available: https://journals.sagepub.com/doi/pdf/10.1177/1609406921995299

Stoffregen, Thomas A., Benoît G. Bardy, Bruno Mantel. Affordances in the design of enactive systems. Virtual Reality, Springer Verlag, 2006, 10 (1), pp.4-10. Available: https://hal.archives-ouvertes.fr/hal-02939726/file/SB%26M_VirtualReality%282006%29.pdf

Stratton, Samuel J. (2021) Population Research: Convenience Sampling Strategies. Prehospital and Disaster Medicine, Volume 36, Issue 4, p.373-374. Available: https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/population-research-convenience-sampling-strategies/B0D519269C76DB5BFFBFB84ED7031267

Stutterheim, Sarah E., Sarah E. Ratcliffe (2021) Understanding and Addressing Stigma through Qualitative Research: Four Reasons Why We Need Qualitative Studies. American Psychological Association, Volume 6, No. 1. Available: https://psycnet.apa.org/doiLanding?doi=10.1037%2Fsah0000283

Suh, Ayoung, Prophet, Jane (2017) The state of immersive technology research: A literature analysis. Computers in Human Behaviour, 86, 77-90. Elsevier. Available: https://www.sciencedirect.com/science/article/pii/S0747563218301857

Suso-Ribera, Carlos, Javier Fernandez-Alvarez, Azucena García-Palacios, Hunter G. Hoffman, Juani Breton-Lopez, Rosa M. Banos, Soledad Quero and Cristina Botella. 2019. Virtual Reality, Augmented Reality, and In Vivo Exposure Therapy: A Preliminary Comparison of Treatment Efficacy in Small Animal Phobia. Cyberpsychology, Behavior, and Social Networking Volume 22, Number 1, 2. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6352498/pdf/cyber.2017.0672.pdf

Sutherland, Ivan E. (1965) The Ultimate Display [Online] Available: https://pdfs.semanticscholar.org/3d87/a9cdff1923e3e842f7e38c9fcd6f383817b0.pdf?_ga=2.63658472.677326061.1567598546-219277985.1567598546

Sutherland, Ivan E. (1968) A head-mounted three-dimensional display. Available: https://dl.acm.org/doi/pdf/10.1145/1476589.1476686

Sweeney, Angela, Beth Filson, Angela Kennedy, Lucie Collinson, Steve Gilard (2018) A paradigm shift: relationships in trauma-informed mental health services. BJ Psych Advances, Vol. 24, 319-333. Available: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/B364B885715D321AF76C932F6B9D7BD0/S2056467818000294a.pdf/div-class-title-a-paradigm-shift-relationships-in-trauma-informed-mental-health-services-div.pdf

Sweeney, Angela, Sarah Clement, Beth Filson, Angela Kennedy. 2016. Trauma-informed mental healthcare in the UK: what is it and how can we further its development? Mental Health Review Journal. OL. 21 NO. 3 2016, pp. 174-192, Emerald Group Publishing Limited, ISSN 1361-9322. Available: https://www.emerald.com/insight/content/doi/10.1108/MHRJ-01-2015-0006/full/pdf. p.175

Szasz, Thomas S. (1962) The Myth of Mental Illness. In: Tony B. Benning (2016) No such thing as mental illness? Critical reflections on the major ideas and legacy of Thomas Szasz. British Journal of Psychiatry Bulletin. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5353517/

Thieme, Anja, Jayne Wallace, Thomas D. Meyer, Patrick Olivier, P. (2015) Designing for Mental Wellbeing: Towards a More Holistic Approach in the Treatment and Prevention of Mental Illness. ICPS Proceedings. British HCI '15. Available: https://dl.acm.org/citation.cfm?doid=2783446.2783586

Thomas, Sandra, P. (2020) Resolving tensions in phenomenological research interviewing. Jan. Available: https://onlinelibrary.wiley.com/doi/full/10.1111/jan.14597

Toulmin, Stephen, David E. Leary (1985) The Cult of Empiricism in Psychology, and Beyond. A Century of Psychology as Science. Edited by Sigmund Koch and David E. Lerary, 594-617. New York: McGraw-Hill. Available: https://scholarship.richmond.edu/cgi/viewcontent.cgi?article=1020&context=psychology-faculty-publications

Truong, Khai N., Gillian R. Hayes, Gregory D. Abowd (2006) Storyboarding: An Empirical Determination of Best Practices and Effective Guidelines. Available: https://ellieharmon.com/wp-content/uploads/2014-02-27-Truong-Storyboarding.pdf

Vaisvaser, Sharon (2021) The Embodied-Enactive-Interactive Brain: Bridging Neuroscience and Creative Arts Therapies. Conceptual Analysis, Volume 12, Frontiers in Psychology. Available: file:///C:/Users/w17025407/Downloads/fpsyg-12-634079.pdf

Valmaggia, Lucia R., Leila Latif, Matthew J. Kempton, Maria Rus-Calafell (2016) Virtual reality in the psychological treatment for mental health problems: A systematic review of recent evidence. Psychiatry Research. Available: https://www.sciencedirect.com/science/article/pii/S0165178116300257?via%3Dihub

van Berkel, Niels, Dennis, Simon, Zyphur, Michael, Li, Jinjing, Heathcote, Andrew, Kostakos, Vassilis (2021) Modeling interaction as a complex system, Human Computer Interaction, 36:4, 279-305. Available: https://doi.org/10.1080/07370024.2020.1715221

van Elk, Michiel, Marc Slors, Harold Bekkering (2010) Embodied language comprehension requires an enactivist paradigm of cognition. Frontiers in Psychology [Online] Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3153838/

Varela, Francisco J., Thompson, Evan, Rosch Eleanor (1991) The Embodied Mind. Cognitive Science and Human Experience. The MIT Press, Cambridge, Massachusetts

Van Der Kolk, Bessel A. (2014) The Body Keeps The Score. Mind, brain and body in the transformation of trauma, Penguin Books, UK

Verplanck, Bill (2009) Interaction Design Sketchbook. Frameworks for designing interactive products and systems. Available: http://www.billverplanck.com/IxDSketchBook.pdf

Vertelney, Laurie (1989) Using Video To Prototype User Interfaces. Sigchi Bulletin, Volume 21, Number 2. Available: http://minnow.cc.gatech.edu/ael/uploads/38/vertelney-UsingVideo.pdf

Villalobos, Mario, Dewhurst, Joe (2017) Enactive autonomy in computational systems. Synthese 195, 1891-1908. Available: https://link.springer.com/article/10.1007/s11229-017-1386-z

Visell, Yon (2008) Tactile sensory substitution: Models for enaction in HCI. Interacting with Computers. Elsevier. Available: https://www.sciencedirect.com/science/article/abs/pii/S0953543808000490

Ward, Dave, Silverman, David, Villalobos, Mario (2017) Introduction: The Varieties of Enactivism. Springer Science-Business Media Dordrecht. Available: 10.1007/s11245-017-9484-6

Ward, Dave., Silverman, David., Villalobos, Mario. (2017) Introduction: The Varieties of Enactivism. Springer Science-Business Media Dordrecht. Available: DOI: 10.1007/s11245-017-9484-

Warnock, Mary (1911) Ethics Since 1900. p.1. Oxford University Press

Weber, Andreas., Varela, Francisco, J. (2002) Life after Kant: Natural purposes and the autopoietic foundations of biological individuality, Phenomenology and the Cognitive Sciences. Kluwer Academic Publishers

Weiss, Daniel S. (2007) The Impact of Event Scale: Revised. In: Wilson, J.P., Tang, C.Sk. (eds) Cross-Cultural Assessment of Psychological Trauma and PTSD. International and Cultural Psychology Series. Springer, Boston, MA. Available: https://doi.org/10.1007/978-0-387-70990-1_10

Weiss, Daniel, S., Marmar, Charles, R. (1997) The impact of events scale – revised in: Wilson JP, Keane TM, editors. Assessing psychological trauma and PTSD. New York: Guilford Press.

White, Michael, and David Epston. 1990. Narrative Means to Therapeutic Ends. New York, NY: WW Norton.

Williams, Michael, Moser, Tami (2019) The Art of Coding and Thematic Exploration in Qualitative Research, Vol. 15, No. 1. Available: http://www.imrjournal.org/uploads/1/4/2/8/14286482/imr-v15n1art4.pdf

World Health Organization (2022) World mental health report: transforming mental health for all. Geneva. Available: https://www.who.int/publications/i/item/9789240049338

World Health Organization (2022) World mental health report: transforming mental health for all. Geneva. Available: https://www.who.int/publications/i/item/9789240049338

Wynter, Sylvia [Ed. Katherine McKittrick (2015) On Being Human As Praxis. Duke University Press

Zarbo, Cristina, Giorgio A. Tasca, Francesco Cattafi, Angelo Compare (2016) Integrative Psychotherapy Works. Frontiers in Psychology. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2015.02021/full

Zeng, Nan, Pope, Zachary, Eun Lee, Jung, Gao Zan (2018) Virtual Reality Exercise for Anxiety and Depression: A Preliminary Review of Current Research in an Emerging Field. Journal of Clinical Medicine, 7, 42. Available:10.3390/jcm7030042

Northumbria Research Link

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 Rebair
Health and Life Sciences, Department
of Nursing, Midwifery and Health,
Northumbria University
annessa.rebair@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 dig- ital 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

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[1] 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 immer- sive technology and how users experience these technologies'* [62]. One potential reason why this is the case is highlighted by Sanches

---

[1]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 multidisci- pli-nary 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, character- ized 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 associa- tions of trauma type with PTSD in the World Health Organization (WHO) World Mental Health (WMH) surveys involving represen- tative participant-data from 24 countries, found that 70.4% of re- spondents 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[2], 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 struc- tures 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, poten- tial 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 in- voke 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[3], that takes on a certain significance in IIVEs. What this

---

[2] Perception or awareness of the movement or position of the human body; also known as kinesthesia.
[3] Enactivists regard the enactive process as being two-way between the person and their environment, also referred to as brain, body, environment coupling.

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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[4] 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[5] interventions, offer something supportive because older brain systems[6] 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-20th 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

(XR) environment and offer it as a space where 'the user is percep- tually 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, syn- thesizing 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 technol- ogy 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

---

[4]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.
[5]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.
[6] 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.
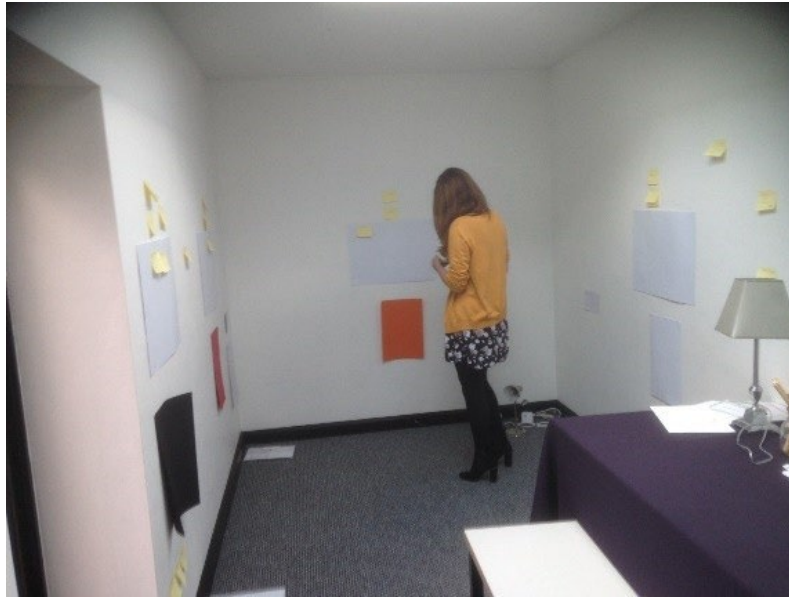
Figure 1: *The Timeline*: Original Rapid Prototype (2018)

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 hotspots. 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

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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^2; 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. Tech- nically, before the immersive system is user-ready a technician commissions the system involving adjustment of the projector out- puts to each wall, calibrating the sensors and balancing the audio.

4 STUDY DESIGN: STUDY 1 – EXPERTS BY 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 inter- ventions?* 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 partici- pants 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 se- nior 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 en- vironments where patients take part in therapies and collective knowledge of: Anxiety, Bereavement, Abuse, Post-Traumatic Stress Disorder, Severe Depression, Borderline Personality Disorder, Psy- chosis, 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 pur- posive 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 com- munication 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 under- lying 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 uni- versity.

5 FINDINGS

We offer abbreviated findings from the first study. The data analy- sis 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: *Ac- tive 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 affor- dance 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 cas- sette 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, includ- ing: audio, visual, haptic and kinesthetic. Participant responses in

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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 sys- tem. 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 apprehen-

sion: "[. . .] *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 hap- pen*" (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 thera-*

pists, 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 sug- gested 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 expe- rience, 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 com- parison 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 dis- cussed the design aims. Initially, components of the original and lo-fidelity prototypes were observed, then a scene-by-scene story- board 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
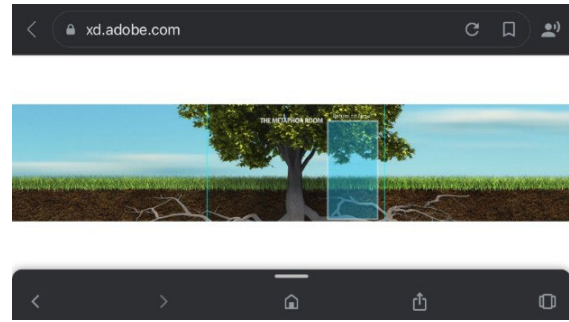
Figure 4: Wireframe imagery created using Adobe XD

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

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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[7] welcomes and describes purpose of the system
3	Approach and press illuminated touch sensor point reading: *The Timeline*
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[8] 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[9], Metaphor Room[10], Cognition Room[11]
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

[7] 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.

[8] 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.

[9] Word Room contains a series of changeable words that act as discussion points for the participant or between the participant and facilitator

[10] 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

[11] 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.

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

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

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 under- stood that no participants had experienced technology such as an immersive room in therapy. In total, participants had previously taken part in counselling, CBT, Hi-intensity CBT, EMDR, yoga, meditation, reading and Transactional Analysis. Certain partici- pants 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 do- ing, 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

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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 a 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 be- haviour [. . .] 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 indica- tion 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: A Qualitative Study Exploring Therapeutic Experiences in an Immersive Interactive Virtual Environment (IIVE) for Trauma Mental Healthcare

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

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 op- tions. This, externalization of a person's narrative, is made possible through what could be described as prompts, cues and sense mak- ing 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 per- ceive 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 lo-fidelity model of *The Timeline*. Because Study 1 involved gathering qualitative data to inform Study 2 and the design of the hi-fidelity prototype, it is considered that video prototyping can be an effec- tive, cost-efficient approach and one that offers replicability of the intentions of the study at a distance. Due to regional lockdown re- strictions 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 lo-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 co-producers 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 multi-sensory responses and ways to interact, future studies might investigate and compare the benefits of a lo-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 experiencer, 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.

ACKNOWLEDGMENTS

REFERENCES

[1] Elias Aboujaoude, Lina Gega, Michelle B. Parish, Donald M. Hilty. 2020. Editorial: Digital Interventions in Mental Health: Current Status and Future Directions. Frontiers in Psychiatry. p.1. https://doi.org/10.3389/fpsyt.2020.00111

[2] Christine E. Agaibi, John P. Wilson. 2005. Trauma, PTSD, and Resilience: A Review of the Literature. Trauma Violence Abuse 2005; 6; 195. p.196 DOI: 10.1177/1524838005277438,

[3] Sarah Elsie Baker, Rosalind Edwards. 2012. How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National Centre for Research Methods. https://eprints.ncrm.ac.uk/id/eprint/2273/4/how_many_interviews.pdf

[4] Jakob Bardram, Claus Bossen, Andreas Lykke-Olesen, Rune Nielsen, Kim Halskov Madsen. 2002. Virtual video prototyping of pervasive healthcare systems. DIS '02: Proceedings of the 4th conference on Designing Interactive System: processes, practices, methods, and techniques, p.177. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.83.4914

[5] Deborah C. Beidel, B. Christopher Frueh, Sandra M. Neer, Clint A. Bowers, Benjamin Trachik, Thomas W. Uhde, Anouk Grubaugh. 2017. Trauma management therapy with virtual reality exposure therapy for combat-related PTSD: A randomised controlled trial. Journal of Anxiety Disorders. https://doi.org/10.1016/j.janxdis.2017.08.005

[6] Paul Best, Alison McKenna, Paul Quinn, Michael Duffy, Tom Van Daele. 2020. Can Virtual Reality Ever Be Implemented in Routine Clinical Settings? A Systematic Narrative Review of Clinical Procedures Contained Within Case Reports for the Treatment of PTSD. Frontiers in Virtual Reality. https://doi.org/10.3389/frvir.2020.563739

[7] Debra Boeldt, Elizabeth McMahon, Mimi McFaul, Walter Greenleaf. 2019. Using Virtual Reality Exposure Therapy to Enhance Treatment of Anxiety Disorders: Identifying Areas of Clinical Adoption and Potential Obstacles. Frontiers in Psychiatry, p.2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6823515/pdf/fpsyt-10-00773.pdf

[8] Ronald Laurids Boring. 2002. Human-Computer Interaction As Cognitive Science. Proceedings of the Human Factors and Ergonomics Society. p.1769. https://doi.org/10.1177/154193120204602103,

[9] Virginia Braun, Victoria Clarke. 2006. Using thematic analysis in psychology. Qualitative Research in Psychology 3, 2 (2006), 77–101. DOI: https://doi.org/10.1191/1478088706qp063oa

[10] Virginia Braun, Victoria Clarke. 2006. Using thematic analysis in psychology. Qualitative Research in Psychology 3, 2 (2006), 77–101. DOI: https://doi.org/10.1191/1478088706qp063oa

[11] Blazej Cieslik, Justyna Mazurek, Sebastien Rutkowski, Pawel Kiper, Andrea Turolla, Joanna Szczepanska-Gieracha. 2020. Virtual reality in psychiatric disorders: A systematic review of reviews. Complimentary Therapies in Medicine. https://pubmed.ncbi.nlm.nih.gov/32951730/

[12] Maxime Cordeil, Tim Dwyer, Karsten Klein, Bireswar Laha, Kim Marriott, Bruce H. Thomas. 2017. Immersive Collaborative Analysis of Network Connectivity: CAVE-style of Head Mounted Display? IEEE Trans Vis Comput Graph. 2017 Jan;23(1):441-450. p.448. DOI: 10.1109/TVCG.2016.2599107. PMID: 27875160.

[13] Caroline Cruz-Neira, Daniel J. Sandin, Thomas A. DeFanti 1992. The CAVE: audio visual experience automatic virtual environment. Communications of the ACM, Volume 35, Issue 6. p.71. https://dl.acm.org/citation.cfm?id=129892

[14] Thomas A. DeFanti, Daniel Acevedo, Richard A. Ainsworth, Maxine D. Brown, Steven Cutchin, Gregory Dawe, Kai-Uwe Doerr, Andrew Johnson, Chris Knox, Robert Kooima, Falko Kuester, Jason Leigh, Lance Long, Peter Otto, Vid Petrovic, Kevin Ponto, Andrew Prudhomme, Ramesh Rao, Luc Renambot, Daniel J. Sandin, Jurgen P. Schulze, Larry Smarr, Madhu Srinivasan, Philip Weber, Gregory Wickham. 2011. The future of the CAVE. Central European Journal of Engineering, 1, 16-37. https://link.springer.com/article/10.2478/s13531-010-0002-5

[15] Merve Dilgul, Lauren M. Hickling, Daniela Antonie, Stefan Priebe, Victoria J. Bird. 2021. Virtual Reality Group Therapy for the Treatment of Depression: A Qualitative Study on Stakeholder Perspectives. Frontiers in Virtual Reality. https://doi.org/10.3389/frvir.2020.609545

[16] Diana Domingues. 2013. The interfaced subject immersed in virtual spaces, Grupo Artecno – NTAV – Lab. p.1. https://www.academia.edu/501172/The_interfaced_subject_immersed_in_virtual_spaces

[17] Daniel Freeman, S. Reeve, A. Robinson, A. Ethers, D. Clark, B. Spanlang, M. Slater. 2017. Virtual reality in the assessment, understanding, and treatment of mental health disorders, Psychological Medicine (2017), 47, 2393–2400. p.2397. Cambridge University Press. doi:10.1017/S003329171700040X

[18] Paul Galdas. 2017. Revisiting Bias in Qualitative Research: Reflections On Its Relationship With Funding And Impact. International Journal of Qualitative Methods. Volume 16, 2. https://doi.org/10.1177/1609406917748992

[19] Shaun Gallagher. 2017. Enactivist Interventions. Rethinking The Mind. Oxford University Press, p.23

[20] Chris N.W. Geraets, Elizabeth C.D. van der Stouwe, Roos Pot-Kolder, Wim Veling. 2021. Advances in immersive virtual reality interventions for mental disorders: A new reality? Current Opinion in Psychology, p.43. https://doi.org/10.1016/j.copsyc.2021.02.004

[21] Maryrose Gerardi, Barbara Olasov Rothbaum, Kerry Ressler, Mary Heekin, Albert Rizzo. 2008. Virtual Reality Exposure Therapy Using a Virtual Iraq: Case Report. *National Institute of Health. J Trauma Stress.* 2008 April; 21(2): 209-213. Doi:10.1002/jts.20331.

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

NordiCHI '22, October 08–12, 2022, Aarhus, Denmark

[22] Paulo Veloso Gomes, Antonio Marques, Javier Pereira-Loureiro, Joao Donga. 2019. The Influence of Immersive Environments on the Empathy Construct about Schizophrenia. Proceedings 2019, 21. 3. DOI: https://doi.org/10.3390/proceedings2019021003

[23] Greg Guest, Arwen Bunce, Laura Johnson. 2006. How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. Field Mathods, Vol. 18, 59-82. DOI: 10.1177/1525822X05279903

[24] Sanneke de Haan. 2020. *Enactive Psychiatry*. Cambridge University Press. p.66

[25] David Haniff, Alan Chamberlain, Louise Moody, Sara De Freitas. 2014. Virtual environments for mental health issues: A review. *Journal of Metabolomics and Systems Biology*. Vol. 3(1), pp. 1-10, April 2014. DOI:10.5897/JMSB11.003

[26] Morton Heilig. 1955 [Reprinted 1992]. El Cine del Futuro: The Cinema of the Future. Espacios. In Presence, Volume I, Number 3. The Massachusetts Institute of Technology. p.282. DOI:https://doi.org/10.1162/pres.1992.1.3.279

[27] Kristina Hook. 2018. Designing With The Body. Somaesthetic Interaction Design. The MIT Press, Cambridge Massachusetts. p.31.

[28] Alina Ionescu, Tom Van Daele, Albert Rizzo, Carolyn Blair, Paul Best. 2021. 360° Videos for Immersive Mental Health Interventions: a Systematic Review. *J. technol. behave. sci.* 6, 631–651 (2021). https://doi.org/10.1007/s41347-021-00221-7

[29] Jay Jantz, Adam Molnar, Ramses Alcaide. 2017. A brain-computer interface for extended reality interfaces. p.1. https://dl.acm.org/citation.cfm?id=3089290

[30] M. Carmen Juan, David Perez. 2009. Comparison of the Levels of Presence and Anxiety in an Acrophobic Environment Viewed via HMD or CAVE. Presence, Vol. 18, No. 3, June 2009, 232–248. p.241. Massachusetts Institute of Technology. https://direct.mit.edu/pvar/article/18/3/232/18749/Comparison-of-the-Levels-of-Presence-and-Anxiety

[31] Ronald C. Kessler, Sergio Aguilar-Gaxiola, Jordi Alonso, Corina Benjet, Evelyn J. Bromet, Graça Cardoso, Louisa Degenhardt, Giovanni de Girolamo, Rumyana V. Dinolova, Finola Ferry, Silvia Florescu, Oye Gureje, Josep Maria Haro, Yueqin Huang, Elie G. Karam, Norito Kawakami, Sing Lee, Jean-Pierre Lepine, Daphna Levinson, Fernando Navarro-Mateu, Beth-Ellen Pennell, Marina Piazza, José Posada-Villa, Kate M. Scott, Dan J. Stein, Margreet Ten Have, Yolanda Torres, Maria Carmen Viana, Maria V. Petukhova, Nancy A. Sampson, Alan M. Zaslavsky & Karestan C. Koenen. 2017. Trauma and PTSD in the WHO World Mental Health Surveys, European Journal of Psychotraumatology, 8:sup5, DOI: 10.1080/20008198.2017.1353383

[32] Hanneke Kip, Saskia M. Kelders, Kirby Weerink, Ankie Kuiper, Ines Bruninghoff, Yvonne H. A. Bouman, Dirk Dijkslag, Lisette J. E. W. C. van Gemert-Pijnen. 2019. Identifying the Added Value of Virtual Reality for Treatment in Forensic Monetal Health: A Scenario-Based Qualitative Approach. Frontiers in Psychology. DOI: https://doi.org/10.3389/fpsyg.2019.00406

[33] Alexandra Kitson, Mirjana Prpa, Bernard E, Riecke. 2018. Immersive Interactive Technologies for Positive Change: A Scoping Review and Design Considerations. Frontiers in Psychology, 9:1354. https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01354/full

[34] Oswald D. Kothgassner, Andreas Goreis, Johanna X. Kafka, Rahel L. Van Eickels, Paul L. Plener & Anna Felnhofer. 2019. Virtual reality exposure therapy for posttraumatic stress disorder (PTSD): a meta-analysis, European Journal of Psychotraumatology, 10:1. DOI: 10.1080/20008198.2019.1654782

[35] Myron W, Krueger. 1977. Responsive environments. National Computer Conference. The University of Wisconsin. p.431. https://zeitkunst.org/media/pdf/Krueger1977.pdf

[36] Bastian Lange, Paul Pauli. 2019. Social anxiety changes the way we move – A social approach-avoidance task in a virtual reality CAVE system, p.6, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0226805

[37] German Leiva, Cuong Nguyen, Rubaiat Habib Kazi, Paul Asente. 2020. Pronto: Rapid Augmented Reality Video Prototyping Using Sketches and Enaction, CHI 2020, p.3. https://3dvar.com/Leiva2020Pronto.pdf

[38] Jack M. Loomis., James J. Blascovich, Andrew C. Beall. 1999. Immersive virtual environment technology as a basic research tool in psychology. *Behavior Research Methods, Instruments and Computers*, 31 (4) p.557-564 (1999). DOI: https://doi.org/ 10.3758/BF03200735.

[39] Moira Maguire, Brid Delahunt. 2017. Doing a Thematic Analysis: A Practical, Step-by-Step Guide for Learning and Teaching Scholars. All Ireland Journal of Higher Education, Volume 9, Number 3. https://ojs.aishe.org/index.php/aishe-j/article/view/335

[40] Jessica L. Maples-Keller, Brian E. Bunnell, Sae-Jin Kim, Barbara O Rothbaum. 2017. The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. *Harv Rev Psychiatry*, 2017;25(3): 103-113. DOI:10.1097/HRP.0000000000000138.

[41] Robert F. K. Martin, Patrick Leppink-Shands, Matthew Tiachac, Megan DuBois, Christine Conelea, Suma Jacob, Vassilios Morellas, Theodore Morris, Niolaos Papanikolopoulous. 2021. The Use of Immersive Environments for the Early Detection and Treatment of Neuropsychiatric Disorders, p. 3-4. https://www.frontiersin.org/articles/10.3389/fdgth.2020.576076/full

[42] Robert F. K. Martin, Patrick Leppink-Shands, Matthew Tiachac, Megan DuBois, Christine Conelea, Suma Jacob, Vassilios Morellas, Theodore Morris, Niolaos Papanikolopoulous. 2021. The Use of Immersive Environments for the Early Detection and Treatment of Neuropsychiatric Disorders, p. 3-4. https://www.frontiersin.org/articles/10.3389/fdgth.2020.576076/full

[43] Katharina Meyerbröoker, Nexhmedin Morina, Gerard Kerkhof, Paul M.G. Emmelkamp. 2011. Virtual Reality Exposure Treatment of Agoraphobia: a Comparison of Computer Automatic Virtual Environment and Head-Mounted Display. Studies in Health Technology and Informatics. Volume 167, p.51-56. https://ebooks.iospress.nl/doi/10.3233/978-1-60750-766-6-51

[44] Xue-Rong Miao, Qian-Bo Chen, Kai Wei, Kun-Ming Tao, Zhi-Jie Lu. 2018. Posttraumatic stress disorder: from diagnosis to prevention. Military Medical Research (2018) 5:32 https://doi.org/10.1186/s40779-018-0179-0

[45] Janice M. Morse, Michael Barrett, Maria Mayan, Karin Olson, Jude Spiers. 2002. Verification Strategies for Establishing Reliability and Validity in Qualitative Research. International Journal of Qualitative Methods. p.17. DOI: https://doi.org/10.1177/160940690200100202

[46] Fariba Mostajeran, Jessica Krzikawski, Frank Steinicke, Simone Kuhn. 2021. Effects of exposure to immersive videos and photo slideshows of forest and urban environments. Sci Rep 11, 3994. DOI: https://doi.org/10.1038/s41598-021-83277-y

[47] Sarah Nelson. 2002. Physical Symptoms in Sexually Abused Women: Somatization or Undetected Injury? Child Abuse Review Vol. 11:51-64. https://onlinelibrary.wiley.com/doi/epdf/10.1002/car.721

[48] NHS. 2021. Types of talking therapy.https://www.nhs.uk/mental-health/talking-therapies-medicine-treatments/talking-therapies-and-counselling/types-of-talking-therapies/

[49] NHS Health Research Authority. 2022. Research Passport. https://www.hra.nhs.uk/planning-and-improving-research/best-practice/research-passport/Navarro-Mateu, Beth-Ellen Pennell, Marina Piazza, José Posada-Villa, Kate M. Scott, Dan J. Stein, Margreet Ten Have, Yolanda Torres, Maria Carmen Viana, Maria V. Petukhova, Nancy A. Sampson, Alan M. Zaslavsky & Karestan C. Koenen (2017) Trauma and PTSD in the WHO World Mental Health Surveys, European Journal of Psychotraumatology, 8:sup5, DOI: 10.1080/20008198.2017.1353383

[50] NHS inform. 2022. Mental Health. https://www.nhsinform.scot/illnesses-and-conditions/mental-health

[51] Dorthe Varning Poulsen, Ulrika K. Stigsdotter, Dorthe Djernis, Ulrik Sideniu. 2016. 'Everything just seems much more right in nature': How veterans with posttraimatic stress disorder experience nature-based activities in a forest therapy garden. *Health Psychology Open*, 1-14. SAGE. DOI: 10.1177/2055102916637090

[52] Giulia Pozzi, Federico Pigni, Claudio Vitari. Affordance Theory in the IS Discipline: a Review and Synthesis of the Literature. 2014. *ACMIS 2014 Proceedings, Savannah, United States.* https://halshs.archives-ouvertes.fr/halshs-01923663

[53] Hannah Richie, Max Roser. 2018. Mental Health. www.ourworldindata.org/mental-health

[54] Elise Rimer, Lars Vagsholm Husby, Stian Solem. 2021. Virtual Reality Exposure Therapy for Fear of Heights: Clinicians' Attitudes Become More Positive After Trying VRET. Front. Psychol., 15 July 2021. DOI: https://doi.org/10.3389/fpsyg.2021.671871

[55] Jurgita Rimkeviciene, John O'Gorman, Jacinta Hawgood, Diego De Leo (2016) Timelines for difficult times: use of visual timelines in interviewing suicide attempters. Qualitative research in Psychology, 13: 3, 231.245. Available: https://doi.org/10.1080/14780887.2016.1170913

[56] Guiseppe Riva, Silvia Serino. 2020. Virtual Reality in the Assessment, Understanding and Treatment of Mental Health Disorders. Journal of Clinical Medicine. file:///C:/Users/w17025407/Downloads/jcm-09-03434-v2.pdf, p.1. DOI: https://doi.org/10.1089/cyber.2017.29099.gri

[57] Guiseppe Riva, Brenda K. Wiederhold, Fabrizia Mantovani. 2019. Neuroscience of Virtual Reality: From Virtual Exposure to Embodied edicine. Cyberpsychology, Behavior, and Social Networking, Vol. 22, No. 1. DOI: 10.1089/cyber.2017.29099.gri

[58] Albert Rizzo, Gerard Jounghyun Kim. 2005. A SWOT Analysis of the field of Virtual Reality Rehabilitation and Therapy. Presence: Teleoperators and Virtual EnvironmentsVolume 14Issue 2April 2005 pp 119–146. https://doi.org/10.1162/1054746053967094

[59] Albert A, Rizzo, Mark Wiederhold, John Galen Buckwalter. 1998. Basic Issues In The Use Of Virtual Environments For Mental Health Applications. Virtual Environments in Clinical Psychology and Neuroscience. p.129. https://pubmed.ncbi.nlm.nih.gov/10350922/

[60] Jose Luis Rubio-Tamayo, Manuel Gertrudix Barrio, Francisco García. 2017. Immersive Environments and Virtual Reality: Systematic Review and Advances in Communication, Interaction and Simulation. *Multimodal Technol. Interact.*, 1, 21. p.1-9. DOI: https://doi.org/10.3390/mti1040021

[61] Pedro Sanches, Axel Janson, Pavel Karpashevich, Camille Nadal, Chengcheng Qu, Claudia Daudén Roquet, Muhammad Umair, Charles Windlin. 2019. HCI and Affective Health: Taking stock of a decade of studies and charting future research directions. *Proceedings of the 2019 Conference on Human Factors in Computing Systems.* Paper No.:245, p.9. DOI: https://doi.org/10.1145/3290605.3300475.

[62] Ayoung Suh, Jane Prophet. 2018. The state of immersive technology research: A literature analysis, *Computers in Human Behavior, 86*, 77-90. doi.org/10.1016/j.chb.2018.04.019.

[63] Carlos Suso-Ribera, Javier Fernandez-Alvarez, Azucena García-Palacios, Hunter G. Hoffman, Juani Breton-Lopez, Rosa M. Banos, Soledad Quero and Cristina Botella. 2019. Virtual Reality, Augmented Reality, and In Vivo Exposure Therapy: A Preliminary Comparison of Treatment Efficacy in Small Animal Phobia. Cyberpsychology, Behavior, and Social Networking Volume 22, Number 1, 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6352498/pdf/cyber.2017.0672.pdf

[64] Barbara Olasov Rothbaum, L. Hodges, R. Alarcon, D. Ready, F. Shahar, K. Graap, J. Pair, P. Hebert, D. Gotz, B. Wills, D. Baltzell. 1999. Virtual Reality Exposure Therapy for PTSD Vietnam Veterans: A Case Study. *Journal of Traumatic Stress*, Vol.12, No 2. DOI: 10.1023/A:1024772308758.

[65] Ivan E. Sutherland. 1965. The Ultimate Display. Proceedings of the IFIP Congress. https://citeseer.ist.psu.edu/viewdoc/summary? DOI=10.1.1.136.372

[66] Angela Sweeney, Sarah Clement, Beth Filson, Angela Kennedy. 2016. Trauma-informed mental healthcare in the UK: what is it and how can we further its development? Mental Health Review Journal. OL. 21 NO. 3 2016, pp. 174-192, Emerald Group Publishing Limited, ISSN 1361-9322. p.175. https://www.emerald.com/insight/content/doi/10.1108/MHRJ-01-2015-0006/full/pdf

[67] Anja Thieme, Jayne Wallace, Thomas D Meyer, Patrick Oliver. 2015. Designing for Mental Wellbeing: Towards and More Holistic Approach in the Treatment and Prevention of Mental Illness. British HCI '15. Proceedings of the 2015 British HCI Conference, p.6. DOI:10.1145/2783446.2783586

[68] Aimilia Tzanavari, Nefi Charalambous-Darden, Kyriakos Herakleous, Charalamos Poullis. 2015. Effectiveness of an Immersive Virtual Environment (CAVE) for

Teaching Pedestrian Crossing to Children with PDD-NOS, IEEE 15TH International Conference on Advanced Learning Techniques, p.425. https://poullis.org/assets/pubs/POULLIS_ICALT2015.pdf

[69] Lucia R. Valmaggia, Leila Latif, Matthew J. Kempton, Maria Rus-Calafell. 2015. Virtual reality in the psychological treatment for mental health problems: A systematic review of recent evidence. Psychiatry Research. https://kclpure.kcl.ac.uk/portal/files/47275030/Valmaggia_VR_Review_rev_Dec2015.pdf

[70] Minke M. Van de Kamp, Mia Scheffers, Janneke Hatzmann, Claudia Emck, Pim Cuijpers, Peter J. Beek. 2019. Body-and Movement Oriented Interventions for Posttraumatic Stress Disorder: A Systematic Review and Meta Analysis. Journal of Traumatic Stress, p.967. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6973294/pdf/JTS-32-967.pdf

[71] Bessel A. Van der Kolk. 2014. The body keeps the score: Mind,body and brain in the transformation of trauma, Penguin Books, p.62

[72] Dave Ward, David Silverman, Mario Villalobos. 2017. Introduction: The Varieties of Enactivism. Springer Science-Business Media Dordrecht. p.368. DOI: 10.1007/s11245-017-9484-

[73] World Health Organization. 2019. Mental Disorders. https://www.who.int/news-room/fact-sheets/detail/mental-disorders

[74] Nan Zeng, Zachary Pope, Jung Eun Lee, Zan Gao. 2018. Virtual Reality Exercise for Anxiety and Depression: A Preliminary Review of Current Research in an Emerging Field. Journal of Clinical Medicine, 7, 42. DOI:10.3390/jcm7030042

RESEARCH FRAMEWORK

ONTOLOGY	EPISTEMOLOGY	PARADIGM (OF INQUIRY)
The Nature of Reality What is reality/What exists? How I understand the world E.g. One single reality - Objectivist Multiple realities - interpretivist ==Reality is constantly debated or interpreted==	How to examine? How can I know reality? E.g. knowledge can be measured Knowledge needs interpreted ==Reality should be examined using the most appropriate available tools== A greater emphasis on interpretation being inherent from experience	Positivism – one single reality or truth exists; be measured Constructivism there are multiple realities and knowledge needs interpreted. Maintains separation of thought from action whereas Enactivism combines constructionism and embodied cognition Interpretivist understanding is seen as a value of its own ==Pragmatist== reality is constantly negotiated and requires best tools to solve the problem; understanding is regarded as ==instrumental in relation to the change of existence==

(↓)

==ENACTIVIST== ➡	==PHENOMENOLOGIST==	➡ ==PRAGMATISM==
Observer and world ==co-evolve== – reciprocated interaction same ontology as physics. Rooted in phenomenology. Does enactivism bring phenomenology and pragmatism together?	How humans make sense of their own reality through themselves	Understands knowing the world as ==inseparable from agency== with it

THE RESEARCHER IS AT THE CENTRE OF THE STUDY AND THE CHOICES MADE REFLECT BOTH THE NATURE OF THE STUDY AND THE NATURE OF THE RESEARCHER,
RIGHT THROUGH TO THE METHODS OF INQUIRY AND CONSTRUCTING OF DATA COLLECTION METHODS

(↓)

	LITERATURE REVIEW (Synthesis of theories) Research gap: if more aligned to positivism (more causal and statistic based and is objectivist and more quantitative) Problem solving: more aligned to interpretivism – there is ==no single reality, more description and qualitative==	
Gap in Literature How have other researchers defined key concepts and theories? Justify any links between concepts and theories.	**THEORETICAL FRAMEWORK** A lens which defines which way to view and limits the view of the relevant data	**Gap in Literature** Argue what is not yet met through research, e.g. ==a gap exists in relation to the study of relationships between mind, body and environment utilising IIVEs==

(↓)

Phase I questions (2020):	**CONCEPTUAL FRAMEWORK** Sets stage to present research question and drives study Enactive; Sense-making; Coupling	**Phase II questions (2021):**
Based around the Video Prototyping	**RESEARCH QUESTION:** **How might enactive approaches to designing and understanding IIVEs support new therapeutic interventions experienced by people presenting MH challenges?** ==What is the effect of an IIVE Timeline approach on participants with Childhood Trauma?==	Based around the Immersive Interactive Virtual Environment (IIVE)
⬅	**RESEARCH OBJECTIVE:** ==Exploratory, Descriptive== **RESEARCH OUTPUTS:** Health; Industry; Innovation **SAMPLE SIZE:** ==Small==	➡
	RESEARCH STRATEGY Qualitative interviewing; Video Prototyping	
	METHODOLOGY ==Inductive==, Qualitative Exploratory Research with Participatory Design Elements through the iterative development Video Prototypes; in inviting participants into a process to discover some insights; defining and clarifying a need, analysing and developing theory.	
	METHODS OF COLLECTION Semi-structured interviews; Video recording	
	METHODS OF ANALYSIS ==Thematic== - patterns, themes and holistic features	

CEN.	ONTOLOGICAL ASSUMPTIONS	POSITIONS OR BELIEFS IN RELATION TO COGNITION	TECHNOLOGIES
600-100BC	The whims of the gods were responsible People are sick (with a sacred disease or illness) Physical restraint and counselling Hippocratic treatise *On Sacred Disease*	**Atomism** **Materialism** – all that exists is matter and void and the world of atoms is a scaled down version of the everyday world	Philosophy and medicine shared a lot of topics
100AD	Four fluids – hot, dry, cold, wet Vagus nerve – Gut, Liver, Heart, Brain	==Critical empiricism== (Galen) – Observer – Suggests a triangle involving the heart, stomach, gut, liver and the Vagus Nerve	Surgical tools
17th	Correctional houses are the answer; Forced confinement of beggars, criminals and those deemed to be mad or insane;	**Empiricist** – information received via the senses of observation and documentation of patterns through experience and turned into a method of inquiry to then experiment and control over variables **Rationalism** – knowledge through reason and logical argument **Dualism** – the mental and the physical are radically different or separate **Dual aspect monism** - the mental and the physical are two aspects of, or perspectives on, the same substance	Irons, Water Immersion, Correctional Houses of Confinement; Houses of Correction are the answer
18th	People have nervous diseases and hysteria; Potions and remedies are the answer	**Positivist** (late 18th) – all knowledge is scientific; rejects intuitive knowledge **Determinist** – there are laws that apply to each individual **Reductionist** – any explanation of behaviour at it simplest level can be deemed this **Phenomenologist –** study of structures of consciousness from first-person view – experience intention	Hydrotherapy, Oil, Purges, Bitters, Home-care (UK)
19th	Psychology laboratories and psychiatry is the answer, Many regard true 'Age of Confinement'	**Structuralist** – phenomena of human life is unintelligible except through interrelation **Existentionalist** – humans define their own meaning through rational decisions **Functionalist** – social order derives shared values, beliefs and collective conscience	Psychology, Psychiatry, Showers, Retreat, Custodial Care (USA)
20th	Interventions are the answer; Medication is the answer	**Anti-positivist** – look for meaning in subjective experience in social interaction **Operationalist** – all entities can be defined as a set of operations **Behaviourist** – controlled laboratory, behaviour-shaping **Physicalism** – everything is physical **Cognitivist** – focus on mental processes and seek to understand cognition **Connectionist** – thought, behaviour and learning explained by neural networks **Constructionist** – questions what is defined by humans and society to be reality **Constructivist** – humans construct knowledge/meaning from their experiences	Medication, Electric Shock, Therapies
21st	An open field: Medication, Intervention, Mediation, Therapy, Cognitive science, Technology Sensorimotor – receiving sensory messages from bodies and the environment through vision, hearing, touch (proprioception – awareness of bodily position or movement)	**Rationalist** – a set of truths exist that the individual can access through reason **Humanist** - Subjective perception and understanding (Rogers, Maslow) **Holist** – the whole is the sum of the parts. At each level emergent properties exist **Interpretivist** (anti-positivism) – prefer humanistic qualitative methods ==Enactivist== - cognition arises through an acting organism and its environment. A radicalization of the embodied framework. Roots in phenomenology **Realist** – a viewpoint which accords to things that are known ==Autonomist Enactivist== (sensorimotor) – how experience emerges from sensorimotor **Panpsychism** - everything material, however small, has an element of individual consciousness ==Animism== – Perceives all things as living and alive	Medication, Medical Therapies, Holistic Therapies, Websites, Apps, Head-Mounted Display; Immersive Interactive Environments

A HISTORY OF INVENTION AND INNOVATION IN IMMERSIVE VIRTUAL REALITY TECHNOLOGIES

ERA	INVENTOR/DEVELOPER	TECHNOLOGY DESCRIPTION
Pre-history∞	Global	Human beings close their eyes and enter a reality alike their own external reality
History	Global	As language and connectivity across geographical realms becomes widespread, so does the ability close one's eyes and transport oneself virtually to a range of new environments. The human brain craves optical information
1400	Global language	Virtual has held the meaning of being something in *essence* or in *effect* since the 15th century
1838	Charles Wheatstone	The Stereoscope is a device for viewing a stereoscopic pair of separate images, depicting left-eye and right-eye views of the same scene, as a single three-dimensional image
1839	William Gruber	The View-Master is the trademark name of a line of special-format stereoscopes and corresponding View-Master "reels", thin cardboard disks containing seven stereoscopic 3-D pairs of transparent color photographs on film
1849	David Brewster	The Lenticular Stereoscope
1929	Edward Link	The Link Trainer, the first example of a commercial flight simulator
1935	Stanley G. Weinbaum	Sci-Fi Writer who imagined the (HMD) via 'Pygmalion's Spectacles'
1938	Anton Artaud	Playright described the illusory nature of characters and objects in theatre as "la réalité virtuélle"
1956∞	Morton Heilig	Sensorama
1960	Morton Heilig	Telesphere Mask (HMD)
1961	Corneau, Bryan	Headsight
1965	Ivan Sutherland	Ultimate Display (HMD)
1966	Thomas Furness	Military Simulator for Air Force
1968	Ivan Sutherland, Bob Sproull	Sword of Damocles (HMD)
1969	Myron Krueger	Computer-Generated Environments
1975∞	Myron Krueger	VideoPlace – Artificial Reality laboratory and first 'surround' Interactive Platform using projectors and cameras
1977	David Em	First artist to produce navigable virtual worlds at NASA's Jet Propulsion Laboratory
1977	M.I.T.	Aspen Movie Map
1979	Eric Howlett	Developed to Large Expanse, Extra Perspective (LEEP) Optical System
1979	McDonnell-Douglas Corporation	HMD with VR
1982	Damien Broderick	The term 'Virtual Reality' first used in the context of science fiction by this author in '*The Judas Mandala*'
1982	Atari	Founded a research lab for VR which closed in 1984
1982	Tron	A movie directed by Steve Lisberger where central character '*Flynn*' is transported into a digital reality
1985	Scott Fisher	The 1979 LEEP system was redesigned for NASA's Ames Research Centre for their first virtual reality installation, the VIEW (Virtual Interactive Environment Workstation), providing the basis for most VR HMD's
1985	Jaron Lanier	A modern pioneer in VR who founded the company VPL Research, developing the DataGlove and the Power Glove
1988	Cyberspace Project at Autodesk	First to implement VR on a low-cost personal computer
1990	Eric Gullichsen	Founded Sense8 Corporation and developed the WorldToolKit virtual reality SDK offering first real-time graphics with Texture mapping on a PC
1991	Sega	Announced the Sega VR headset for arcade games and the Mega Drive console
1991	Virtuality	Offered one of the first VR experiences via a multiplayer VR entertainment system including a dedicated VR arcade at Embarcadero Centre featuring HMD's and exoskeleton gloves
1991∞	Cruz-Neira, Sandin, DeFanti	From the Electronic Visualization Laboratory created first cubic immersive room, the Cave Automatic Virtual Environment (CAVE)
1992	Angels	First real-time interactive immersive movie with interaction facilitated with a dataglove and high resolution goggles
1992	Louis Rosenberg	Created the Virtual Fixtures system at the United States Air Force Armstrong Labs using a full upper-body exoskeleton, enabling a physically realistic mixed reality in 3D
1992	Lawnmower Man	Movie based on Jaron Lanier's early laboratory days with equipment from his company VPL used in set-design
1994	Sega	Released the Sega VR-1 motion simulator arcade attraction in SegaWorld amusement arcades
1994	Apple	Released QuickTime VR, which despite using the term VR was unable to represent VR and instead displayed photographic panoramas
1995	Nintendo	Nintendo's Virtual Boy console released
1995∞	Chet Dagit, Bob Jacobson	Created Cave-like public demonstrations of a 270 degree immersive projection room called 'Virtual Environment Theatre' in Seattle
1995	Forte	Released the VFX1, a PC-powered VR headset
2001∞	Maurice Benayoun, David Nahon	SAS Cube (SAS3) became the first PC-based cubic room, developed by Z-A Production, installed in Laval, France – giving birth to Virtools VRPack
2001	Vanilla Sky	A Cameron Crowe movie which considers 'Life Extension' program in a Virtual 'Lucid' Reality
2002	Tarr, Warren	Given the high incidence of brain injury in the population, brain damage rehabilitation is still a relatively undeveloped field. Virtual reality (VR) has the potential to assist current rehabilitation techniques in addressing the impairments, disabilities, and handicaps associated with brain damage
2004	Kuntze, Stoermer et al.	Our pilot study will show that immersive virtual reality (IVR) is as good or even better in eliciting subjective and physiological craving symptoms as classical devices
2005	Rose, Brooks, Rizzo	Given the high incidence of brain injury in the population, brain damage rehabilitation is still a relatively undeveloped field. Virtual reality (VR) has the potential to assist current rehabilitation techniques in addressing the impairments, disabilities, and handicaps associated with brain damage
2007	Google	Introduced Street View, showing panoramic views of global locations
2009∞	Persky, McBride	One such emerging research tool is immersive virtual environment technology (aka: virtual reality), a methodology that gives researchers the ability to maintain high experimental control and mundane realism of scenarios, portray and manipulate complex, abstract objects and concepts, and implement innovative implicit behavioural measurement. We suggest that immersive virtual environment technology can play in furthering future research in genomics-related: education, decision-making, test intentions, behaviour change and healthcare provider behaviour
2010	Palmer Luckey	Designed the first prototype of the Oculus Rift
2011∞	Sun Joo (Grace) Ahn	Embodied experiences in immersive virtual environments
2012∞	Immersive Interactive	UK-based company develops Immersive Virtual Environments (IVE's) for simulation use in education support and SEN settings, then branching into healthcare and training products. Their adaptation of the 270 degree IVE system involves three projectors and a 270 degree series of screens, generally 4mx4m, 5mx5m, 6mx6m
2013	Febretti et al.	CAVE2 Hybrid Reality Environment
2014	Facebook	Purchased Oculus VR for £3 Billion
2014	Sony	Announced Project Morpheus, a VR HMD for the Playstation 4 video game console
2015	Google	Announced Cardboard, a DIY stereoscopic viewer
2015	Michael Naimark	Appointed Google's first resident artist in their new VR Division
2016	Multi-Companies	230 companies developing VR-related products including: Amazon, Apple, Facebook, Google, Microsoft, Samsung and Sony, all with dedicated VR and AR groups
2017∞	Bruce, T.A.	A UK-based researcher adapts the Immersive Interactive's three-projector IVE system for adoption in mental health with childhood trauma, beginning with a low fidelity 'Timeline' prototype in his dining room using 2D 'Post It' notes
2018	Norway University of Applied Sciences	26 healthy adults underwent three experimental conditions: nature walk, sitting-IVE, and treadmill-IVE. In the IVE conditions, the participants wore a head-mounted display with headphones reproducing a 360° video and audio of the nature walk, either sitting on a chair or walking on a manually driven treadmill
2018	Freeman, Haselton et al., Oxford University	Tested the efficacy of an automated cognitive intervention for fear of heights guided by an avatar virtual coach (animated using motion and voice capture of an actor) in VR and delivered with the latest consumer equipment
2018	Kim Bullock, Stanford University	Investigating motor and sensory reprogramming for people with psychosomatic illnesses who experience disruptions in their bodily sensations and sense of agency. One of the questions is whether a patient who experiences regaining the use of a paralyzed limb in a virtual world (through embodying an avatar) could regain its use in the physical world
2019	Newcastle University	The Blue Room, developed by working alongside technology firm Third Eye NeuroTech, allowed the team to create a personalised 360 degree environment involving the fear which may debilitate the person with autism in real life
2020∞	Immersive Interactive Northumbria University	A multidisciplinary PhD and broader collaborative study assesses effects and efficacy of IVE's, HMD's and Augmented Reality HMD's through rigorous prototype design and clinical trials in cognitive 'mental' healthcare

Bruce, T.A. (2019) A History of Invention and Innovation in Immersive Virtual Reality Technologies

ENACTIVISM OR ENACTIVE (ORIGINS)

Phenomenologically inspired /A radicalization of the embodied framework / Aims to explore the non-representational - or "direct" - nature of perception – human conceptual system within a system / direct coupling between perception and action

Name	Date	Description	Notes
DESCARTES∞	1641	Descartes should perhaps be considered as associating the head *with* the body, not decapitating the head *from* the body. He wrote: *Nature also teaches me, by the sensations of pain, hunger, thirst and so on, that I am not merely present in my body as a pilot in his ship, but that I am very closely joined and, as it were, intermingled with it, so that I and the body form a unit. If this were not so, I, who am nothing but a thinking thing, would not feel pain when the body was hurt, but would perceive the damage purely by the intellect, just as a sailor perceives by sight if anything in his ship is broken* (Descartes, Meditations VI:81 in Cottingham 1986:56).	
KANT∞	1724-1804	Kant distinguished between *phenomena*, which are our perceptions of things or how things appear to us, and *noumena*, which are the things in themselves, which we have no knowledge of. Kant conceives of living systems as self-organising systems which are actively self-maintaining and so both cause and effect of itself	idealist: believing we have no direct way of perceiving the external world and that all we have access to is our ideas of the world, including what our senses tell us.
JOSEF BRUER	1842-1925	A distinguished physician who made key discoveries in neurophysiology, and whose work in the 1880s with his patient Bertha Pappenheim, known as Anna O., developed the talking cure (cathartic method) and laid the foundation to psychoanalysis as developed by his protégé Sigmund Freud	
HUSSERL∞	1859-1938	German philosopher who established the school of phenomenology. The slogan of Husserl's phenomenology is "all consciousness is consciousness of something", which implies a distinction between "acts of thought" (the noesis) and "intentional objects of thought" (the noema). Thus, the correlation between noesis and noema becomes the first step in the constitution of analyses of consciousness.	
JOHN DEWEY∞	1859-1952	Clearly characterized what has become known as enactivism. We begin in perception, he suggests, not with a sensory stimulus, but with a sensorimotor coordination . . . it is the movement which is primary, and the sensation which is secondary, the movement of body, head and eye muscles determining the quality of what is experienced. (Dewey 1896, p. 358) in (Gallagher, 2015: 392-393)Cognition – as the American naturalist Dewey (1896) pointed out, cannot be understood by breaking it into parts; it always exists at the level of the situated organism as a whole	
KURT KOFFKA	1886-1941	Koffka believed that most of early learning is what he referred to as, "sensorimotor learning," which is a type of learning which occurs after a consequence. Koffka worked with Wolfgang Köhler and Max Wertheimer as a representative of the gestalt movement. He helped to establish the theories that gave rise to the study of Gestalt psychology. It is based on the idea that it is best to experience what we feel "here and now" and not keep thinking about the past or worry about the future. ... At the center of Gestalt therapy is the idea of "awareness" (knowing)	
MARTIN HEIDEGGER∞	1889-1976	For Heidegger the method of ontology is phenomenology. "Phenomenology," he says, "is the way of access to what is to become the theme of ontology." Being is to be grasped by means of the phenomenological method. Dasein (German pronunciation: [ˈdaːzaɪn]) is a German word that means "being there" or "presence" (German: da "there"; sein "being"), and is often translated into English with the word "existence". ... Heidegger uses the expression Dasein to refer to the experience of being that is peculiar to human beings.	
EDITH STEIN	1891-1942	Developed a phenomenological theory according to which certain types of feelings involve knowledge and judgements about things, persons/situations in the world, notably about how they are evaluated and cherished.	
ALFRED SCHUTZ	1899-1959	Intersubjectivity, Schutz concluded, was a matter of everyday life to be simply described and not to be constituted within the transcendental sphere of a self-reflective consciousness giving an account of how the other comes to appearance. Just as Schutz had argued that the social world dictated the methods for its own social scientific investigation, so here it seemed to prescribe to phenomenology the approach appropriate to its description.	
HANS JONAS∞	1903-1993	According to Jonas, the boundary, i.e., that which allows us to identify the individual organism as individual is an emerging distinction. He says: Sameness, while it lasts ... is perpetual self-renewal through process, borne on the shift of otherness. This active self-integration of life alone gives substance to the term "individual" ... its very existence at any moment, its duration and its identity in duration is, then essentially its own function, its own concern, its own continuous achievement (Jonas, 1966/2001, p. 80) in Kyselo, M. (2014)	
JAMES GIBSON∞	1904-1979	Ecological psychology - The term 'affordance' refers to the opportunities for action provided by a particular object or environment. For Gibson the noun affordance pertains to the environment providing the opportunity for action. Affordances require a relationship in which the environment and the animal can work together. Some theorists have suggested provides a fundamental way to understand that duality of mind and external reality. With its roots in Gibsonian ecological psychology (Gibson, 1979) an important branch of enactivism focuses on a non-representationalist account of perception based on so-called "sensorimotor contingencies"	Ecological Psychology. Affordance. Behaviourism rejected by Gibson. Gibson became more philosophical and criticised cognitivism. Gibson argued strongly in favour of direct perception and direct realism
JEAN PAUL SARTRE	1905-1980	Sartre argues against Kant's concept that the appearance of a phenomenon is pure and absolute. The noumenon is not inaccessible—it simply isn't there. Appearance is the only reality. From this starting point, Sartre contends that the world can be seen as an infinite series of finite appearances	
MERLEAU PONTY∞	1908-1961	In his later writings, Merleau-Ponty becomes increasingly critical of the intellectualist tendencies of the phenomenological method as well, although with the intention of reforming rather than abandoning it. "The whole universe of science is built upon the world as directly experienced, and if we want to subject science itself to rigorous scrutiny and arrive at a precise assessment of its meaning and scope, we must begin by reawakening the basic experience of the world of which science is the second-order expression" (Merleau-Ponty, The phenomenology of perception).	The characteristic approach of Merleau-Ponty's theoretical work is his effort to identify an alternative to intellectualism or idealism, on the one hand, and empiricism or realism, on the other, by critiquing their common presupposition of a ready-made world and failure to account for the historical and embodied character of experience.
JEROME BRUNER∞	1915-2016	The first definition of enaction was introduced by psychologist Jerome Bruner. He identified three stages of cognitive representation: ▪ Enactive (action-based), which is the representation of knowledge through actions ▪ Iconic (image based), which is the visual summarization of images ▪ symbolic representation (language based), which is the use of words and other symbols to describe experiences Relates to the ideas of cognitive development of Piaget (child spatial perception and world interaction) and also social constructivism of Vygotsky. Relates to situated cognition – a theory that posits that knowing is inseparable from doing	Bruner's constructivist theory suggests it is effective when faced with new material to follow a progression from enactive to iconic to symbolic representation; this holds true even for adult learners Bruner's work also suggests that a learner even of a very young age is capable of learning any material so long as the instruction is organized appropriately, in sharp contrast to the beliefs of Piaget and other stage theorists
PETER MUNZ	1921-2006	According to Munz, "an organism is an *embodied theory* about its environment... Embodied theories are also no longer expressed in language, but in anatomical structures or reflex responses	
GEORGE LAKOFF MARK JOHNSON	1941 - Current 1949	Permeation of cognition by metaphor. thesis that lives of individuals are significantly influenced by the central metaphors they use to explain complex phenomena	
FRANCESCO VARELA, EVAN THOMPSON, ELEANOR ROSCH	1946-2001 1962 - Current 1938 – Current	The term 'enactivism' is close in meaning to 'enaction', defined as "the manner in which a subject of perception creatively matches its actions to the requirements of its situation. Proposed the name to "emphasize the growing conviction that cognition is not the representation of a pre-given world by a pre-given mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs. Enactivism is closely related to situated cognition and embodied cognition, and is presented as an alternative to cognitivism, computationalism, and Cartesian dualism	Enactivist
LAWRENCE BARSALOU	1951 – Current	Embodied and Grounded Cognition. The conceptual system is grounded in multimodal simulation, situated conceptualization, and embodiment.	Embodied and Grounded Cognition
JOSEPH LEVINE∞	1952 – Current	Works on Philosophy of Mind. Explanatory gap* is the difficulty physicalist theories have in explaining how physical properties give rise to the way things feel as they are experienced. *In the end, we are right back where we started. The explanatory gap argument doesn't demonstrate a gap in nature, but a gap in our understanding of nature. Of course a plausible explanation for there being a gap in our understanding of nature is that there is a genuine gap in nature. But so long as we have countervailing reasons for doubting the latter, we have to look elsewhere for an explanation of the former* (Levine, 1999).	Explanatory gap
ANDY CLARK	1957 – Current	'We need new tools with which to investigate effects that span multiple time scales, involve multiple individuals, and incorporate complex environmental interactions' (1999:221).	
MARK ROWLANDS	1962 – Current	Enactivism is one of a cluster of related theories sometimes known as the *4Es*. As described by Mark Rowlands: ● Mental processes are embodied, involving more than the brain, including a more general involvement of bodily structures and processes ● Embedded functioning only in a related external environment ● Enacted involving not only neural processes, but also things an organism *does* ● Extended into the organism's environment	
ALVA NOE PAUL DOURISH	1964 – Current 1966 - Current	Perception is not something that happens to us, or in us He published "Where the Action Is: The Foundations of Embodied Interaction" (MIT Press) in 2001.[11] This book explores the relationship between phenomenological sociology and interaction design, particularly with reference to physically embodied computation and ubiquitous computing. 'So from the phenomenological perspective, we encounter, interpret, and sustain meaning through our embodied interactions with the world and with each other' (2004:127).	
SHAUN GALLAGHER∞	Current	Enactivist Interventions is an interdisciplinary work that explores how theories of embodied cognition illuminate many aspects of the mind, including intentionality, representation, the affect, perception, action and free will, higher-order cognition, and intersubjectivity. Cognition involves an integration of brainy and worldly processes. 1. First, cognition is not simply a brain event. It emerges from processes distributed across brain-body-environment. 2. Second, the world (meaning, intentionality) is not pre-given but is enacted by cognition, action, and social interaction. 3. Third, our understanding of cognitive processes has to be in view of their role in worldly contexts where they acquire meaning rather than as a representational mapping or replicated internal model of the world. 4. Fourth, enactivist approaches have strong links to dynamical systems theory, and they emphasize the relevance of dynamical coupling and coordination across brain–body-environment. 5. Fifth, cognitive systems are extended, intersubjective, and socially situated, but the concept of extension is not equivalent to the functionalist extended mind. 6. Sixth, higher-order cognitive functions, such as deliberation, reflective thinking, and imagination, are exercises of skilful know-how and are closely coupled with situated and embodied actions. 7. And seventh, such cognitive functions are grounded not only in sensorimotor coordination, but also in affective and autonomic aspects of the full body.	I also introduce the position that I am defending—enactivism. I provide a broad historical background (showing how enactivism is influenced or prefigured by pragmatism and phenomenology) and I situate it in the contemporary context of embodied cognition This is where enactivism capitalizes on both its phenomenological and pragmatic roots a neopragmatist view of intentionality works best to capture the contextualized, action-oriented nature of cognition what phenomenologists call operative or bodily intentionality I suggest, we need to think of that process as one where the embodied agent actively engages in the world rather than as one where an inference-making brain generates action simply for purposes of predicting or sampling an unknown environment.
JESSE PRINZ∞	Current	In sum, I don't see a plausible case for the enactive view. The evidence offered in its defense falls far short of the mark, and there is considerable reason to be skeptical. *I think we have a lot to learn from the enactive approach. We should bear in mind that we perceive the world in order to respond successfully to it. Perception is, in this respect, for action. Cognitive science should pay attention to the environment. Living organisms have bodies and are situated in the world. I have little doubt that, as cognitive scientists pay more attention to these humble facts, their theories will be improved, and perhaps a few cherished assumptions will be abandoned* (2006, 17-18).	Scepticism Book: Gut Reactions: A Perceptual Theory of Emotion
MATTHEW RATCLIFFE	Current	Ratcliffe argues that existential feelings form a distinctive group by virtue of three characteristics: they are bodily feelings, they constitute ways of relating to the world as a whole, and they are responsible for our sense of reality. He explains how something can be a bodily feeling and, at the same time, a sense of reality and belonging.	
RANDALL D BEER	Current	Dynamical Systems Theory understanding how coordinated behavior arises from the neurodynamics of an animal's nervous system, its body and its environment. He works on the evolution and analysis of dynamical "nervous systems" for model agents	
VAN ELK, SLORS & BEKKERING	Current	One of the most exciting discoveries in cognitive neuroscience over the last decades is certainly the finding that our brain "resonates" to action representations. Observing the actions of others, for instance, activates brain areas comparable to the areas that are activated when one would perform these actions oneself. enactivism can be defined as the view that cognition emerges in the interaction between an organism and the environment, such that perception and action are co-constitutive of it. Cognition is manifested in the kind of appropriate, dynamic perception–action coupling that allows us to cope effectively with our physical and social environment. On the enactivist view it is misleading to think of such coupling as requiring discrete representations of one's environment: effectively dealing with one's environment does not presuppose awareness of features of one's environment, rather it reflects such awareness. Enactivism implies that cognition is essentially tied to action and that cognition is always context-bound. We refer to these diverse approaches as "enactivist." A defining feature of the enactivist paradigm of cognition is that it challenges the representationalism of the traditional cognitivist paradigm by taking cognition to be based on "knowing *how*" instead of "knowing *that*." That is, an organism's knowledge of its environment is not taken to consist in the adequate representation or internal modelling of environmental features. Rather, knowledge consists in the way sensory information is linked to motor output. The structuring and restructuring of sensorimotor links in the recursive interaction of an organism with its environment, by means of which the organism adapts to it, implies or specifies knowledge of the world.	Support a non-representationalist, enactivist model and avoids problems of cognitivist interpretation Via an enactivist move simulationist interpretation of the function of mirror neurons is rejected In cognitive neuroscience the notion that concepts are embodied primarily means that there is a correspondence between the brain activations associated with processing the referent of a concept and the processing of the concept itself.
MAREK MCGANN	Current	Enactivism attempts to mediate between the explanatory role of the coupling between cognitive agent and environment and the traditional emphasis on brain mechanisms found in neuroscience and psychology	anti-representationalist
EZEQUIEL DI PAOLO, DE JAEGHER	Current	The interactive brain hypothesis aimed at broadening the spectrum of possible explanations in social cognition research. the enactive approach foregrounds a different notion of the living body (of which the brain is a part) in its ongoing sense-making relation to the world. According to this approach, the brain is understood as embedded, not in a protective and nourishing casing, but in ongoing circular processes of sense-making that pass through it, the body and the world; in other words it is understood as a mediating organ with all the implications that this view has for the study of brain function.	
XABIER BARANDIARAN∞	Current	Organisms are accordingly conceived as agents which: "define themselves as individuals as an ongoing endeavour and through the actions they generate" and as a consequence "have goals or norms according to which they are acting" (Barandiaran et al., 2009, p. 3)	Autonomist sensorimotor enactivist
FUCHS & DE JAEGHER DANIEL STERN	Current Current	Enactive inter-subjectivity Forms of Vitality: Vitality takes on many dynamic forms and permeates daily life, psychology, psychotherapy and the arts, yet what is vitality? We know that it is a manifestation of life, of being alive. We are very alert to its feel in ourselves and its expression in others. Life shows itself in so many different forms of vitality. But just how can we study this phenomenon?	
PETER F DOMINEY	Current	His research interests include understanding and simulating the neurophysiology of cognitive sequence processing, action and language, and their application to robot cognition and language processing, and human-robot cooperation	
JOEL KREUGER	Current	Direct Social Perception (DSP). 'Neither phenomenology nor enactivism disputes that brains are necessary for cognition, but they do question their sufficiency. For both, brains are part of larger systems—including bodies interacting with their environment—and cognitive processes are realized within the integrated brain-body-environment dynamics comprising these systems. As a result, many cognitive processes have external world-facing parts that can be seen by others. These parts are found within the character of our embodiment and our ongoing interactions with the people and things around us'. 'Without the ability to spontaneously express their emotions via the relevant sensorimotor circuits like gestures and facial expressions—and activate efferent and aferent feedback mechanisms within these circuits—part of the emotion' (i.e., its external expressive profile, critical for self-regulation) is missing and its experiential character diminished' (2019:3-4).	

2.3 The current mental healthcare system and biomedical model

The NHS is an institution built upon politically sturdy foundations, founded in 1948, as an example of an effective model of social innovation serving the UK population. This was an ambitious plan to bring healthcare to all. Monthly experimental[1] statistics in the first quarter of 2022 show that during one month alone, 1.58 million people were in contact with NHS mental health services, with a majority 1,054,003 in contact with adult services. A total of 367,594 new referrals were received and 21,242 were subject to the Mental Health Act, including 16,110 who were detained in hospital (NHS Digital, 2022). From a viewpoint of rising population figures, when the NHS began the UK population was 49.4 million - less than 75 years later this figure is more than 68 million. This, against a backdrop of a global population that was around 1.2 billion in the mid-19th century, rocketing towards 8 billion currently.

Davies discusses that a nation which keeps its citizens healthy is *'more likely to remain economically productive'* (2013: p.255[i]), pointing toward agendas linked not solely to personal well-being, but in keeping a person in a fit state to contribute to boosting the nation's GDP[2]. The main frontline therapeutic response in supporting a social problem of a crisis in mental healthcare is Cognitive-Behaviour Therapy (CBT), delivered through the UK's Improving Access to Psychological Treatment (IAPT) programme. CBT - based on observation of behaviour as a social process, not on a therapist's acute knowledge of what takes place (conceptually) inside an individual. The IAPT Manual (NHS, 2021), describes its development since national implementation in 2008 that sees the programme now reach over 1.15 million people per year, delivering a range of National Institute for Health and Care Excellence (NICE) recommended psychological therapies, as evidence-based psychological therapies including: low intensity interventions: guided self-help; computerised CBT; group-based physical activity programmes; hi intensity interventions: CBT; interpersonal psychotherapy (IPT), behavioural activation; couple-therapy for depression; brief psychodynamic therapy and counselling for depression. Conditions treated include: Agoraphobia; Body dysmorphic disorder; Chronic fatigue syndrome; Depression; Generalised anxiety disorder; Health anxiety; Mixed anxiety

---

[1] Experimental statistics undergo development and evaluation and are of use to those requiring access to fast-information in line with operational decision-making and secondary purposes

[2] Office for National Statistics (2018) Gross domestic product (GDP) measures value of goods and services produced in UK. It estimates size of and growth in the economy.

and depressive disorder; Medically unexplained symptoms (MUS); Obsessive Compulsive Disorder (OCD); Panic disorder; Post-traumatic strees disorder (PTSD); Social anxiety disorder aka social phobia (NHS, 2021: P. 5-11). The IAPT workforce operates within a stepped care model, as shown in Figure X, used by IAPT services to make a clinical decision as to the level of treatment is deemed most appropriate for the person being assessed.
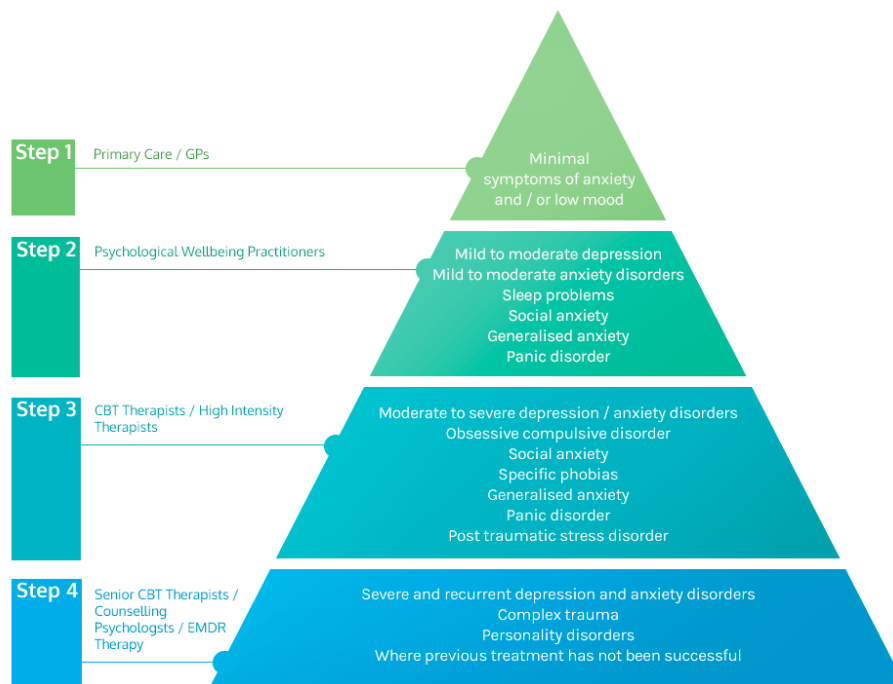

Figure 1: Improving Access to Psychological Therapies (IAPT) Stepped Care Model.
Sourced via: Mental Health Matters (2021)[ii]

Rose talks of *'identity projects'*, linking people to a new breed of *'engineers of the human soul'* and encouraging them to become more ethical *'whole'* beings. The new *'therapeutics of finitude'*, Rose suggests, is where suffering is reframed by expertise, *'to be managed as a stimulus to the powers of the self'* (1998: 156-157[iii]). David, Cristea and Hofmann (2018: p.1[iv]) argue that CBT is the best psychological treatment currently available, accepting that room for improvement exists as many patients do not respond to CBT and/or relapse. They predict continued improvements in psychotherapy will derive from CBT (as a treatment pathway with unrivalled research support) and will move the field toward an integrative scientific psychotherapy, This will bring about an emphasis to develop CBT's efficacy and effectiveness with the therapy serving as a foundational platform to build on and integrating it into a larger picture of science to further validate its underlying constructs, involving cognitive neurogenetics. From a UK Government perspective a consultation outcome relating to a reform

of the Mental Health Act highlights approaches to new ways of doing things, whereby an act that is arranged around a system established in 1959, does not fit in with a modern sense of how healthcare should be delivered in the 21st century. Respondents involved in the report described experiences of an over-reliance on medication an emphasis on a common standard for therapies that must be well evidences, effective and personalised. This would, as the report points out, prompt a more holistic approach to patient care that takes into account a range of options and the wider environment (Gov.UK, 2017: 17[v]). Table 1 shows a series of stages indicating how a concept might emerge and become embraced as a paradigm, for example, in a similar way to how CBT became accepted. At Stage 6, once a concept is implemented in society, it may be a challenging task to shift, due to a fact that preparations are made so this concept can be3come embedded.

Table 1: The Journey of a Paradigm

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Thoughts that could also be conceptualised as whole system impulses, i.e. brain, body, environment	Impulses that become discussed by the one who initiates the concept	Impulses that become shared 1-1 or with those who have power to instil change	Impulses that don't settle and become something more realised	Concepts that become acted upon	Concepts that begin a journey to become embraced by many

[i] James Davies (2013) Cracked: Why Psychiatry is Doing More Harm Than Good, p.255. Icon Books Limited, UK

[ii] Mental Health Matters (2022) Stepped Care. Available: https://www.mhm.org.uk/pages/faqs/category/stepped-care

[iii] Rose, N. (1998) Inventing Ourselves: Psychology, Power and Personhood. Cambridge University Press, United Kingdom

[iv] Daniel David, Ioana Cristea, Stefan G. Hofmann (2018) Why Cognitive Behavioral Therapy Is the Current Gold Standard of Psychotherapy. Frontiers in Psychiatry, Volume 9, Article 4 (Available) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5797481/pdf/fpsyt-09-00004.pdf

[v] Gov.UK (2021) Reforming the Mental Health Act: Government response to consulation. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002885/reforming-mental-health-act-consultation-response-print-ready.pdf

Epistemology

The current thesis is situated in HCI, as an interdisciplinary field that analyses with a view to improve interactive processes between users, digital information and environment (Rubio-Tamayo, Barrio, Garcia, 2017: 1-15[i]). An intention was to design and develop a user-oriented system, as a process to assist what McCarthy and Wright describe as an experience of technology that has ability to extend to the sense people make of themselves in their lives, (McCarthy and Wright 2004:42[ii]). A study intention was to build inductively on recent views from within the cognitive sciences and design and develop something akin to an enactive system, for use in psy-practices such as those offered via mental healthcare services. De Haan offers:

> *Such practicing of new ways of sense-making is precisely what happens in psychotherapy. From an enactive perspective, psychotherapy can be regarded as the attempt to offer optimal interactions for the patient to learn and practice new ways of sense-making in a durable way. This is in line with the traditional idea of therapy as a 'practice relationship': within the safe environment of the therapeutic setting, patients can try out a broader range of behaviours, thoughts, and feelings, and thereby practice different ways of relating and sense-making*
>
> *(de Haan, 2020:p261[iii])*

By embracing the enactive view, a system such as the IIVE combined with *The Timeline,* as a proposed digital intervention within this study, has potential, as this thesis argues, in offering new ways for participants to re-author their narratives and engage with tools, as afforded features. Throughout this process the behaviour of a participant links not only to voicing where they are at, but encourages movement, touch, sight, listening, using their entire physical self to assist a process of recovery. This places the person at the centre of this type of study and investigates their experience. In other words, it starts with the human, who the system is designed to assist.

In determining how to investigate a social problem through a phenomenological lens, a line of thinkers and practitioners are evident. These range by title from Philosopher, Physician and Physiologist, to Phenomenologist, Psychologist, Psychiatrist and, more recently, Neuroscientist, Radical Embodied Cognitive Scientist and Enactivist. Each present different

views and from an enactivism viewpoint, are phenomenologically inspired. As Gallagher and Zahavi describe:

> *In this organization of cognitive disciplines, phenomenology, defined as the specific philosophical approach, was pushed aside and said to be irrelevant…When methodological questions arose about how to study the experiential dimension scientifically, and therefore, without resorting to old-style introspectionism, a new discussion of phenomenology was started… The second thing that happened to motivate a reconsideration of phenomenology as a philosophical-scientific approach was the advent of embodied approaches to cognition… Functionalism led us to believe that cognition could be instantiated in a disembodied computer program, or 'brain-in-a-vat', and that embodiment added nothing to the mind* (Gallagher, Zahavi, 2008:4-5[iv]).

Phenomenological approaches have permitted insights into participatory experiences within studies that this thesis translates as a phenomenological epistemology, due to phenomenology offering a means of describing a conceptual conscious experience. As a paradigm of inquiry this study has considered an interpretivist lens, as the methods of inquiry and data collection including participant observation and interviewing, support this. The *interpretivist* paradigm is concerned with understanding the world as it is from subjective experience of individuals. However, as Pham points out, research outcomes can become *'unquestionably affected by the researcher's own interpretation, own belief system, ways of thinking'* and whilst interpretivists *'aim to gain a deeper understanding and knowledge of phenomena'* the approach *'tends to leave out a gap in verifying validity and usefulness'* (2018:4[v]).

A further paradigm of inquiry consideration is *constructivist*. Piaget[1]'s theory argues that people produce knowledge and form meaning based on experiences, with the current study in Chapter 2 considering the ways people in society have been labelled and categorised, as well as being problematized as having illnesses which can only be dealt with by experts. A constructivist inquiry can inform the designers of systems and is seen as relativist, in that there is no single, tangible reality which can be reduced and approximated, only multiple, constructed ones. From an epistemological viewpoint, constructivism sees subjectivity as the sole option in the research process (Pickard, Dixon, 2004[vi]), though whereas constructivism

---

[1] Jean Piaget was a Swiss psychologist and the first to make a systematic study of cognitive development, studying the acquisitions of understanding in children. Piaget is considered by many to have been the first major figure in 20th century developmental psychology

holds greater value over making and gaining knowledge, knowing about interconnections is a focus of enactivism - where cognition is grounded in bodily functionality.

As the study largely involves individuals reasoning with their reality and constructing a set of truths, a *rationalist* paradigm of inquiry is considered, alongside a notion that *realist* perspectives would fit into the context of an Action Research methodology. Additionally, *holism* tries to understand a phenomenon by gaining as many perspectives on it as possible and then synthesizing those perspectives into a more complete understanding. Defenders of qualitative inquiry endorse holism and oppose efforts at *reductionism* (Schwandt, 2007:140[vii]). The researcher has opted toward a *pragmatist* paradigm of inquiry, which reflects both the researcher's style of inquiry in constantly negotiating the most effective tool for problem solving (as was the case throughout this study from its conception in 2017-18); one which was a constant strategizing to seek agency. Goldkuhl writes: '*Even if qualitative research is often associated with interpretivism, there are alternatives*', adding:

> *Pragmatism is concerned with action and change and the interplay between knowledge and action. This makes it appropriate as a basic for research approaches intervening into the world and not merely observing the world* (2012(a):136-144[viii]).

A notion of action and intervening with the world meets the intentions of the current study, whereby the participants are not merely present, but also actively engaging in an experience designed to present opportunities to improve on their understanding of self. A pragmatist paradigm of inquiry, in essence, concerns action(s) and change; human beings acting and reacting against the backdrop of a world in a constant state of becoming. Blumer claims:

> '*…the essence of society lies in an ongoing process of action – not in a posited structure of relations. Without action, any structure of relations between people is meaningless. To be understood, a society must be seen and grasped in terms of the action that comprises it*' (1969, p. 71[ix]).

In support of this, the thesis will now describe how specific action was taken, via a human centred approach in HCI through Interaction Design.

---

[i] Rubio-Tamayo, J.L., Barrio, M.G., Garcia, F. (2017) Immersive Environments and Virtual Reality: Systematic Review and Advances in Communication, Interaction and Simulation. Multimodal Technologies and Interaction [Online] Available at: https://www.mdpi.com/2414-4088/1/4/21

[ii] John McCarthy, Peter Wright (2004) Technology as experience. Interactions, Volume 11, Issue 5. Available: https://dl.acm.org/doi/10.1145/1015530.1015549

[iii] Sanneke de Haan. 2020. *Enactive Psychiatry*. p.261. Cambridge University Press

[iv] Shaun Gallagher, Dan Zahavi (2008) The Phenomenological Mind. An introduction to philosophy of mind and cognitive science. Routledge

[v] Lan Thi Mai Pham (2018) Qualitative Approach To Research. School of Education, The University of Adelaide. Available:
https://www.researchgate.net/publication/324486854_A_Review_of_key_paradigms_positivism_interpretivism_and_critical_inquiry

[vi] Alison Pickard, Pat Dixon (2004) The applicability of constructivist user syudies: how can constructivist inquiry inform service providers and system designers. Information research, Vol. 9, No. 3. Available: http://informationr.net/ir/9-3/paper175.html

[vii] Thomas A. Schwandt (2007) The SAGE Dictionary of Qualitative Inquiry. (3 ed.) SAGE Publishing. Available: https://experts.illinois.edu/en/publications/the-sage-dictionary-of-qualitative-inquiry

[viii] Goran Goldkuhl (2012) Pragmatism vs interpretivism in qualitative information systems research, European Journal of Information Systems, 21:2, 135-146. Available: https://www.tandfonline.com/doi/pdf/10.1057/ejis.2011.54?needAccess=true

[ix] Herbert Blumer (1969) Symbolic Interactionism. Perspective and Method. University of California Press. Available: https://edisciplinas.usp.br/pluginfile.php/2747599/mod_folder/content/0/COMPLEMENTAR%20-%201969%20-%20Blumer%20-%20Symbolic%20Interactionism.pdf

VIDEO PROTOTYPE: SHOOTING SCHEDULE

IMMERSIVE INTERACTIVE VIRTUAL ENVIRONMENTS IN MENTAL HEALTH

Video Prototype Overview: All suggested visual, audio and touch-interactive media was discussed with Immersive Interactive on October 15, 2020, with items the company felt suitable to include in the Video Prototype considered.

As this 2020 phase of the data collection links to clinicians and staff who are "Experts by Experience" of trauma in mental health, it is felt that the choice of visual imagery, audio and haptic (touch responsive) be applicable to this viewership.

TIMING	TITLES	ACTION
15 seconds	**OPENING TITLE** Immersive Interactive Virtual Environments: A proposed future setting in mental healthcare.	A title on screen containing a still image of the immersive room.

1 minute	**INTRODUCTION**
	
	The film you are about to watch is a Video Prototype. In the world of design and human computer interaction, video prototypes are used as a technique to open up discussion with people who may be able to inform the design process.
	The views of people such as yourself are highly important to this process and could help in the development of future mental healthcare interventions.
	You will see three scenarios of approximately six minutes in total length. You will then be asked to comment on what you see. The scenarios you will view are:
	   I. A clinician preparing the immersive room
	   II. A participant exploring features of the immersive room
	   III. A participant testing The Timeline. This is a proposed future mental healthcare intervention
		Introduction words on screen.

5 seconds	**VIDEO PROTOTYPE I**	Title on screen
2 minutes	**VP1: In this video a clinician is preparing the room as a mental healthcare setting**	A clinician enters the immersive room which is powered down. The clinician approaches to keyboard and powers up the system. After ten seconds the walls in the room transform from blank to show the walls as now being live. The clinician makes reference to looking up at the projectors and the sensors in the room and

		then approaches the rear main facing wall and uses the keyboard to access the interface displaying a menu of items.

This scene then illustrates:

Visual: Lively New York City Scene / Homely Living Room Scene

Audio: Buddhist Music

Touch: 3D Content; ISS Floating Objects |
| **5 seconds** | **VIDEO PROTOTYPE II** | Title on screen |
| **2 minutes** | **VP2: In this video a participant is exploring features of the room** | A participant enters the room.

The participant approaches the keyboard and accesses the interface menu. The participant views the visual walls, listens to the audio and interacts with the content being displayed.

Visual: Anglesea Beach Visual

Audio: Relaxing

Touch: 3D Content |
| **5 seconds** | **VIDEO PROTOTYPE III** | Title on screen |
| **2 minutes** | **VP3: In this video a participant interacts with The Timeline. This is a proposed future application in immersive interactive virtual environments, linked to mental healthcare** | A participant enters the room

The participant approaches the keyboard and accesses the interface menu.

Visual: A Timeline appears on the wall |
| **10 seconds** | **Thank you for viewing. You will now be asked a series of questions based on the video prototypes.** | Words on screen |
| **7 min 40** | **END** | Title on screen |

PROTOCOL: THE TIMELINE

STUDY TITLE: Exploring enactive approaches to designing and understanding immersive interactive virtual environments in mental healthcare

WORKING TITLE: The Timeline: Co-Production of Future Settings and Digital Interventions in Mental Healthcare

IRAS PROJECT ID: 306798

HEALTH RESEARCH AUTHORITY: REF 1100/89/122/81

NORTHUMBRIA UNIVERSITY ETHICS REF: 32928

DATE: NOVEMBER 05, 2021

VERSION: 04

CHIEF INVESTIGATOR: Tor Alexander Bruce / 07398 1000 73 / tor.a.bruce@northumbria.ac.uk

LEAD INVESTIGATOR ORCID ID: 0000-0002-9997-9786

DOCTORAL SUPERVISORS:

Professor Lars Erik Holmquist / 07507 917 767 / lars.holmquist@northumbria.ac.uk

Dr Annessa Rebair / 07538 842 217 / annessa.rebair@northumbria.ac.uk

SPONSOR: Northumbria University / Laura Hutchinson, Research Ethics and Integrity Manager / laura.hutchinson2@northumbria.ac.uk / 07896 606 754

FINANCIAL SPONSOR: Immersive Interactive / Peter Salt / 0776 969 1031 / peter@immersive.co.uk

STUDY PARTNER: Alliance Psychological Services

Leanda Kane-Fidgeon / 0776 690 0259 / leandakane-fidgeon@alliancepsychology.com

Dr Adam Hegarty / adamhegarty@alliancepsychology.com / 0800 107 5880

LIAISON CONTACT BETWEEN UNIVERSITY AND JAMES COOK HOSPITAL:

Joe Millar, Research Governance Manager, Durham Tees Valley Research Alliance, South Tees Hospitals NHS FT / 07773 740 784 / joe.millar@nhs.net

PATIENT PUBLIC INVOLVEMENT: National Institute for Health Research Design Service (NIHR/RDS) at Gateshead Clubhouse. Alex Robertson / PPI Engagement Manager / alex.robertson@newcastle.ac.uk

CONFIDENTIALITY STATEMENT: This document contains confidential information that should not be disclosed to any party outside of the study collaborators as listed above.

TABLE OF CONTENTS

1. AMENDMENT HISTORY

Amendment	Version	Date	Author of Change	Details of Change
1	03	October 30, 2021	Tor Alexander Bruce	The document in its initial format was too brief. The whole document was overhauled with each section becoming more specific. The author(s) had full information available but this was not previously contained within a single protocol document.
2	02	November 01, 2021	Tor Alexander Bruce	Additions of: Synopsis, Background, Problem Formulation, Rationale, Study Design and Ethics sections.
3	01	November 04, 2021	Tor Alexander Bruce	The study sponsor information was altered to specify the main sponsor at Northumbria University, versus the financial sponsor, at Immersive Interactive.

2. SYNOPSIS

STUDY TITLE	The Timeline: Co-Production of Future Settings and Digital Interventions in Mental Healthcare
KEYWORDS	Immersive Technology; Mental Healthcare; Digital Intervention; Trauma; Enactivism
TYPE OF STUDY	A human computer interaction (HCI) study involving the design and in-situ trialling of a digital therapeutic intervention called: The Timeline. The co-production approach involves qualitative interviewing with therapists and participants who have experience of life trauma. The study is situated in an immersive interactive virtual environment.
STUDY PHASES	Phase 1: Interviews with Experts by Profession (Therapists) Phase 2: Interviews with Experts by Experience (Trauma)
STUDY DURATION	October 2019 – October 2021
DATA COLLECTION	Phase 1: January-March 2021 Phase 2: December 2021 – February 2022
RESEARCH QUESTION	How might immersive interactive virtual environments support people making sense of trauma in their lives?
METHODOLOGY	Inductive, qualitative, exploratory research with a human-centred design and supports the ontological perspective of an enactive person-world system, where people make sense of reality via person-world interaction. The co-production approach to the study aligns with a need to understand service-user views and attitudes and create a platform for dialogue, to collaborate with end-users as research partners.
METHODS	Phase 1: Qualitative Semi Structured Interviewing involving the use of a Video Prototype and audio-recording of verbatim responses Phase 2: Qualitative Semi Structured Interviewing involving participants experiences of the technology in-situ and audio recording of verbatim responses
DATA ANALYSIS	The interview transcripts are being used for the basis of a thematic analysis following Braun and Clarke's six-step guide and Maguire and Delahunt's guidance in achieving both a semantic and latent analysis of the data.
SAMPLE STRATEGY	A purposive sample based on participants with direct experience in the delivery and receiving of mental healthcare interventions. This study's sampling number is based on an anticipated number of participants required, before repetition of the same data-reponse (as a saturation point) is received. It is also based on what seems manageable within the restraints of a full year as relating to: data collection, data management; data analysis. The interviewing is intended toward a homogenous sample group in both phases and are semi-structured, which suggests that this is a study which is seeking a more defined and less of a casual response. The intended objectives are to gather data which informs the design of a new environment in healthcare. Guest, Bunce and Johnson [i] found 12 interviews enough to achieve saturation within a homogenous group. Where rich and trustworthy data is important and the participants are assumed to be the holders of the knowledge required via an investigation, 12 may seem appropriate, although Baker and Edwards [ii] conclude that the agreed upon sample number depends on multiple factors.

SAMPLE SIZE	Phase 1: N=12 Experts by Profession Phase 2: N=12 Experts by Experience
INCLUSION-EXCLUSION	Yes.
INFORMED CONSENT	Yes.
BASELINE SCREENING	An Impact of Events (IoE) Scale to assess the eligibility of all participants in Phase 2.
RESEARCH AIM	An aim is to report on iterative design stages that have led to the creation of a novel digital-therapeutic healthcare intervention, situated in an IIVE, called: *The Timeline*. Here, we envisage a user can engage in a multisensory setting where a life trajectory can be broken down into manageable, conceptual segments: *Deep Past, Past, Now, Future*, to provide opportunity to interact chronologically with events that have formed epochs in their lives. Because the study assumes that traumas exist in society, one of the two chosen study-partners specializes in providing services for people who present a range of mental health challenges, including trauma, whereby an individual client or patient seeking support can be regarded as being on a quest to heal themselves.
RESEARCH OBJECTIVES	i. To survey and synthesise literature in fields of: mental health history; immersive technologies; phenomenology, embodied cognition and enactivism; narrative-interventions and co-production - to develop a research framework for designing IIVEs; ii. To develop storyboards and Video Prototypes of IIVE design within the research framework and use this to gain feedback from "*Experts by Profession*" (senior mental health staff and clinicians) which can inform an interview protocol involving "*Experts by Experience*" (participants who have endured trauma); iii. To iterate the design in an IIVE and run evaluative, qualitative interview sessions to understand these experiences (with "trauma" participants) at a hospital; to transcribe this data; iv. To create a bespoke environment and therapeutic intervention in an IIVE incorporating Unity software, where people with experience of trauma can re-author their life narrative and gain efficacy
ETHICS	Yes.
RISK ASSESSMENT	Northumbria University stipulates that RAs should be in place during each preliminary visit to Alliance Psychological Services and to James Cook Hospital. During COVID 19 each RA contains additional information relevant to ensuring compliance with full safety measures, including the adopting of wearable masks and safe-distancing measures.
DISSEMINATION POLICY	Phase 1 (2021): The data is included in a full technical paper with a focus toward Human Computer Interaction (HCI) conferences. Phase 2: It is anticipated the data will be included in a full technical paper with a focus toward a health and psychology journal.

3. BACKGROUND, PROBLEM FORMULATION AND RATIONALE

Background

This study originated in 2017 based on an idea to stand a typical mental healthcare intervention up on its feet and trial a standing approach. An initial room was used, containing blank walls where cardboard placards indicated a chronological timeline showing Deep Past, Past, Now, Future and where Post-it notes were used by participants visiting the room to try out the proposed therapy. In 2019, with the study accepted for doctoral study at Northumbria University, the original room's design was, literally, plugged in to an Immersive Interactive Virtual Environment, based at Coach Lane's Clinical Skills facility. The study was then designed, with an aim of involving two participatory groups, (i) therapists as Experts by Profession and (ii) individuals who have experienced trauma, as Experts by Experience.

Problem Formulation

An initial approach of the study was to consider: What exists? The literature review examined key areas: mental health as a global, social problem; the use of technology in mental health, becoming specific to a particular classification – immersive technologies; enactivism, informing a theoretical underpinning of the study whereby brains, bodies and environments are regarded philosophically as an holistic dynamical system and cognition is viewed as sense-making. To the enactive view, organisms create or generate their own experience through their action. From the literature the problem formulation is regarded as complex and includes:

  i.   Mental Health: The presentation of mental ill health and mental health challenges in society is global;
  ii.   Environments and Interventions: There is a need for continued application of innovative thinking in HCI and psychology relating to settings and delivery of interventions in a mental healthcare context;
  iii. Immersive Technology: There is a lack of evidence in trialling digital technologies in human-centred studies that go beyond the design and are situated in real-world settings;
  iv.   Partnerships: A challenge exists in bringing multidisciplinary partners together and some key literature indicates the problem exists in both communication, action and maintaining these toward achieving results

In particular as related to (iv) it has become clear throughout two years of doctoral study that communication leading to partnership building is critical to the success of any future therapeutic intervention becoming recognised as suitable for uptake in mental healthcare. As researchers, the Lead Investigator has observed the number and level of partnerships required and makes note in this protocol document to highlight that one of the main challenges identified can only be achieved through co-operation and continued dedication to improve.

Justification

The National Institute for Health Research (NIHR) offers guidance in co-producing a research project and explain that this is an approach in which researchers, practitioners and the public engage together and share both power and responsibility. They offer that a key to co-producing research is through the evolving of relationships between the people involved working together [iii]. By definition co-production can be an approach driven by inviting input from intended users, offering a dialogical space where views can be heard and acted upon. In our study's case these users are mental healthcare therapists and participants who have faced traumas with an acknowledgment here that end-users of a product or a service are best placed to assist in its development, resulting ideally in a shift from an expert-based healthcare system to one that is co-productive [iv]. As a concept, a critique of co-production in mental health was of services not fully acknowledging their users and user-experiences, with a pragmatic solution reached to involve them more [v]. A progressive intention is to create a digital therapeutic intervention to implement and evaluate with users as part of a mental healthcare service-delivery. At a basic level, good service co-production requires civil discourse with recognizable, respectful interaction and effective communication [vi]. We had a strong level of initial control over the process in that we set out during early stages to develop a first-stage prototype of *The Timeline* without

consulting experts. We coded this Design Decision 1 (DD1) with justification being that the original concept was born out of professional practice by one of this paper's authors who, since 2017, was building on 12 years engagement in the voluntary sector and working in the field of mental healthcare as a solutions-focused therapist. Therefore, *The Timeline* was created in response to a gained understanding from practice that people presenting challenges in mental healthcare do verbally-offload a storyline of events - and these can often form a somewhat chaotic narrative. Whilst not aligned with any one particular therapy pathway *The Timeline* became a focus originally realized upon a blank room wall, where users could enter, stand up, move around and interact. From a clinical view, evidence has shown that working with timelines in a therapeutic context can assist in producing enhanced coping [vii] and may also enforce a linear organizational framework [viii]. Visual timelines also have ability to illustrate ways a person's life events have evolved and research describes these as visualization storytelling tools [ix] which our study has imagined in both a personalized and interactive way. The first-stage prototype warranted a high number of meetings and visits to an immersive room situated at a North-East England University's Clinical Skills Facility. This would not have been as straightforward or even not possible, if coordinating several bodies each with their own daily agendas. The initial design-decisions, therefore, resulted in such a way to allow an early-stage prototype to emerge. We began with a series of pencil-sketches as storyboards and then recreated these in digital form. These allowed us to consider what potential users might encounter.

4. OBJECTIVES

The primary objective is:

i.   To create a bespoke environment and therapeutic intervention in an IIVE incorporating Unity software, where people with experience of trauma can re-author their life narrative and gain efficacy

Objectives aligned with the study include:

ii.   To survey and synthesise literature in fields of: mental health history; immersive technologies; phenomenology, embodied cognition and enactivism; narrative-interventions and co-production - to develop a research framework for designing IIVEs;

iii.   To develop storyboards and Video Prototypes of IIVE design within the research framework and use this to gain feedback from "*Experts by Profession*" (senior mental health staff and clinicians) which can inform an interview protocol involving "*Experts by Experience*" (participants who have endured trauma);

iv.   To iterate the design in an IIVE and run evaluative, qualitative interview sessions to understand these experiences (with "trauma" participants) at a hospital; to transcribe this data

5.   STUDY DESIGN

5.1 Summary

The PhD as a doctoral study is between October 2019 to October 2022. It was initially intended to engage with participants throughout the process where all interviews would take place in-situ, inside of an immersive room at Coach Lane's Clinical Skills facility within Northumbria University. When the study secured a working partnership with Alliance Psychological Services, it became clear that interviews would take place in the Teeside geographical region. As the COVID 19 pandemic took hold, the study's Lead Investigator considered its each phase, 1 and 2, where an appropriate strategy was involved in approaching each data collection in a way that suited the participants as well as the study itself. Hence, whilst the study's interviewing process in Phase 1 was conducted remotely, as pandemic restrictions have lifted, the focus is in gathering interview responses from an initial demonstration and testing of the immersive interactive technology, in-situ. As a schematic overview of the study Table 1 represents the study's design during Phases 1-2:

PROCEDURE	THE TIMELINE			
	Screening	Baseline	Phase 1	Phase 2
Inclusion Exclusion Criteria	X			
Participatory PIS	X			
Consent Form	X			
Impact of Events (IES-R)	X			
Video Prototype			X	
Phone Interview			X	X
In-Situ Demonstration				X
Participant Notes Template		X		
In-Situ Trial				X
Phone Interview				X
Debrief			X	X

5.2 Inclusion and Exclusion

INCLUSION	EXCLUSION
▪ Participant is male, female or transgender and is age 18 or above ▪ Participant is willing to offer full informed consent via appropriate form ▪ Will adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Has identified some form of trauma from their past ▪ Has agreed to sign a Consent Form having received full research study information via Participatory Information PIS sheet ▪ Is not currently a drug user or excessive alcohol ▪ Client has received two or more blocks of counselling, e.g. CBT/EMDR/IPT through Alliance Psychological Services and is no longer receiving therapy ▪ Client is demonstrating no current risk ▪ Has been made fully aware of all ethical considerations ▪ Has agreed to complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Has agreed to discuss Impact of Events Scale with gatekeeper at Alliance Psychological Services ▪ All ethical considerations are explained ▪ Clear contractual agreements between the client and the research study ▪ Has agreed to visit James Cook Hospital and take part in demonstration of technology ▪ Able to comply with the study requirements	▪ Is under 18 years of age ▪ Will not adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Participant who does not identify some form of past trauma ▪ Participant will not sign a Consent Form or read to Participatory Information PIS sheet ▪ Is a current persistent user of drugs or alcohol ▪ Has not received counselling through Alliance Psychological Services or discussed the study with this company ▪ Demonstrates current risk ▪ Has not been made fully aware of all ethical considerations ▪ There is no contractual arrangement between the Researcher (Northumbria University document) and the participant ▪ Will not complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Will not agree to visit James Cook Hospital and take part in demonstration of technology ▪ Will not comply with the study requirements

5.3 Study Participants

Phase 1: The study participants are therapists and former therapists or nurses with a working knowledge of frontline mental healthcare services.

Phase 2: The study participants are individuals who have experience what they identify with as trauma and are no longer receiving treatment.

5.4 Study Procedures

5.4.1   Informed Consent

Prior to providing consent to take part in the study each participant will read and acknowledge their understanding of a Participatory Information document knows as a PIS sheet. Each participant taking part in the study must provide informed consent and this is discussed with the host-partner at Alliance

Psychological Services through gatekeeper, Dr Adam Hegarty. Each participant will understand the full nature of the study including the implications of the protocol and any potential risks or hazards involved. It will also be clearly stated that any participant choosing to do so, is free to withdraw from the study at any point they feel appropriate. The participant will be permitted as much time as they choose, to consider the information presented to them and they will have the opportunity to discuss the research with the gatekeeper. The participant will personally initial and data and sign the latest approved version of the informed consent prior to any study specific procedures being undertaken.

5.4.2   Impact of Events Scale

Each participant taking part in the study will complete the Impact of Events scale. The IES-R was developed in 1997 by Daniel Weiss and Charles Marmar to reflect the DSM-IV criteria for post-traumatic stress disorder (PTSD). The original Impact of Events Scale (IES) predated the adoption of PTSD as a legitimate diagnosis in the DSM-III of 1980 and measured two of the four DSM-IV criteria for PTSD; specifically 're-experiencing / intrusion' and 'avoidance / numbing' [x]. The IES-R was designed to also assess hyperarousal, another of the DSM criteria for PTSD. Other criteria include exposure to a traumatic event, duration of symptoms and impairment due to symptoms. The maximum mean score on each of the three subscales is '4', therefore the maximum 'total mean' IES-R score is 12. Lower scores are better. A total IES-R score of 33 or over from a theoretical maximum of 88 signifies the likely presence of PTSD.
This scale will be provided to each participant taking part in Phase 2 of the study and the scores will be discussed with Alliance Psychological Services. In the event of a participant scoring 33 or over their participation in the study will be discussed with Alliance Psychological Services.

5.4.3   Definition of End of Trial and Study

From the last visit of the final participant taking part in the demonstration and trial of the technology at James Cook Hospital, each participant will receive a telephone call to take part in an audio-recorded interview. Once the interview recording is transcribed this data will be written up and included in a research paper and a doctoral thesis. The participatory involvement will end at the closure of the final interview, with a participatory debrief should the participant have any further questions. The completion of the study will be defined at around October 2021 when the thesis is entered for review by those conducting the viva voce oral examination.

5.4.4   Anonymity and Storage of Data

The participants taking part in this study will be referred to by the study participant number, 001-024, not by name. All documents including original recordings and transcribed discussions will stored safely in confidential conditions. Both the ethics application and the Participatory Information document contain a more detailed acknowledgment.

6 ETHICS AND RISK MANAGEMENT

The investigators ensure that this study is conducted in accordance with the principles of the Declaration of Helsinki, where the health and wellbeing of each participant taking part in the study is a first consideration priority. Included in the study in additional to ethical approval being granted was completion of Health and Life Sciences Project Overview (PO) documentation and a copy of the Risk Assessment (RA), as applicable to the study. The RA is entitled: *Working within the Clinical Skills Centre and Knowledge Exchange Hub during COVID-19*; also, RA dated 11/09/2020 which also relates to observation of social distancing (SD) measures, the wearing of face masks and familiarity with full H and S procedures. This PO itself relates to their being between 1-3 persons within an immersive room, where SD of more than two metres will be in place during access within this room throughout the study.

At this exploratory stage of the research, the criteria for selection of participants is based on 'expert-voice' and learning from 'expert perspectives' of relevance to the overall PhD research. As the overall thesis explores the adoption of new immersive technologies in healthcare-related settings and engaging patients and staff in new ways, Phase 1 and Phase 2 of the data collection seeks to learn from experts in the field of mental health and clinical professionals as experts who are highly informed in this field and then, in turn, from those who have direct experience of trauma, via participants who are experts from having encountered trauma in their lives.

REFERENCES

[i] Greg Guest, Arwen Bunce, Laura Johnson, 2006. How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. Field Mathods, Vol. 18, 59-82. DOI: 10.1177/1525822X05279903

[ii] Sarah Elsie Baker, Rosalind Edwards, 2012. How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National Centre for Research Methods. https://eprints.ncrm.ac.uk/id/eprint/2273/4/how_many_interviews.pdf

[iii] NIHR. 2021. Guiding on co-producing a research project https://www.learningforinvolvement.org.uk/wp-content/uploads/2021/04/NIHR-Guidance-on-co-producing-a-research-project-April-2021.pdf - p.1-5

[iv] Roger Dunston, Alison Lee, David Boud, Pat Brodie, Mary Chiarella. 2009. Co-production and Health System Reform. The Australian Journal of Public Administration, vol. 68, no. 1, pp. 39–52 doi:10.1111/j.1467-8500.2008.00608.x. p.42.

[v] Michael Clark. 2015. Co-production in mental health care. Mental Health Review Journal, 20 (4). ISSN 1361-9322. http://eprints.lse.ac.uk/64331/

[vi] Maren Batalden, Paul Batalden, Peter Margolis, Michael Seid, Gail Armstrong, Lisa Opipari-Arrigan, Hans Hartung, 2016. Coproduction of healthcare service, BMJ Qual Saf; 25:509–517. doi:10.1136/bmjqs-2015-004315. p. 511.

[vii] Glenn Marland, L. McNay, M. Fleming, M. McCaig, 2011. Using timelines as part of recovery-focused practice in psychosis. Journal of Psychiatric and Mental Health Nursing. https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2850.2011.01738.x, p.875

[viii] Michelle L. Patterson, Melinda A. Markey, Julian M. Somers, 2012. Multiple Paths to Just Ends: Using Narrative Interviews and Timelines to Explore Health Equality and Homelessness. International Institute for Qualitative Methodology, https://journals.sagepub.com/doi/pdf/10.1177/160940691201100202, p.152

[ix] Matthew Brehmer, Bongshin Lee, Benjamin Bach, Nathalie Henry Riche, Tamara Munzner. 2017. Timelines Revisited: A Design Space and Considerations for Expressive Storytelling. IEEE Transactions On Visualization and Computer Graphics, https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7581076, p. 2151.

[x] J. Gayle Beck, Demond, M. Grant, Jennifer P. Read, Joshua, D. Clapp, Scott F. Coffey, Luana, M. Miller, Sarah A. Palyo, 2008. The Impact of Events Scale – Revised: Psychometric properties in a sample of motor vehicle accident survivors. Journal of Anxiety Didord. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2259224/pdf/nihms39777.pdf

Integrated Research Application System (IRAS) Order of items Non-commercial study sponsored by Northumbria University	APPROVED
1 Protocol	Yes
2 Northumbria University Internal Approval Form – Signed by Supervisor and Pro Vice Chancellor for Department	Yes
3 Health Research Authority – approval of study as "research"	Yes
4 Primary Care Tripartite Agreement – Signed by University as sponsor	Yes
5 Interactive Costing Tool (Online completion by University Research Team)	Yes
6 IRAS Checklist of items requested after completion of application	Yes
7 South Tees Hospital 'Service Evaluation' confirmation of "research"	Yes
8 IRAS Form – Snapshot of study	Yes
9 Participatory Information Sheet	Yes
10 Organisation Information Document (OID) Non-Commercial	Yes
11 IRAS Schedule of Events (Excel)	Yes
12 Certificate of Employers' Liability Insurance – Northumbria University	Yes
13 Certificate of Professional Indemnity Insurance – Northumbria University	Yes
14 Helen Poole (IRAS), Approvals Specialist, Health Research Authority Laura Hutchinson (NU), Research Policy Manager, Research and Innovation Services	Yes

Impact of Events Scale - Revised (IES-R)

Identifier   Date

Below is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you **DURING THE PAST SEVEN DAYS** with respect to (your problem), how much were you distressed or bothered by these difficulties? This assessment is not intended to be a diagnosis. If you are concerned about your results in any way, please speak with a health professional.

0 = Not at all   1 = A little bit   2 = Moderately   3 = Quite a bit   4 =Extremely

1   Any reminder brought back feelings about it

2   I had trouble staying asleep

3   Other things kept making me think about it

4   I felt irritable and angry

5   I avoided letting myself get upset when I thought about it or was reminded of it

6   I thought about it when I didn't mean to

7   I felt as if it hadn't happened or wasn't real

8   I stayed away from reminders about it

9   Pictures about it popped into my mind

10   I was jumpy and easily startled

11   I tried not to think about it

12 I was aware that I still had a lot of feelings about it, but I didn't deal with them

13 My feelings about it were kind of numb

14 I found myself acting or feeling like I was back at that time

15 I had trouble falling asleep

16 I had waves of strong feelings about it

17 I tried to remove it from my memory

18 I had trouble concentrating

19 Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart

20 I had dreams about it

21 I felt watchful and on guard

22 I tried not to talk about it

Avoidance

Intrusion

Hyperarousal

Total Mean IES-R Score

Total IES-R Score

Introduction to the IES-R

The IES-R was developed in 1997 by Daniel Weiss and Charles Marmar to reflect the DSM-IV criteria for post-traumatic stress disorder (PTSD). The original Impact of Events Scale (IES) predated the adoption of PTSD as a 'legitimate' diagnosis in the DSM-III of 1980 and measured two of the four DSM-IV criteria for PTSD; specifically 're-experiencing / intrusion' and 'avoidance / numbing'.

The IES-R was designed to also assess hyperarousal, another of the DSM criteria for PTSD. Other criteria include exposure to a traumatic event, duration of symptoms and impairment due to symptoms.

The hyperarousal scale adds new items to the original IES; items 4, 10, 15, 18, 19 and 21. These new items help measure hyperarousal symptoms e.g. anger and irritability, heightened startle response, difficulty concentrating and hypervigilance.

For comparisons with IES scores, some consider using the sum of the 'avoidance' and 'intrusion' items. However, the response format in the IES assesses the 'frequency of symptoms' (not at all = 0, rarely = 1, sometimes = 3 and often = 5) and was changed in the IES-R to measure 'symptom severity' (0 = not at all, 1 = a little bit, 2 = moderately, 3 = quite a bit and 4 = extremely).

The main strengths of this revised measure are that it is short, quick and easy to administer and score and may be used repeatedly to assess progress. It is intended to be used as a screening tool, not a diagnostic test.

Scoring the IES-R

Avoidance Subscale = mean of items   5, 7, 8, 11, 12, 13, 17 and 22
Intrusion Subscale = mean of items   1, 2, 3, 6, 9, 14, 16 and 20
Hyperarousal Subscale = mean of items   4, 10, 15, 18, 19 and 21
Total mean IES-R score =   The sum of the means of the three subscale scores

The maximum mean score on each of the three subscales is '4', therefore the maximum 'total mean' IES-R score is 12. Lower scores are better. A total IES-R score of 33 or over from a theoretical maximum of 88 signifies the likely presence of PTSD.

Privacy - please note - this form does not transmit any information about you or your assessment scores. If you wish to keep your results, either print this document or save this file locally to your computer. If you click 'save' before closing, your results will be saved in this document. These results are intended as a guide to your health and are presented for educational purposes only. They are not intended to be a clinical diagnosis. If you are concerned in any way about your health, please consult with a qualified health professional.

Horowitz, M.J., Wilner, M. & Alverez, W. (1979). Impact of Events Scale: A measure of subjective stress. Psychosomatic Medicine, 41(3), 209-218.

Weiss, D.S. (2007). The Impact of Event Scale: Revised. In J.P. Wilson & C.S. Tang (Eds.), Cross-cultural assessment of psychological trauma and PTSD (pp. 219-238). New York: Springer.

Northumbria University
NEWCASTLE

PARTICIPATORY INFORMATION SHEET

Statement: This study's sponsor is Northumbria University.

> **You are being invited to take part in a research study. Before you decide whether you want to take part it is important that you read this information so you understand the reason you are being asked to participate and what the study involves. By reading this information sheet and discussing it with other people or asking any questions you may have in relation to the study, you can decide whether or not you would like to take part.**

Study Title: *Exploring enactive approaches to designing and understanding immersive interactive virtual environments in mental healthcare*

What is the purpose of the study?

This PhD research study will explore the role of immersive environments (or rooms, spaces) in the context of mental health therapy interventions. The research responds to the pressing social issue of a continually increasing number of individuals presenting mental health challenges, assuming at the time of the study being conducted, that people have a restricted number of options in terms of complementary interventions, as well as settings where these take place across mental health services. An intention is to involve participants who can inform the study and this will involve a demonstration of the technology inside of the immersive environment, followed by each participant trialling the technology up to 20 minutes – at James Cook Hospital. For practical reasons the visits to the immersive room will take place initially, followed by each interview via telephone where the voice will be recorded and then this information will be written up (transcribed) as data.

You are regarded as an 'expert' voice throughout this study and two stages of expert voice are being considered:

Expert 1 Phase 1	Expert 2 Phase 2
Alliance Psychological Services Clinical Staff x 12 Experts by Profession	Alliance Psychological Services x 12 Experts by Experience (of trauma)

Why have I been invited?

You represent a valid and expert voice within the population. Your view is important to the study as it provides insight into what an individual, as representative of a community and an active citizen, is thinking. It is key to the success of this research study that thoughts are from a population perspective. The purpose of the research is to gain insight into how the general-public think, as representative of a population and to involve these views in the development of the study.

Do I have to take part?

No. It is your decision whether you want to take part in this study. This information sheet is designed to help you decide whether you want to make a decision to take part or not.

Can I opt out during the study?

You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. In the event a participant is withdrawn from the study due to the loss of mental capacity identifiable data collected up to that point will be retained.

What will I be asked to do if I take part?

The study is being conducted through Alliance Psychological Services who have selected Dr Adam Hegarty as gatekeeper. He has selected study participants as individuals who expressed interest through Alliance Psychological Services to take part in the study. You will be asked to:

- Read this information sheet and then sign and return the *Consent Form*; you will be assigned a participant code to ensure anonymity, such as 001;
- Complete the *Impact of Events Scale* – it is anticipated as part of an Inclusion Criteria that each interviewee will score low or where not scoring low will discuss this with Dr Adam Hegarty;
- Visit a simulation room at James Cook Hospital in Teeside and trial the immersive technology in-situ (20 minutes) to include a 5-10 minute initial demonstration of the technology;
- Engage in a semi-structured interview process (30 minutes) over the telephone. The response you provide will be audio-recorded and this recording will be transcribed by the researcher. This means that the researcher will listen to your responses and write them down word-for-word, also known as verbatim;
- After the study you will be given a debrief sheet which explains the nature of the research, how and where you can find out about the results

What personal data will be collected throughout this study and how will it be used?

We will need to use information from you for this research project, The information will include your:

(i)   Full name
(ii)   Telephone number
(iii)   email address

People will use this information to do the research. People who do not need to know who you are will not be able to see your name of contact details. Your data will have a code number instead. We will keep all information about you safe and secure. All digital data will be stored on an encrypted hard-drive of the Lead Researcher, which when not used will be stored in a locked cabinet on Northumbria University premises. All hardcopy materials will be stored in a locked cabinet. All data records will be stored in file structures using logical filing and naming conventions with backups stored via Northumbria University cloud-based retrieval system for additional security in the event of damage or loss. All data will be retained for a period of one year for the duration of the study.

Where can you find out more about how your information is used?

You can find out more about how we use your information:

- at www.hra.nhs.uk/information-about-patients/
- by asking one of the research team
- by sending an email to: tor.a.bruce@northumbria.ac.uk or lars.holmquist@northumbria.ac.uk
- by calling us on: 07398 1000 73 or 07507 917767
- Both of these source contacts will be able to point you to the study sponsor's Data Protection Officer who is available at Northumbria University via: dp.officer@northumbria.ac.uk
- The NHS Health Research Authority link is at: www.hra.nhs.uk/patientdataandresearch

What are your choices about how your information is used?

We need to manage your records in specific ways for the research to be reliable. This means that we won't be able to let you see or change the data we hold about you.

Anonymising your data

Once we have completed the study we will keep some of the data so we can check results. We will write up our data in a way that no-one can work out that you took part in the study. Each participant is identified throughout the study via a number: 001 to 012 (Phase 1) and 013-024 (Phase 2). Any identifiable data from transcriptions will be removed and the audio recording will be deleted immediately the research team is satisfied that transcription is complete.

Publishing your data

Direct quotes from your interview will be transcribed and published as research but these will be de-identified, i.e. you will be related to via a number.

What is the legal basis for processing personal data?

GDPR Article 9 (2): Processing is necessary for scientific purposes. This will be adhered to throughout this study and only the researcher at Northumbria University will have access to the data.

What will happen to the results of the study and could personal data be collected and used in future research?

The general findings from the research might be reported in a scientific journal or they could be presented as part of an event such as a research conference. However, if this is the case the data will continue to be anonymised and neither you nor the data you provide will be identifiably linked to any known person. By emailing the researcher at the link listed in this document, you can be provided with a summary of the findings from the research study.

Who is funding and organising this study?

The study is funded by an industrial partner called Immersive Interactive, in partnership with Northumbria University. The study is being organised with a further research partner: Alliance Psychological Services.

Reimbursing your expenses

The study sponsor at Northumbria University is responsible for reimbursing your expenses, e.g. car, taxi, public transport - and no personal data will be shared with any other party outside in relation to this.

Who has reviewed the study's ethics and approved it?

The research study has a submission reference number: 32928. This was approved by Northumbria University's Online Ethics Committee. It was reviewed to safeguard your interests and permission was granted to approve the commencing of the study.

What are my rights as a participant in this study?

You have a right to access a copy of the information provided by you from this study, which includes all of your responses to any questions asked during the data collection process. If you are dissatisfied with Northumbria University's processing of personal data, you have the right to complain to the Information Commissioner's office. For information visit: https://ico.org.uk.

Your health and safety and compliance to Covid-19

Full consideration is given throughout this study in relation to interviews taking place and the study's phase one interviews were conducted remotely. With Covid-restrictions lifted any face-to-face contact will be carried out with appropriate social-distancing measures and where applicable full protective face-wear, sanitising. In particular any risk will be minimised and Risk Assessments are in place.

WHO CAN I CONTACT FOR FURTHER INFORMATION OR TO MAKE A COMPLAINT?

> **Lead Researcher:** Tor Alexander Bruce / E: tor.a.bruce@northumbria.ac.uk – 07398 1000 73
> **Supervisor:** Professor Lars Erik Holmquist / E: lars.holmquist@northumbria.ac.uk - 07507 917767
> **Records and Information Officer:** Duncan James / E: dp.officer@northumbria.ac.uk
> You can find out more about how Northumbria University uses your information via: www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/gdpr---privacy-notices/
> or by contacting any member of the research team as listed above.

SINCERE THANKS FOR YOUR PARTICIPATION IN THIS STUDY

PARTICIPANT CONSENT FORM

Study: *Exploring enactive approaches to designing and understanding immersive interactive virtual environments in mental healthcare*

Lead Researcher: Tor Alexander Bruce   **Organisation:** Northumbria University

Participant Name: 002

	INITIALS
I have been supplied with and have read and understood a Participatory Information Sheet (PIS) for the research project and have had time to decide whether or not I want to participate.	K
I understand that my taking part is voluntary and that I am free to withdraw at any time, without giving a reason.	K
I understand that any information I give will only be used for the purposes set out in the PIS.	K
I consent to discussing the Video Prototype (via: YouTube) from the design activity and this interview will take place via Zoom or Teams or telephone as part of a remote data collection process.	K
I have been told that any data generated by the research will be securely managed and disposed of in accordance with Northumbria University's guidelines.	K
I am aware that all recordings and documents will remain confidential with only the research team having access to them.	K
I understand that my name, or personally identifiable information, will not be used on any documents about the research.	K
My consent is conditional upon the University complying with its duties and obligations under the General Data Protection Regulation (GDPR).	K

Signature of Participant:

K	
Date	11/01/2021

Signature of Researcher:

I can confirm that I have explained the nature of the research to the above named participant and have given adequate time to answer any questions concerning it.	
TOR ALEXANDER BRUCE	
Date	January 11, 2021

Any queries regarding the information on this form can be directed to the research study supervisor:

Professor Lars Erik Holmquist:

Telephone: 07507 917767   **Email:** lars.holmquist@northumbria.ac.uk

IMMERSIVE ENVIRONMENTS IN MENTAL HEALTHCARE
SEMI-STRUCTURED INTERVIEW – 30 MINUTES
BACKGROUND, OPEN ENDED DISCUSSION AND CLOSED QUESTIONS
EXPERIENCES AND ATTITUDES
EXPERTS BY PROFESSION (EbP) / EXPERTS BY EXPERIENCE (EbE)

INTERVIEW DATE	2021
INTERVIEW NUMBER	00
TIME STARTED	am/pm
TIME ENDED	am/pm
TOTAL	Minutes
LOCATION/METHOD	IPhone
TRANSCRIBE TIME	hours minutes

Your input today will feed into a longer design process and will shape the eventual design of an immersive technology. It could also lead to the design of software and a content package including a process called: "*The Timeline*", as a therapeutic intervention adapted toward a specific 'trauma' patient-population.

The purpose of the 11-minute Video Prototype you have watched was to stimulate thinking around the role of immersive interactive virtual environments and how these might influence people's engagement with mental healthcare services in the future.

There are different types immersive technologies available in the world. This study's focus is immersive rooms, or spaces, or environments, known as IIVEs.

We will discuss the 11-minute video and the interview questions will act as a general guide. If possible, could you include the question in your response.

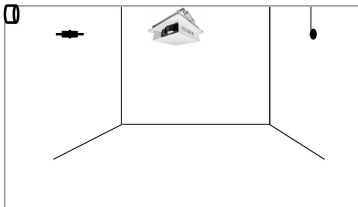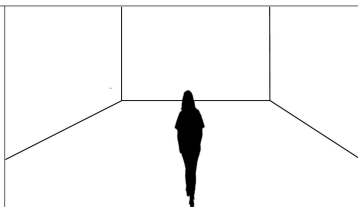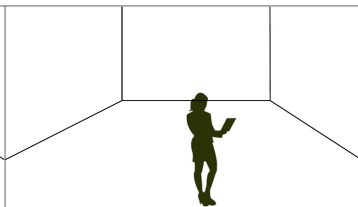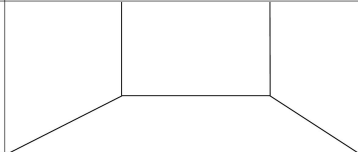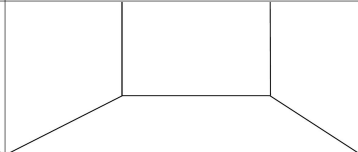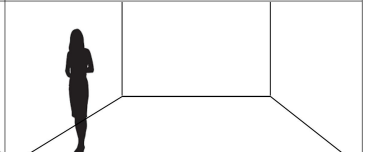| NO.	DISCUSSION POINT	TIMING
	GENERAL BACKGROUND	
0.1	**Did you recently watch the 11-minute video prototype via YouTube?**	
0.2	**In a sentence or two describe your current employed role (or participation – EbE) in mental healthcare and the types of service or intervention you are involved with?**	
0.3	**In diagnostic terms, what type of mental illness or mental healthcare challenges do you have experience of working with, e.g. anxiety, schizophrenia, trauma?**	
0.4	**What year did you begin working in mental healthcare and how many years experience?**	
0.5	**What is your view of the term *mental illness* and would you frame it any differently in your own words – a few sentences or less is fine?**	
0.6	**How would you describe a typical setting or space or environment where interventions take place in mental healthcare?**	
0.7	**In your view is *the environment* important to mental healthcare – please describe?**	
0.8	**Have you experienced or witnessed any example or examples of technology in mental healthcare and if so could you name or describe?**	
	SCENE ONE	
1.1	**Scene 1 of the video prototype shows a technician powering up an IIVE. What was your initial impression of an Immersive Interactive Virtual Environment or IIVE – describe in as much detail as you like?**	
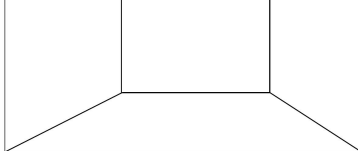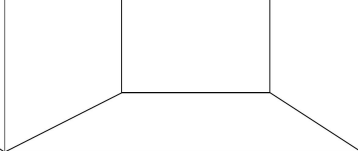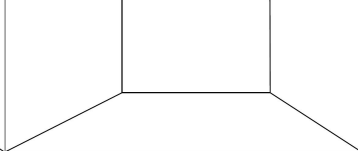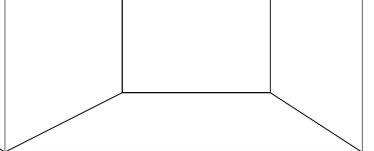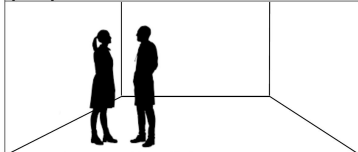
1.2	Anything else to add Scene One?	
	SCENE TWO		
2.1	In Scene Two a researcher enters the room and speaks to the technology which responds back to him – any thoughts on this speaking feature of the technology?	
2.2	In Scene Two the walls are touch interactive – any thoughts on this feature of the technology from viewing the video?	
2.3	From the still and video imagery on the walls in the immersive room, did anything stand out?	
2.4	Anything else to add rom Scene 1-2?	
	SCENE THREE		
3.1	Scene 3 shows a participant experiencing a proposed intervention called *The Timeline* – your view on personalizing content for participants in a mental healthcare context?	
3.2	The participant is guided from the Deep Past through to the Future as part of The Timeline process – your thoughts in a mental healthcare context?	
3.3	Scene 3 shows a participant closing a door on the Deep Past – any thoughts?	
3.4	Scene 3 showed the participant viewing a Future Wall – your thoughts on this in the context of mental healthcare?	
3.5	Any view of *The Timeline* overall from your viewing of the video?	
	SCENE FOUR		
4.1	Scene 4 shows the participant being guided through *The Timeline*, on this occasion by a facilitator-clinician – your thoughts on mental healthcare being delivered with facilitator involvement or without?	
4.2	Could the participant standing approach in Scene 4 offer anything novel in a mental healthcare context?	
4.3	Could the participant view and attempt The Timeline via a YouTube video, for example, in their own home?	
4.4	Could you see yourself experiencing this type of immersive interactive technology experience and if so what features would be important to you as an individual?	
	SCENE FIVE		
5.1	The final scene of the Video Prototype shows a facilitator and participant reflecting on the intervention – how important is reflection as part of a mental healthcare intervention process?	
5.2	Does the IIVE offer an environment where people could make sense of their lives in a mental healthcare context?	
5.3	Could this type of setting offer any novel ways to collect data in mental healthcare?	
5.4	Finally, could you envisage this type of environment having any place in the future of mental healthcare?	

IMMERSIVE INTERACTIVE VIRTUAL ENVIRONMENTS (IIVEs) IN MENTAL HEALTHCARE

2. A3 STORYBOARD
- PARTICIPANT ACCE

VIDEO PROTOTYPE STORYBOARD

VIDEO PROTOTYPE: VP #1

OVERVIEW OF WHAT IS TAKING PLACE: A participant is powering up the system and trialling features of the immersive interactive environment.

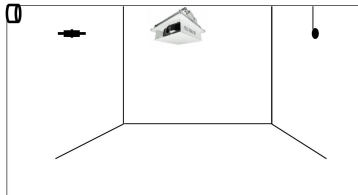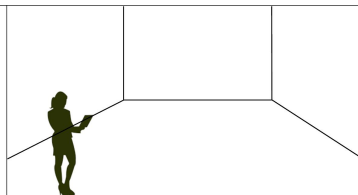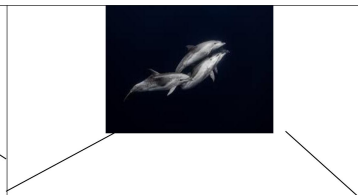|			
 IMMERSIVE ROOM SHOWN HERE FULLY EQUIPPED COMPLETE WITH CEILING PROJECTORS, WALL SENSORS, AUDIO LINK AND CEILING-BASED SMOTS CAMERA.	 SCENARIO: A participant enters the room which is powered down.	 SCENARIO: The participant picks up a keyboard device and powers the system up via the click on the keypad.	 SCENARIO: Interacting with the keyboard brings up a rear wall interface and opens up some options.
SCENARIO: The participant selects an option which creates a video imagery of a city scene, which the participant views.	SCENARIO: The participant selects some audio piano music which plays over the city scene.	SCENARIO: The participant selects another scene, which now contains interactive features.	SCENARIO: The participant interacts with the new scene and shows its kinaesthetic capabilities.
 SCENARIO: A clinician enters the immersive room and asks how progress is going.	SCENARIO:	SCENARIO:	 SCENARIO: The participant exits the immersive room with all features powered down.
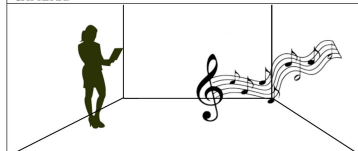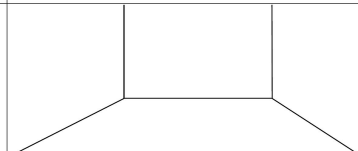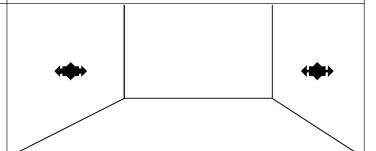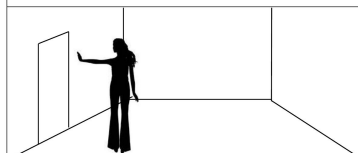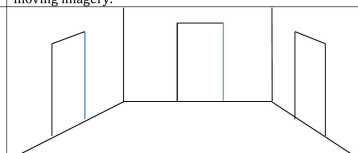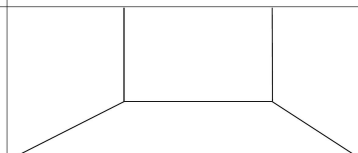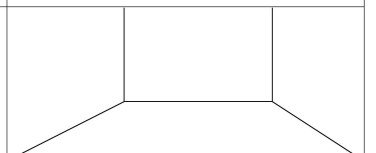
NOTES

_____

IMMERSIVE INTERACTIVE VIRTUAL ENVIRONMENTS (IIVEs) IN MENTAL HEALTHCARE

VIDEO PROTOTYPE STORYBOARD

VIDEO PROTOTYPE: VP #2

OVERVIEW OF WHAT IS TAKING PLACE: A participant creates some new scenes and sensory activities within the immersive environment.

IMMERSIVE ROOM SHOWN HERE FULLY EQUIPPED COMPLETE WITH CEILING PROJECTORS, WALL SENSORS, AUDIO LINK AND CEILING-BASED SMOTS CAMERA.	SCENARIO: A participant enters the immersive room and accesses the keyboard.	SCENARIO: The participant brings up an image of dolphins swimming.	SCENARIO: The participant brings up an image of mountains.
SCENARIO: The participant introduces some audio into the immersive room and chooses piano music.	SCENARIO: The participant introduces an image showing whales in the water and introduces music over the moving imagery.	SCENARIO: The participant removes all imagery from the walls.	SCENARIO: The participant adds some sensory scenes to the walls.
SCENARIO: The participant interacts with the wall sensor and opens and closes a door.	SCENARIO: The sensor opens a number of virtual doors within the interactive room and the participant observes these.	SCENARIO:	SCENARIO:

NOTES

_____
_____
_____

ALLIANCE PSYCHOLOGICAL SERVICES

INCLUSION CRITERIA PLUS ALLIANCE IN-HOUSE INFORMATION

INCLUSION	EXCLUSION
▪ Participant is male, female or transgender and is age 18 or above ▪ Will adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Has identified some form of trauma from their past ▪ Has agreed to sign a Consent Form having received full research study information via Participatory Information PIS sheet ▪ Is not currently a drug user or excessive alcohol ▪ Participant is no longer receiving therapy ▪ Participant is demonstrating no current risk ▪ Has been made fully aware of all ethical considerations ▪ Has agreed to complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Has agreed to discuss Impact of Events Scale with gatekeeper at Alliance Psychological Services ▪ All ethical considerations are explained ▪ Clear contractual agreements between the client and the research study ▪ Has agreed to visit James Cook Hospital and take part in demonstration of technology ▪ Able to comply with the study requirements	▪ Is under 18 years of age ▪ Will not adhere to COVID protection such as wearing a mask and keeping safe distance ▪ Participant who does not identify some form of past trauma ▪ Participant will not sign a Consent Form or read to Participatory Information PIS sheet ▪ Is a current persistent user of drugs or alcohol ▪ Participant is receiving therapy ▪ Demonstrates current risk ▪ Has not been made fully aware of all ethical considerations ▪ There is no contractual arrangement between the Researcher (Northumbria University document) and the participant ▪ Will not complete an Impact of Events Scale to determine no-risk or to identify where the participant is at in relation to the scale ▪ Will not agree to visit James Cook Hospital and take part in demonstration of technology ▪ Will not comply with the study requirements

LICBT	**HICBT**
• Mild to moderate mental health problems, e.g. Depression, GAD, OCD, Panic disorder, Health anxiety, Social anxiety, Specific Phobias. • Low risk to self and/or others, i.e. no recent suicide attempts, no plans made, no regular self-harm, etc. • Preferably short duration but can also work with longer-term problems if not too complex • **Not appropriate** for trauma, addictions, eating disorders, bereavements or relationship issues • **Not appropriate** for Psychosis/Personality Disorder/Bi-polar that is unstable and/or the issue the client wants to focus on	• HICBT works with the same presentations as LICBT as well as: PTSD Type I trauma (single event) & Type II trauma (multiple events **that can be managed within PCT short term work**); Anxiety Management; Body Dysmorphic Disorder (BDD); Pain Management; Assertiveness; Self-Esteem; Perfectionism; Sleep issues; Anger; Binge Eating/Bulimia - **not anorexia** • Co-morbidities with longer duration/severity • Moderate risk to self and/or others, e.g. recent suicide attempts, self-harm which would not be managed at LICBT– **HOWEVER** if risk can still not be managed within PCT client would be referred back to GP, Access, or a more appropriate service as they require a level of stability before engaging in therapy • **Not appropriate** for Psychosis/Personality Disorder/Bi-polar that is unstable and/or the issue the client wants to focus on
COUNSELLING	**EMDR**
• Relationship issues • Bereavement • Re-occurring/long term depression • Pre/Post-natal depression	• **Any client considered for EMDR must be discussed with an EMDR therapist before being placed onto this pathway to check appropriateness** • Client must have engaged in prior therapy

• Victims of sexual abuse; domestic violence and/or assault • Sexual problems; Confusion about sexual orientation • Family problems/difficulties • Physical, emotional and/or psychological abuse • To explore, reflect and process in order to become the best person you can be • Behaviour is harmful to self or others	• PTSD Type I trauma (single event) & Type II trauma (multiple events **that can be managed within PCT short term work**) • Also for events/distressing memories that have not been fully processed and therefore still impacting on a client in the present • Fixed and/or unhelpful beliefs or cognitions • Phobias/OCD • Flashbacks, Nightmares, Reliving; Avoidance • Don't necessarily have to disclose anything

IPT **Interpersonal Psychotherapy**	CfD **Counselling for Depression**
• For clients presenting with **moderate to severe Depression** where depression is the main issue	• Depression • Internal conflict

and interpersonal or relational problems fall into one (or more) of the 4 following areas:

Interpersonal disputes: Disagreements or arguments with others, and unmet expectations

Role transitions: Life changes such as divorce/separation, retirement, becoming a parent, ill health, becoming a carer etc.

Grief and loss: An emotional reaction to a major loss through bereavement

Interpersonal struggles: Difficulties starting and/or maintaining relationships

- Identity Issues
- Adjusting to change or loss
- Perfectionism
- Unresolved loss or trauma
- If a client is unable to access emotions
- If a client experiences unhelpful emotions
- Anger that is turned on self
- Excessive self-criticism

PLEASE BEAR IN MIND WHEN CONSIDERING ALL PATHWAYS:

WHIST WE ARE AWARE OUR STAFF HAVE THE SKILLS TO OFFER THERAPIES APPROPRIATE FOR MOST ISSUES, WE MUST BE MINDFUL OF THE SHORT TERM NATURE OF OUR PCT SERVICE AND CLIENTS WITH LONGER STANDING PROBLEMS DEVELOPED IN CHILDHOOD ARE – NOT ALWAYS - BUT OFTEN MORE SUITABLE FOR SECONDARY CARE INVOLVEMENT WHERE THEY CAN BE OFFERED LONGER TERM THERAPY

<div align="center">

Experts by Profession
List of interview questions – 7 background + 18

</div>

Main research questions from thesis:

How do expert senior workers and clinicians as *Experts by Profession* with experience in frontline mental healthcare, imagine how an immersive interactive virtual environment could function in a context of mental healthcare?

Background

- In a sentence or two describe your current employed role (or participation – EbE) in mental healthcare and the types of service or intervention you are involved with?
- In diagnostic terms, what type of mental illness or mental healthcare challenges do you have experience of working with, e.g. anxiety, schizophrenia, trauma?
- What year did you begin working in mental healthcare and how many years experience?
- What is your view of the term *mental illness* and would you frame it any differently in your own words – a few sentences or less is fine?
- How would you describe a typical setting or space or environment where interventions take place in mental healthcare?
- In your view is *the environment* important to mental healthcare – please describe?
- Have you experienced or witnessed any example or examples of technology in mental healthcare and if so could you name or describe?

Theme 1: *Therapists existing views of mental healthcare technologies and environments*

The immersive interactive virtual environment (IIVE)

- What was your initial impression of an Immersive Interactive Virtual Environment or IIVE – describe in as much detail as you like?
- Anything else to add Scene One?

Theme 2: *Therapists first impressions of the IIVE environment*

Observing features of the room

- In Scene Two a researcher enters the room and speaks to the technology which responds back to him – any thoughts on this speaking feature of the technology?
- In Scene Two the walls are touch interactive – any thoughts on this feature of the technology from viewing the video?
- From the still and video imagery on the walls in the immersive room, did anything stand out?
- Anything else to add rom Scene 1-2?

Theme 3: *Therapists view of multisensory features of an IIVE*

The Timeline

- Scene 3 shows a participant experiencing a proposed intervention called *The Timeline* – your view on personalizing content for participants in a mental healthcare context?
- The participant is guided from the Deep Past through to the Future as part of The Timeline process – your thoughts in a mental healthcare context?
- Scene 3 shows a participant closing a door on the Deep Past – any thoughts?
- Scene 3 showed the participant viewing a Future Wall – your thoughts on this in the context of mental healthcare?
- Any view of *The Timeline* overall from your viewing of the video?

The Timeline

- Your thoughts on mental healthcare being delivered with facilitator involvement or without?
- Could the participant standing approach in Scene 4 offer anything novel in a mental healthcare context?
- Could the participant view and attempt The Timeline via a YouTube video, for example, in their own home?
- Could you see yourself experiencing this type of immersive interactive technology experience and if so what features would be important to you as an individual?

Theme 4: *Therapists views of The Timeline as a proposed therapeutic intervention, situated in an IIVE*

Reflection

- How important is reflection as part of a mental healthcare intervention process?
- Does the IIVE offer an environment where people could make sense of their lives in a mental healthcare context?
- Could this type of setting offer any novel ways to collect data in mental healthcare?
- Could you envisage this type of environment having any place in the future of mental healthcare?

Experts by Experience
List of interview questions – 7 background + 17

Main research questions from thesis:

How do participants with lived experience of trauma as *Experts by Experience* interpret their experience of *The Timeline* situated in an IIVE?

Justification: these views influence next iteration.

Background

- In few words, how would you define the trauma you have had experience of?
- How do you define the term *trauma* in a sentence or two?
- Have you ever received any form of intervention such as counselling and if so what was this called; and throughout how many days, weeks, months or years did this last?
- Briefly, could you describe the environment or setting where this support took place?
- Was it a seated or a standing environment?
- Would you consider the setting or environment important to mental healthcare or not? If so in what way?
- Have you experienced examples of technology in mental healthcare and if so could you name or describe?

Theme 1: Trauma expert existing views of trauma and mental healthcare environments

The immersive interactive virtual environment (IIVE)

- What was your initial impression of the overall environment as a setting?
- How does it differ from setting you've experienced 1-1 previously?

Theme 2: Trauma expert initial view of IIVE

Interpreting experience of The Timeline

- What was your experience of The Timeline?
- *Auditory:* Your experience of the speaking feature of the technology, i.e. the voice describing the technology?
- *Visual:* What were the visual features like to experience?
- *Kinesthetic:* Any thoughts on the touch-interactive features from your experience?

The Timeline as a process relating to trauma

- The Timeline offers a deep past to past to now to a future – how does this relate to the experience of trauma?
- Closing a door on the Deep Past in relation to your experience of trauma?
- The Word Room, Cognition Room, Metaphor Room?
- What was your experience of standing up and moving around as an approach?
- Is it important to have a facilitator or would you envisage a user attend alone or both?

Theme 3: Interpretation of experience (experiential)

User autonomy

- Could The Timeline be used therapeutically as an <u>environment</u> support people working rhrough trauma and if so, how?
- Could people make sense of trauma in an IIVE? How?
- Can closing a door in virtual reality relate to the real world?
- What would you change or add to the experience?
- Do you perceive any limitations?
- Is there anything else you feel is important?

Theme 4: Sense-making

Experts by Experience

How do participants with lived experience of trauma as *Experts by Experience* interpret their experience of *The Timeline* situated in an IIVE?

Overview: A total of 12 experts by experience took part in Study 2 and experienced a trial of the immersive interactive technology and The Timeline at James Cook Hospital, in Teeside, UK. All participants were female with an age range between 21-72. Interviews lasted on average 27 minutes and each participant, as part of a screening process, 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 the lowest score obtained was 0 and the highest score was 79, with a mean average score across all participants of 20.25. Two above-33 scores of 61 and 79 were discussed with both the participant and Alliance Psychological Services, as the study's advisory partner, prior to the participants taking part. In each of these cases the participant consented to take part.

Emerging from the codes, building towards themes

1. A "really visual", "different", "interactive", "environment" "evoking curiosity" and is "away from everything else"
2. A space that encourages "movement", as "a process", that "carries you" and promotes "control" and "choice" and "autonomy"
3. The Timeline presents "opportunity" to "visualise" and "deal with past, present and future", as parts of a person's life, in one setting
4. Potential to alter the dynamic of the "therapist-client relationship"
5. In The Timeline you are visually and haptically "interacting with trauma", both verbally talking as well as "visually" and "kinaesthetically" connecting with it as a multisensory, therapeutic experience
6. The Timeline is an "active", participatory, through-experience; not static
7. The Timeline can be seen as a therapy offering "choice" and "autonomy" and personal "freedom"
8. The Timeline is a "process" that offers "prompts" and 2cues", to "address", "compartmentalise" and "move past" and "move through" trauma
9. A "new" way for people who "struggle" with "social interactions" and "social anxiety" to experience therapy
10. A "person-centred", "client led" experience where the person "takes charge" and "leads" their own therapy
11. Less a passive receiver of treatment, more an "active" agent
12. Moving around "might literally disperse some of those physiological reactions to the thoughts that are in your head"
13. The Timeline process could require less of a therapist, more a "facilitator"
14. The Timeline offers visual "metaphors" that encourage users to open up about things and opens up "a different dimension" to therapy – The Timeline: A new dimension to trauma therapy
15. Trauma can put a person at a "crossroads" and have them feel "stuck" but The Timeline can present "endless options"
16. The Timeline offers an environment where people can put their thoughts or chaotic narrative in order and "make sense"

Themes

1. Experience of a new type of setting containing movement in mental healthcare
2. Experiencing Active, Control, Choice, Autonomy in a person-centred therapeutic process
3. Experiencing a different relationship between participant and an interactive therapist with structure and purpose
4. Experience of a sense making environment

STUDY 1	STUDY 2
EXPERTS BY PROFESSION	**EXPERTS BY EXPERIENCE**
How might an IIVE act as a suitable space to conduct mental health interventions?	*How do participants with lived experience of trauma as Experts by Experience interpret their experience of The Timeline situated in an IIVE?*
Therapists existing views of mental healthcare technologies and environments	Experience of a new type of setting containing standing and movement in mental healthcare
Therapists first impressions of the IIVE environment	Experiencing Active, Control, Choice, Autonomy in a person-centred therapeutic process
Therapists view of multisensory features of an IIVE	Experiencing a different relationship between participant and an interactive therapist with structure and purpose
Therapists views of The Timeline as a proposed therapeutic intervention, situated in an IIVE	Experience of a sense making environment

BACKGROUND		CODES LEADING TO THEMES
1.1	**The study is creating an anonymised chart to show at a glance the types of ways people with lived experience of trauma define it. In a few words, how would you define the type of trauma you experienced?**	
	"Terrorist attack" *"Bullied significantly"; "Lost my Mother; unexpectedly died when I was 16"* *"Emotional trauma"* *"Childhood trauma; Violence; Bereavement; Murder"* *"A minefield of bad memories"* *"Emotional trauma"* *"Quite debilitating; mental trauma"* *"Mental abuse; Divorcing a narcissist"* *"Birth Trauma"* *"Parental death at a young age"* *"Traumatic Loss"* *"Personal trauma through bereavement and loss"*	Trauma
1.2	**What form of therapy or intervention have you accessed in the past and over how many sessions, or days?**	
	CBT; EMDR Counselling x 3 CBT X 5 Generic counselling; A good few blocks; about 6-7 blocks Counselling 5-6; High Intensity CBT CBT Counselling through GP; yoga, meditation, reading Counselling; EMDR – a years worth of both Medication when I was a child from my GP Transactional Analysis x 10 Counselling talking therapies x about 10 sessions	Overall, participants had taken part in Counselling, CBT, Hi-intensity CBT, EMDR, yoga, meditation, reading and Transactional Analysis
1.3	**What was the setting where this took place, if any?**	The environments were generally seated rooms
1.4	**Was it seated or standing?**	Seated
1.5	**Have you any existing experience of technology used in mental healthcare prior to this study and if so what was this?**	The participants had limited experience of technologies used in a therapeutic context. None of the participants had experienced immersive VR technologies previously in therapy
1.6	**Has a timeline ever been used in therapy with you?**	One participant had used a timeline in therapy previously.

Considered Theme 1: Trauma expert existing views of trauma and mental healthcare environments The immersive interactive virtual environment (IIVE)		CODES LEADING TO THEMES
2.1	**Describe your initial impression stepping into the immersive room at James Cook Hospital?**	
	I was quite impressed, I liked the way…I honestly couldn't imagine how it was going to be, before going in, so I was quite curious to see but I really liked the way it was set up, I like the way or using the walls and that it was, that it's really visual and obviously kinaesthetic for people I really enjoyed that aspect of it (P014)	Curious
		Really visual
	It was really interesting to see the different things around the room. It makes you kind of, curious, because it's all around you, it makes you quite inquisitive about what's going to happen next, erm, I felt a bit vulnerable as well, because I didn't know what was going to happen next (P016)	Kinaesthetic
		Interesting
		Inquisitive
	At first I said it was like an episode of 'Black Mirror' because I was like "oh this is different", the fact you could touch the walls and it was all like, interactive, but I liked it 'cause it felt like safe and you were away from everything outside…and the fact that like you were going through these things as like, I don't know from inside your head to process things and dig it out in an environment that's away from everything. So it's not like your just sitting face to face talking to someone (P017)	Black Mirror
		Vulnerable
		Interactive
		It felt safe
		An environment
	It felt like being in like a bit of a cube, like you were just there…hard to describe…I'd never seen anything like it before so I was interested, erm, but the surroundings itself it felt quite cold, quite hospitally (P020)	You were away from everything outside
		An environment that's away from everything
	It was quite calming…it felt instantly that you'd stepped into a different place (P022)	Not like sitting face to face talking
		A cube
	Calming music in the background when I entered, I found it really relaxing because I was a bit apprehensive of: What is this? What am I going to experience? So, but I was also intrigued, I was interested in how it works. I felt very welcomed, I felt safe, which is important to me, erm, in the setting…actually once I saw it I was eager to try the experience, I just wanted to get involved with what's in there and usually I'd stand back and I'd be one of the quiet ones and take things in first before I put myself forward, but I felt the opposite just saw it and I was just drawn in, and I did like that solid wall touch…and I really liked that I could move around the room, that there was space, I wasn't kind of contained, even though I was in a room, but I felt as though there was the freedom, of movement and that physical movement I think would really, really help with the psychological movement (P024)	Never seen anything like it before
		Cold, quite hospitally
		A different place
		Calming
		Relaxing
		Welcomed
		Eager to try the experience
		I was just drawn in
		Solid wall touch
		There was space
	Just to be surrounded by an environment, because I'm just thinking back to when I walked into that room…there was music playing, so it was, the impact on the senses…so it was hearing the music, it was, erm, I think it was like a kind of sky scene, with stars…it was just, erm, I was walking into a room but I walking into a really spacious place. It was a very immediate response that I had to it, emotional and physical. Very evocative, that's the word I would use (P023)	Not contained
		Apprehensive
		Intrigued
		Interested
		Safe
		Freedom
		Surrounded by an environment
		Impact on the senses
		Movement
		Spacious
		Emotional

		Physical
		Evocative
2.2	**Was anything different in this environment compared to a previous healthcare setting?**	
	Yeah, like you were standing up, you were moving about the room, it was really ==interactive==, so that was ==really different== (P016)	Interactive
	I've only ever been had counselling in like an interview room, which is just like a desk and two chairs, so yes it was very, ==very different==…there was nothing soft about it, it was quite, well I suppose it was just three white walls and equipment, there wasn't like, a carpet on the floor, or, a comfy chair (P020)	Really different
		Very different
2.3	**Features:**	
	Auditory: **Your experience of the voice feature of the technology that welcomed you into the room?**	
	No, I felt like I read ahead of the voice (P016)	Soft type voice
	I liked the voice because it was like a nice voice, a ==soft type voice==, it didn't seem like ==clinical== it felt like ==supportive== (P017)	Not clinical
	Yes, it was a woman's voice and it was very ==calming==, she spoke really, erm, like as if she knew it was a first thing, so she was quite ==welcoming== and, erm, had a nice voice…it was like the voice knew that you were just here, like ==she didn't make you feel stupid like intimidating==, does that make sense? It was like every time if somebody goes in it's the first time. That's how it made me feel, like it's all ==new== (P020)	Supportive
		Calming
		Welcoming
		Not intimidating
	I felt the backdrops were quite ==relaxing== and it felt quite ==calm== the room (P021)	New
	It was quite calming it was a ==moderated== voice and it wasn't sort of, ==accented== (P022)	Relaxing
		Moderated
		No accent
2.4	*Visual:* **Your experience of the visual features such as the backdrop imagery or anything else – anything that stood out?**	
	I really like the idea of ==visualizing a timeline== of events and being able to ==work through it==, like ==piecing bits together==, ==making that link== and I think it will help in terms of ==processing== and ==understanding== and ==moving== from like these events as well (P017)	Visualizing a timeline
	I found it ==incredibly calming==, that the music was, very calming. I liked, like the Northern Lights style, it was like all the things that I like, ==calming scenes== and I liked how it ==moved== it made it feel ==really real==, instead of just looking at a wall with pictures on, it was, you felt like ==you were actually somewhere, different==…because it wasn't a static image, it ==moved== and all the time, the whole time I was in there it all ==moved all the time== and that made it feel ==not static== and like ==real== (020)	Working through it
		Piecing bits together
		Making that link
		Processing
		Understanding
	I really liked ==the colour changes== between the sort of the introduction part and the doorways and the buttons and then the cognitive part and then the future part. I really liked ==the switching==…the one thing I didn't like and it did catch my eyeline and it's not a negative but…if my eyeline went above the line of the layout, I ==lost my sort of, momentum==…between the edge of the canvassing and the set up…but other than that I though the whole…aspect of it was, ==as you moved along==, the ==visual== and the ==vocal== and the ==kinaesthetic== changes sort of ==carried you==, I thought that I was ==carried along==, quite nicely (P022)	Incredibly calming
		Calming scenes
		Wasn't static
		The colour changes
		The switching
	I did like the display of the Northern Lights, going on in the background, because that was ==a moving thing==, it wasn't solid where I stood. I think if it was a solid picture, erm, it wouldn't have had the same effect, where it was a ==moving==, like ==visual thing== to look at and look round and ==encourage you to move with it==, that was helpful in sort of settling some of my nerves (P024)	Moved
		Really real
		You were actually somewhere different
		Lost my sort of, momentum
		As you moved along
		Visual
		Kinaesthetic
		The visual and the vocal and the kinaesthetic

			Carried you
			Wasn't solid
			Moving
			Encourage you to move with it
2.5	**The walls are touch interactive – what was that like? What was it like to interact with the room via touch?**		
	I feel it kind of ==distracts you== from what you were thinking about, if that makes sense…because you are ==physically having to do things== and it ==takes your mind of it== a bit (P013)

I didn't know what to expect at first…it was ==really straightforward== (017)

It ==felt like I was actually doing something and being active== so if it was my therapy I quite liked that because ==it would take, maybe, a bit of focus off the therapy== and you would be ==interacting with the buttons== if you know what I mean so you've done a bit of talking and a bit of touching things and ==moving on== it felt quite nice that (P021)

It was ==fluid==…as you ==entered through that doorway==…it felt like you ==flowed into the past== (P022)

==I felt in control==, ==I had choice== and ==to actually move== and touch it and ==things changed== and then ==we moved on to somewhere else==, just that ==whole process==…erm…the doors to me, I loved the ideas of ==opening a door closing a door==, that I could touch and close it and open it and ==have choice==… I think it's ==really important== because ==it empowers the person== that I have got ==choice== or I can take ==control== where some traumatic experiences ==that control's been taken away== from you, or it hasn't been your choice, its someone else's, so I think that's really important (P024) | | Distracts you

Physically doing things

Takes your mind of it

Really straightforward

Felt like I was actually doing something and being active

It would take focus off the therapy

Interacting with the buttons

Moving on

Fluid

Entered through that doorway

Flowed into the past

I felt in control

I had choice

Things changed

We moved on to somewhere else

Whole process

Opening a door, closing a door

Really important

Control where control has been taken away

It empowers the person |

Considered Theme 2: Trauma expert initial view of IIVE Interpreting experience of The Timeline	CODES LEADING TO THEMES
3.1 The Timeline is designed as a VR experience for trauma - could you describe your experience of The Timeline?	
I really liked this feature…I could see, like, how it would be really helpful for both the client to understand what's been going on for them and the therapist, because, if you kind of put a lot of different areas of a person's life in this timeline, you're gonna be able to get themes, if that makes sense…so for example, somebody who is maybe struggling with some form of attachment…it may not just all have happened because of what happened when they were a child…(P014)	Really helpful for client and therapist
	You put a lot of different areas of a person's life in this timeline
	Themes
The Timeline was incredibly interesting…the way to look at it was the use of doors was just, it was so like, it made your brain work without you thinking about it working, if that makes sense, so to have the visualisation of a door and each stage of The Timeline was represented by a door, rather than like pictures or word association which would probably make you think deeper, just the simplicity of a door was, spoke more than anything, than any form of picture would normally do… Obviously with the deep past, that was almost like a way of…if you were with the facilitator the deep past was a way of opening up what experience it was you've had, what type of trauma it was, where it all stems from…then as soon as you come out of that door that one closing and actually disappearing was great…it isn't until the end that you click on to things like that to show that you can go back to your deep past…erm …then with the past, that was almost like, so, the aftermath of what happened because of the trauma and then learning to understand that and then going into the now, how you are dealing with it now and what's happened in your life because of that and then the future and how you are going to deal with it moving forward (P015)	Incredibly interesting
	The use of doors
	The visualization of a door
	The Timeline was represented by a door
	The simplicity of a door
	The deep past was a way of opening up
	It moved you to go past it all
I liked that it moved you through the different stages of it and you went to the deep past and the past…and it moved you to go past it all and through it and leave it behind you, which is a really positive thing. Yeah I think it's a different way of looking at it isn't it, erm, often therapy can sit with that for quite a while and it was nice to be able to choose the speed that you're gonna move through the different stages…because you're interacting with it aren't you, you were touching the walls and choosing when you go past it and what stage you were gonna click on different parts of it…I think it empowers the client to make their choices and you are handing it to them to go through the stages when they're ready to (P016)	Leave it behind you
	A different way of looking at it
	Closing and disappearing
	You click on to things
	Choose the speed that you're gonna move
	Interacting with it
…I liked the idea that with The Timeline that you can start to visualise events and start to like work through it, acknowledging bits from certain areas of your life and putting it all together. So I think that's really good with like being able to see it all in front of you, acknowledge it, understand how it affects you then start like to process and then move forward, but then as I mentioned before, some people might not want to start with the deep past I know I definitely wouldn't. I probably could if I was like in the right environment and built a rapport with someone first, but if that was a first session I'd be a bit like, "no", I'd feel more comfortable speaking about like, recent events that are still like fresh in my mind rather than going into things…I think it could be triggering as well…I think if I started off in the deep past I probably would have been really overwhelmed with it all…personally it's more beneficial to start at a point where you feel comfortable, then have the opportunity to work backwards, but then seeing it all put together before moving forward, so you can kind of like go at your own pace and what you feel comfortable, like, starting to like, go back to, but then having it all in front of you once you feel like more grounded (P017)	Choice
	You are handing it to them
	When they're ready
	Empowerment
	Acknowledging bits from areas of your life
	Putting it all together
	It could be triggering as well
	Overwhelmed with it all
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. The words on there were quite thought provoking so they would prompt you and make you think (P018)	Have the opportunity to work backwards
	Seeing it all put together
Interesting. I think you would get a lot more out of it… as a client, patient or whatever, 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… It kind of give you an insight from the therapists side if you like as to where he was kind of going with things because those prompts were on the wall, you know, the deep past, the future…it put a bit of meat on the bones for what a therapy session was (P019)	Make you think deeper
	Made your brain work
	Go at your own pace
I didn't really get it at first but then when you go further in it makes more sense because you have to obviously touch the option on the wall which is incredible how that works, erm, but yeah I think at first I didn't know what to do…then obviously once you've touched it you know what the process is straight away. You touch one thing and you know you're going into the next stage and then you know you've got to touch another thing to move on and I think it was that initial thing when I touched the wall…I touched the trauma, I wouldn't call it a button because it wasn't a button it was like a space with trauma on and then it moved you on to the next bit and it was, I think it was post-it notes if I remember rightly, or it was post-it notes first, no, trauma, then post-it notes. But then once I knew that you had to touch that to move on, it all made a bit more sense…I loved the image of the door because obviously closing doors on things and it was very visual that the door went once you closed that door… (P020)	Comfortable
	Once you've touched it you know what to do
	Having it all in front of you
	You're going into the next stage
Yeah I felt it was quite good prompts to talk about the therapy, but I think you could be in the deep past for a long time…so it depends on, therapy for myself I would have been in the deep past for ages…so I don't know how that would work in therapy…I think it just takes a while for you to get to your deep past so it depends on where you start, but then I suppose is that you that's set it? So is it like a person who's with you that decides where to go in The Timeline or is that you that goes and chooses? So that's the other thing I suppose it depends where you feel as a client you're alright to talk about. So you might be okay to go to your like recent past but not your deep past yet until you get that relationship I suppose. Because it took me a while to work out, where all my	How you are dealing with it now
	Deal with it moving forward

	things were in my EMDR therapy… And usually when you go to therapy you ask what's going on with you now don't you; how you are struggling now in your day-to-day life and things and then you look at what might be the cause later (P021) I think because I understand The Timeline and how you would do it on paper, you know with someone for yourself or with someone else…because I could move about as well and go to those doorways and press those places to go to and have those choices…it was a very positive experience and I like the fact of being able to move through that timeline…physically as well as being able to make those choices cognitively (P023) I thought it was a great idea. I though by touching so I could move through The Timeline, like you had one, like deep past on one wall, recent past and then like the present. I wanted that door when it opened for the future to be on the other wall, like not go back…I liked that it moved and again that physical movement and watching. So you've got the physical movement of myself going round with The Timeline, talking about my timeline, but also then, erm, the visual of it moving around the room as well…it just co-ordinated. So I liked the visual, loved the tactile part…to physically and psychologically move from deep, present to future, for me was, yeah, I think that's just a brilliant idea; and being able to actually do it. We talk it but we very rarely like, do the movement, the physical side of it (P024)	In therapy you would look I could see a start a middle and end and a future With just CBT you don't see the end of the future Through the prompts…on the walls Touch the option on the wall which is incredible Put a bit of meat on the bones Moved you through different stages Closing doors on things Very visual Post-it notes It all made a bit more sense Prompts to talk about the therapy Leave it behind you It depends on where you start Is that you that goes and chooses? It took me a while to work out…in EMDR therapy Struggling Cause Go to those doorways Being able to move through that timeline Have those choices Physically as well as being able to make those choice cognitively By touching so I could move through The Timeline I liked that it moved That physical movement and watching To physically and psychologically move from deep, present, to future The deep past The tactile part We very rarely like, do the movement, the physical side Visualise events Move forward
3.2	**Would you describe The Timeline process as a therapy or something else?**	
	I would probably describe it as a form of therapy….to me… obviously you've got the doors haven't you? So when you have the doors and you're kind of looking at the past and everything and then you're kind of moving on to the now or moving on to the future, whichever door you are going into, when you are closing that past door to me that makes me think you are closing the door on the past, so yes that past is a part of you but it's not who you are now, it gives that strength of character, you know what I mean, of why you are this strong character moving forward, but it doesn't define you because you are not at that same place in your life any more, as when that trauma happened, you're further on that timeline…you know how mindfulness works and you focus of the present I think the timeline helps you to do that, focus on that present, a lot easier than what you would do if somebody just said: "*Try and focus on that present*"…because there's that visual link as well and I know we were talking and obviously I sort of said oh I was dyslexic so for me visual and kinaesthetic is the best (P014)	a form of therapy moving on to the now or moving on to the future closing that past door to me that makes me think you are closing the door on the past you are this strong character moving forward it doesn't define you

	I would describe it as a therapy because it's a way of opening up your mind and allowing you mind to go to…probably a more freeing space than what you imagine… especially if you are in a really dark place because of trauma you feel a weight…you can almost feel your brain opening to these new things that you're about to discover and the way you are about to manage something you once thought you probably couldn't manage (P015) I think it could be used as a therapy, definitely yeah, erm, I suppose it depends how you're taken through it and who's with you, erm, and what kind of discussions are around those different timeline parts (P016) It's definitely a therapy but quite a real, visual therapy other than just sitting talking. I know in a session you will talk in between, but it's like 'cause you are physically doing it with your being, you know with your hand, you yourself are doing that action and yes I do see it as therapy (P020)	I think the timeline helps you to do that, focus on that present because there's that visual link as well I would describe it as a therapy it's a way of opening up your mind a more freeing space you can almost feel your brain opening to these new things that you're about to discover about to manage something you once thought you probably couldn't manage I think it could be used as a therapy, definitely what kind of discussions are around those different timeline parts It's definitely a therapy but quite a real, visual therapy other than just sitting talking 'cause you are physically doing it with your being I do see it as therapy	
3.3	**Could you envisage The Timeline supporting trauma recovery for somebody in any way and if so how?**		
	…a thousand percent, I think… probably more so for somebody where something's happened, as in like you say a terrorist attack, a rape, a murder, a family death…more so over than, like, a phobia…for something like a physical event or something happening without a shadow of a doubt it would be fantastic for them (P015) I think it could…probably just what I've said about moving through, kind of looking at the trauma itself and acknowledging it and processing it and then moving through those stages and then moving past it and looking to the future (P016) Yeah, I think because you're stepping forward and you're doing the action and it's going in your head the door like the vision and then the door closing. I think for people who have suffered trauma them just closing that door…I think you would need a couple of times and then talking in between and going through, 'cause obviously talking can help a lot but the actual action that you do, yeah I think it would help people massively (P020)	a physical event processing it moving through those stages moving past looking to the future you're stepping forward doing the action just closing that door	

The Timeline as a process relating to trauma	CODES LEADING TO THEMES
3.4 **The Timeline contains virtual reality doors – could these features be applied to trauma healthcare in any way?**	
The doors…it's sort of moving through processes, pushing past where a client might be stuck, erm and again giving them the choice whether they want to move through that door or not, erm and again sort of letting the client have autonomy in it (P016) I liked the doors because with that visual it's like you can step into it type thing rather than just sitting down and trying to like verbalise things, you've got that prompt in front of you and I liked the fact that like it's a door so when you go over and press it, it's like you are going into it and then you're walking out of it, I really liked the visual side of it (P017) I think that there are areas that you do need to explore in order to sort of get better of live with your trauma. 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) Yeah I think they're a lovely idea and I think it was quite a soft, the actual look of it, the visual of it was very soft…of the door, the frame of it was soft and it was like moving again, like everything moves all the time so it's not like a wooden doorframe or a big wooden door, it's like a futuristic-style door, but like soft to look at, not harsh…that's how it feels very real. It really makes a big difference, whereas if you just stuck a picture of a wooden doorframe or a wooden door it wouldn't have the same effect (P020) I thought that it was nice that you could open the door, have a look in it and then come back out if you felt like you needed to, so it would be shutting that off again. I felt the doors were a good option for me (P021) When you think about how therapists would approach treating trauma, I think that you've got to, if not deal with, but you've got to address and compartmentalise, even if you can't, sort of, close it off, but you've got to address and compartmentalise the past, before you can move forward. And I think in any therapy situation, what you've got to do is not let the past sort of, dominate, because otherwise you can't move forward and you get like a block going on, so to separate that in terms of timelines for immersive therapy, it's not that far away, from what you might do in a therapeutic situation I would have thought; because of the way that you kind of, certain pathways demand that you go to address the past before you start thinking about what comes next…I think the doors were a beautiful way to compartmentalise it (P022) 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…whether they choose to go there or not, so that fulfils something…but also about choosing, you know, where to go, erm, in terms of the deep past or the recent past, you know, erm, as well as the present or the future and I think it's important to be able to go back to places…to be able to make those choices of where to go. I really like the way it was set up, erm, and that it was simple and structured and simple to use. I liked that aspect of it because if you going in there and its trauma that you're dealing with you need to have something that's really clear and simple to use (P023) I think the door analogy is really good of: Do we open a door? Do we close a door? And then going through trauma and leaving it in the past and then closing the door behind them. I think it's very helpful (P024)	it's sort of moving through processes pushing past where a client might be stuck giving them the choice Autonomy with that visual it's like you can step into it you've got that prompt in front of you prompts you to talk about them prompts you to realise Visual you don't realise because it's not prompted in front of you as it is, in, the immersive room the visual of it was very soft moving again like everything moves all the time Move forward it's like a futuristic-style door soft to look at, not harsh it feels very real address and compartmentalise the past not let the past sort of, dominate to separate in terms of timelines form immersive therapy the doors were a beautiful way to compartmentalise Compartmentalise
3.5 **What was your experience of standing up and moving around in the room, as an approach?**	Step
I kind of liked it because obviously 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…I know like, for example my friend like he used to do therapy and he hated it, like he actually stopped going because he didn't like sitting and like talking to someone face to face like sat down, so I think, standing up and being able to move round and not having to have like, look at the person, it was like better (P013) 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 it lessened the pressure, if that makes sense. I think sometimes when you're in therapy sessions and you're talking about really emotive stuff, things that are really emotionally charged, it can be really hard going. I know that from myself…like I've come out of counselling before and been absolutely exhausted because I've, you know what I mean, of how I've felt? But I think because you are busy doing things and like the therapist is sort of talking to you as you are kind of going on, it maybe seems more like, erm, like an informal chat than a therapy session, but I think that's a good thing, because I don't think it's then going to feel quite as heavy, but I think you are going to get a lots more therapy out of it than maybe what you would have done just by having a chat (P014) I think it's a lot more freeing. I think sitting down in a chair you feel confined to one chair…I also think standing up allows your brain to flow a bit more…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…but the ability to just move around and not constantly have eyes on you….and just move as freely as you like I think that's brilliant (P015)	didn't like sitting and like talking to someone face to face standing up and being able to move round and not having to have like, look at the person standing together you're almost like a team there's a better therapeutic relationship between the client and the therapist would improve my own therapeutic relationship lessened the pressure you are going to get a lots more therapy out of it a lot more freeing in a chair you feel confined standing up allows your brain to flow a bit more Not having to look at therapist

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 focussing on what you were doing, so I think for a client, they would get a lot from that, erm, it's sort of fully being submerged in the experience isn't it…and it's about their experience and what they're going to get from it, so, 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)

I like that because me personally I get really, really anxious, so like I tend to like shake, or like I'll be like holding something, like whether it be like my car keys, or like I'll be squeezing like my fingers or something like that, playing with my hair as well. I don't like being sat I don't like eye contact like I just feel on the spot, so like being able to walk about and focus on like visuals and like engaging things that way, it felt more natural to have the conversation with you than to sit face to face and speak about stuff without anything going on around you. I don't know, I get quite awkward or anxious…it just gives you that freedom (P017)

I felt like 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 think it's probably, firstly probably it depends on what your trauma was… but in terms of keeping the patient or the client relaxed and less sort of formal then yes definitely it worked for me and also I think people who have, sort of, social anxiety, you know people who really find it difficult to talk face to face to somebody or to look somebody in the eye, They probably find traditional treatment harder because it is literally that, sat across from somebody talking to them, where this, you know, you've got the freedom to stand up and move around. You don't necessarily have to be facing the person that you're talking to, you can be you know looking at the wall and talking to the therapist who could be stood behind you, which for some people is probably more relaxing than, especially I think youngsters these days there's a lot more social anxiety in youngsters these days and it's hard for them to talk and that just makes it easier the whole freedom of the room, the freedom of the space of the room makes it a lot easier I would imagine, particularly for people who struggle with, social interactions anyway…I definitely think that would help (P019)

Erm, yeah, it was funny because you are actually moving, towards what you're going towards, like the square that says trauma then the post-it notes then the doors and then, you're physically, you have to step forward to do it and I think people who have had a trauma and it's affected their mental health, moving forward and even just a step, you know like if you are and you know there's something wrong and you have to go and see a doctor, the first step of going to see the doctor is always the hardest, so stepping forward, to do an action, is almost therapy in itself…obviously reliving trauma is very hard, so taking that step forward, each time, to do that action, is a big step in itself (P020)

I felt like it would take your mind off the intenseness of your trauma and it helps you maybe feel a bit more active about doing something, erm, but then I also think that a seat, as well, is nice, like a comfy seat so that you feel that if you need to take time to sit there and discuss that problem, erm, that would be better (P021)

I do believe there is such a physical element in experiencing trauma and I think that ability in being able to move around the room…I really like that aspect of The Timeline…you know you've got the choice to sit down as well obviously, but having that ability to just stand and walk around and be physical in that space I really liked that (P023)

I loved it. I also think with standing because your feet are firmly on the ground for me, is, I actually felt that that was quite grounding. Even though I was going to work on trauma of The Timeline, it's quite grounding 'cause it's your feet on a solid ground But definitely physically, walking as they say, it just links to me of the progression of time and just walking and then the psychological movement…standing up I quite liked because everything's sat down, usually at a normal session you're just sat facing one another, but even the social distance of yourself alongside me… and following me as though I was leading…it was person centred I felt, more client led (P024)

Better outcomes in therapy

Improving therapeutic relationship

Getting more therapy than just a chat

Lessened the pressure

very interactive

kind of immersed in the experience and really focussing

sort of fully being submerged in the experience

talking and walking them through it

that interaction and the standing up bit was really, really useful

I don't like being sat I don't like eye contact

being able to walk about and focus on like visuals and like engaging things that way, it felt more natural to have the conversation

it just gives you that freedom

I was more in control

I was controlling it

the whole freedom of the room, the freedom of the space of the room

people who really find it difficult to talk face to face

you've got the freedom to stand up and move around

you have to step forward to do it

you are actually moving, towards what you're going towards

reliving trauma is very hard, so taking that step forward

to do that action, is a big step in itself

it would take your mind off the intenseness of your trauma

feel a bit more active about doing something

standing up allows your brain to flow a bit more

there is such a physical element in experiencing trauma

ability in being able to move around the room

having that ability to just stand and walk around and be physical in that space

with standing because your feet are firmly on the ground

I actually felt that that was quite grounding

and following me as though I was leading…it was person centred I felt, more client led

Immersed in the experience

3.6	**When you mention young people and social anxiety do you think in any way this room would in any way benefit that generation?**	
	I think it should be written for them. I absolutely think its perfect for somebody who really struggles to talk; for somebody who really struggles in other people's company; doesn't interact very well with other people; I think this is perfect…I mean imagine trying to treat somebody with trauma who has social anxiety anyway…so you're not even treating social anxiety you're trying to treat the trauma but you can't because they struggle with social interaction anyway…so this to me, you kind of would fight two birds with one stone, do you know what I mean? You are allowing them to be able to talk about things in a more comfortable setting and therefore help them deal with, maybe a different trauma problem, yet, you're helping with that at the same time. You're not hindering the treatment for the trauma by putting them in a setting that makes them uncomfortable; you put them in this and it makes them, in my opinion, it would make them, it's more conducive to being able to get somebody and talk to them who is socially anxious or not particularly really personable or outgoing (P019) Erm, yeah, it was funny because you are actually moving, towards what you're going towards, like the square that says trauma then the post-it notes then the doors and then, you're physically, you have to step forward to do it and I think people who have had a trauma and it's affected their mental health, moving forward and even just a step, you know like if you are and you know there's something wrong and you have to go and see a doctor, the first step of going to see the doctor is always the hardest, so stepping forward, to do an action, is almost therapy in itself…obviously reliving trauma is very hard, so taking that step forward, each time, to do that action, is a big step in itself (P020)	for somebody who really struggles in other people's company doesn't interact very well with other people you kind of would fight two birds with one stone You are allowing them to be able to talk about things in a more comfortable setting and therefore help them deal with, maybe a different trauma problem it's more conducive to being able to get somebody and talk to them you are actually moving, towards what you're going towards you have to step forward to do it you have to step forward to do it so taking that step forward, each time, to do that action, is a big step in itself
3.7	**Do you envisage this is a place where people can take action?**	
	Oh, absolutely, I think, because you would discuss the trauma and obviously you are looking at the past, the results of the trauma…you are looking at the now but you are also looking at the future, so without actually knowing it and the conversations you are having, you are actually taking action on how to move forward with it (P015)	you are looking at the now but you are also looking at the future you are actually taking action
3.8	**Do you think "freedom" and "freely" is important in trauma?**	
	Yes, absolutely…so with, I think with trauma you, it's almost like you are trapped, living through your trauma, but being able to learn to live freely and live, almost alongside your trauma and not let the trauma be the better of you…I think that's got a massive, almost like mental element to it to being able to learn to live freely…and standing up and having that access of just be able to freely walk where you want, is a great psychological way of doing it (P015)	with trauma you, it's almost like you are trapped almost like mental element to it to being able to learn to live freely standing up and having that access of just be able to freely walk where you want a great psychological way of doing it
3.9	**Does trauma impact just the head or does the body play a role – if so how?** **In the context of trauma, is involving the body and movement important?**	
	I think it's a bit of both. I think it's a bit like that chicken and the egg, which comes first? I think its probably more mind-orientated, however, like going back to my example that I used earlier when I sort of said when I had the kids…like I don't like being away from my loved ones, do you know what I mean? Because I'm frightened that something, bad is going to happen to them. I know that that can be prompted by a thought that I have but I also know that sometimes it's promoted by sort of like, physical symptoms that I get first of all like those fight or flight responses (P014). Yeah, I think the body does play a role in trauma, erm, yeah I think it does I think that things can be triggered by, you know, sounds, smells, different things can impact the different senses and as well as moving around a room and all the visual things that a VR can create it can trigger or help and support a client, erm, within that trauma experience…so like having different textures, different scents, you had some kind of relaxing music on …all that kind of stuff can be really like…evoke different emotions, can be like triggering or stimulating for somebody, so I think you could tailor it to individual clients, erm, kind of get something from the client first and looking at their experience and what would trigger them or what would make them feel safe and incorporate that into the VR experience (P016) Yeah, because I think in the sense of trauma impacting your body it does have a massive impact so… I think any type of movement is good especially if people are feeling anxious as well, or even just if people are feeling like a bit uncomfortable like its good to be able to like move about and, especially if you've got like so many decisions about what's going on in your head around you, it might be good to think like actually I can just walk away from this and focus on something else until I feel ready to go back into that, rather than being sat thinking I don't really want to talk about this…personally like the way trauma affects your body I hate the fact that things that you wouldn't think twice of, like when I go and get my nails done, I can't help it because I am constantly shaking and it makes me feel dead embarrassed…my hands just don't stay still and it really pisses me off…you can get different long term conditions because of trauma so it's like, being aware of that link of how that can affect your body as well (P017)	more mind-orientated fight or flight responses I think the body does play a role in trauma things can be triggered the visual things that a VR can create it can trigger or help and support a client evoke different emotions, can be like triggering or stimulating for somebody tailor it to individual clients what would trigger them or what would make them feel safe and incorporate that into the VR experience in the sense of trauma impacting your body it does have a massive impact any type of movement is good especially if people are feeling anxious its good to be able to like move about

	I think trauma affects your mind and your body all at the same time, because sometimes when you've had a trauma some days you don't feel like even getting out of bed; you know your mental health's affected but it also affects your body because some days you just don't even want to function (P020)	the way trauma affects your body
		like when I go and get my nails done…my hands just don't stay still and it really pisses me off
	Yeah I think it's creating a new memory I suppose as you are talking about it so like for me with the EMDR we tap, so to keep you in the here and now, erm so that you are doing your, you are going back into your awful memory and then you are tapping so that's remembering, like making your brain know that you are in you are here and you are safe and what's happened to you in the past is, you are still here…so for example for me, my trauma was my little boy was told that he was going to die, erm, and then he didn't, but I was stuck in the fact thinking that he was dead and he was gonna die and so he was going to be dead… but because I could tap…it was helpful because it kept my now brain here to know that he wasn't dead and what they told me was wrong…I don't know how it works but it's fascinating…the brain is just so complex (P021)	you can get different long term conditions because of trauma
		trauma affects your mind and your body all at the same time
		when you've had a trauma some days you don't feel like even getting out of bed
	When you think about accessing certain memories it makes that fight or flight response over-react…I would think that moving around might disperse some of that panic and anxiety…literally to disperse some of those physiological reactions to the thoughts that are in your head (P022)	your mental health's affected but it also affects your body because some days you just don't even want to function
		I would think that moving around might disperse some of that panic and anxiety
	I think for a lot of people, we do feel trauma in other parts of the body. So I don't know if that's kind of what you mean, but we can have a real tightness, or a heaviness and it can be all over the body, so different aspects…it might be helpful to sort of say: Where does the trauma sit? Where do we feel it, where do we sense it? And we might have an outline of a body. (P024)	literally to disperse some of those physiological reactions to the thoughts that are in your head
		for a lot of people, we do feel trauma in other parts of the body
		we can have a real tightness, or a heaviness and it can be all over the body
3.10	**What was the experience of someone else standing in the room with you?**	
	…if I was there alone I would probably panic about the fact that I would mess it up, I would break it up, or I just wouldn't know how to use the technology…when you are standing together, it's that link of you're not alone, you're not going through this journey on your own, you are going through this with your therapist and you're kind of hand to hand, shoulder to shoulder, you know, going through this (P014)	if I was there alone I would probably panic
		I just wouldn't know how to use the technology
	It wasn't like, almost like it wasn't a clinical form of therapy… I also think that the choice of clothing that the facilitator would wear… with a standard form of therapy I know when I went it was a man in a white shirt and black trousers, its quite clinical, almost intimidating…the clothes that they're wearing makes a hell of a difference (015)	when you are standing together, it's that link of you're not alone
		you're not going through this journey on your own
	Erm, probably comforting having somebody else in the room with me because like I said it was a little bit feeling of vulnerable, not knowing what was going to happen next, erm, it is all around you so you're looking at every bit of the wall all the space around you…I definitely think guiding a client through that experience would be more helpful…I think it would be quite daunting for a client to go in there without some sort of support or guidance on how to use the equipment even (P016)	you're kind of hand to hand, shoulder to shoulder, you know, going through this
		it wasn't a clinical form of therapy
		the choice of clothing that the facilitator would wear
	It was quite comforting because it was an unusual space and it was comforting to know that somebody else was there because it was different and you know when you go into something and it's completely different and you think: Oh God, is this going to be okay? Am I going to feel claustrophobic? So, yeah, it was quite reassuring to have somebody else there (P020)	the clothes that they're wearing makes a hell of a difference
		I definitely think guiding a client through that experience would be more helpful
	…some people might think that the room would be alright on its own but I also think that actually sometimes you need a bit of guidance that you are doing it right, or a bit of reassurance and having that therapist with you, it would make me feel more comfortable (P021)	quite daunting for a client to go in there without some sort of support or guidance on how to use the equipment
		it was comforting to know that somebody else was there because it was different
	I didn't notice that you were there…once you were in the room if you just heard a quiet voice behind you…I think that would be, er, you would need someone there with you I think you would need a little bit of guidance but in all honesty when you are wrapped up in it and you are thinking about it and you are touching and feeling and expressing, I don't think that you would need, a presence like other than someone just sat in the background, facilitating, really (P022)	it was quite reassuring to have somebody else there
		sometimes you need a bit of guidance that you are doing it right
		a bit of reassurance and having that therapist with you
	Yeah, I think that, again, it's very important. How I experienced that when I was in there…you were there, you were there…you weren't intruding in the room or on my experience, but you were just there and I think it's very reassuring actually (P023)	once you were in the room if you just heard a quiet voice behind you
	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)	in all honesty when you are wrapped up in it and you are thinking about it and you are touching and feeling and expressing, I don't think that you would need, a presence like other than someone just sat in the background, facilitating
		you were just there and I think it's very reassuring actually

		reassurance, yeah, I think I would prefer somebody else to be there
3.11	**How important is you being "in charge"?**	
	I'd say its probably a top priority, because at the end of the day you can have a therapist stood there with you, telling you how to action things in your life and how to move forward, but you're in charge of your own mind so being able to lead almost your own way through your therapy shows you that you are in charge of what's going to happen now and how you move forward with it (P015)	you're in charge of your own mind

being able to lead almost your own way through your therapy shows you that you are in charge of what's going to happen now and how you move forward with it |
| 3.12 | **Did you feel part of the environment when you were in there?** | |
| | Yeah, I think that because it was on like three walls, I think that helped with, feeling like, inclusive into like what was going on. I think if it had just been targeted on like the one wall that you are looking at in front of you, I maybe wouldn't have much…but I think the fact that there was three walls to kind of use it… that kind of made you feel a part of that environment, like you're kind of driving down that road, or you're kind of, just about to go through that door (P014) | Inclusive

made you feel a part of that environment |
| 3.13 | **The Word Room (containing words), Metaphor Room (containing a tree image), Cognition Room, as features of The Timeline – any views?** | |
| | The roots were dead small and the tree was dead big so it kind of just like represents that the things that happen to you, they aren't like massive things in your life and you still got like all of your life ahead of you (P013)

I think when we were looking at the word one if I remember correctly, the words that kind of stood out for me was "challenge" and "support"…they were the ones that I really thought if you could only choose two to keep, they would be the ones I would be suggesting (P014)

I think the tree can be kind of implied in any way that the client wants to interpret that. It can have lots of different meanings and metaphors attached to the tree…if I was going through discussing trauma (P016)

Yeah so the Metaphor Room I found it quite motivating, as well as like, giving you that reassurance, so I like the idea when we spoke about that your roots don't define your tree. I liked that because it's kind of acknowledging that your past might have been quite difficult, but it doesn't have to define your future…with the Cognition Room I really liked the option for your relationship with yourself, as well as the other options but it's like increasing that awareness of like how all these different factors are influencing you (P017)

I thought the tree was quite a good visual to have because you understood the roots the trunk the shoots off and again the words were thought provoking so they were quite leading so they were like getting you to speak about things (P018)

The tree, the metaphor…I think it's 'cause the tree wasn't in the ground, it was, the roots were exposed and it was the movement all the time of like the leaves and of the actual tree moving, so it felt like, you know, even though you are uprooted, you can still move and you can still breathe and you can still function and I just thought it was a lovely vision, a lovely picture…you do feel uprooted, you don't quite know where you are, where you belong. Well that's how I feel (P020)

I think each room for what it was able to do would open up more conversations, maybe at a greater depth and it just brought different dimensions to therapy…the writing on the wall, the words and some people struggle to find the right words and maybe that just might just help introduce an area…in my little notes here I've put you can extend from talking…it just might stimulate and help, in different ways (P024) | made you feel a part of that environment

you still got like all of your life ahead of you

the words that kind of stood out for me was "challenge" and "support"…

It can have lots of different meanings and metaphors attached to the tree…if I was going through discussing trauma

the Metaphor Room I found it quite motivating, as well as like, giving you that reassurance

your roots don't define your tree

your past might have been quite difficult, but it doesn't have to define your future

the Cognition Room I really liked the option for your relationship with yourself

quite leading so they were like getting you to speak about things

even though you are uprooted, you can still move and you can still breathe and you can still function

Uprooted

would open up more conversations, maybe at a greater depth and it just brought different dimensions to therapy

you can extend from talking |
| 3.14 | **Your interpretation of The Future, as part of The Timeline?** | |
| | Again, because I think not only does it help you to focus on the now but it looks at how you want the future to be. So do we want to continue and open that door to the past and kind of stay in the same as how we're feeling now, or do we want to permanently close that door and lock it and sort of say: Look, that is dealt with, this is me now, but this is where I want to be in, I don't know, a year's time, ten years time, twenty years time; so I think it helps them to sort of move on from their experience (P014)

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 thought it was really good and it gets the client to look forward…like I said that moving past the trauma and choosing your destination you sort of had different directions that you could go, you had the future door and then the big road and there was the mountains up ahead…I thought it was really useful to be able to sort of say that the options are open, that the future is wherever you want to go (P016) | I think it helps them to sort of move on from their experience

how you are going to live moving forward

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

it gets the client to look forward

moving past the trauma and choosing your destination

the options are open, that the future is wherever you want to go |

| | 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 and then I think the last thing I can remember before going into the future was the relationship with yourself and 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?==…I liked the visuals around it where it was literally that one big, long road, I really liked that…I just like the idea of the fact that it's a big, long road because I think ==when you've been constantly re-living trauma in your head it can feel like no matter how far, far away you're pushing yourself to go, like you're stuck in the past in a way== and like people will be like, you are going around in circles and its like I'm not I'm trying my fucking best (P017)

I think I liked that part the best because that was the road, erm, I sat looking at it for quite some time…and I liked again how it was moving but there was like normal things in the background like a little, it was like a vehicle or something on the left, and it was nice just to look down that long, empty road…I think ==especially when you've had a trauma it can put you at a crossroad and you've got decisions to make==. I felt like I just wanted to get a backpack and go on it. I honestly could have just walked down it and just find out what was there. Because it is and it's a lonely road but it didn't feel that lonely, ==even though you were just in a box of a room it didn't feel lonely because of the movement== (P020)

…==endless opportunities== I suppose…you could have lots of different roads off to different places, rather than just one road I suppose…maybe two roads that split so you can decide which road you go down (P021) | what am I going to do moving forward with all of this?

when you've been constantly re-living trauma in your head it can feel like no matter how far, far away you're pushing yourself to go, like you're stuck in the past in a way

especially when you've had a trauma it can put you at a crossroad and you've got decisions to make

even though you were just in a box of a room it didn't feel lonely because of the movement

endless opportunities

Move on from the experience of trauma

endless opportunities |

Considered Theme 3: Interpretation of experience (experiential) User autonomy	CODES LEADING TO THEMES
4.1 **From your experience, how might you envisage The Timeline being used therapeutically in trauma recovery?**	
We do something like this anyway like looking at the continuums…it's more like step 3 work…its more so like hi intensity therapy thing to use, so like when you look at a trauma looking at that timeline is quite beneficial, like if they can like say like right things started going like this since this year then you can look at right, what was going on that year…and then when they've pieced it all together like it's nice so they can have that in front of them but that's more so like step 3 work…I think it's really beneficial for trauma, especially if people don't know where it's coming from…when you start looking through The Timeline you can see like how these different years; so it would be like different life events…looking at like childhood and adulthood and then just kind of piecing it all together and I think its good sometimes for helping them like move forward (P017) Absolutely yes. I think it was more thought provoking and leading so you could possibly get something out of people in less time than, six to eight sessions for example, sat with a therapist (P018) I think it's really handy to be able to, if you could go back to your trauma and look at it and then come back out and then go back in, I just feel that would be really helpful to see how far you've come, erm, and actually visually see it I suppose, for me I would be saying well look I really struggled with that and then now I've ticked it off or something (P021)	It's more like Step 3 work its more so like hi intensity therapy I think it's really beneficial for trauma, especially if people don't know where it's coming from when you start looking through The Timeline you can see like how these different years; so it would be like different life events…looking at like childhood and adulthood and then just kind of piecing it all together and I think its good sometimes for helping them like move forward it was more thought provoking and leading so you could possibly get something out of people in less time if you could go back to your trauma and look at it and then come back out and then go back in, I just feel that would be really helpful to see how far you've come
4.2 **If The Timeline was accessible when you were in recovery for trauma would you find any features in particular useful?**	
Definitely the deep past one…so like talking about obviously what had happened in the past to me, I probably would say that and then, probably not necessarily the future one but probably more of the now because I know me personally I always worry too much about the future, so maybe like, trying to like concentrate in the now, so like the now part of The Timeline was quite good (P013) I think it being on solid walls and the doors and the use of doors…so the solid walls is, you are walking along in life, trauma happens, it feels like someone puts a wall in front of you… and using those doors is almost like, you pushing your way through those walls and thinking it's not going to stop me from moving forward, I can get through it (P015) Probably the future, I would say, moving past the experience. I think obviously, acknowledging, processing trauma is always difficult for any client, erm, but, being able to be supported in that and then to be able to know that there is something that you can move past and to kind of look forward to (P016) I think it would have promted me to thinking about things and discuss them because I felt that because there was a prompt there that I was expected to talk about it, rather than me thinking should I say this, I don't know what the reaction is going to be (P018) I liked all of it but in particular the disappearing doors…like I said before how they just softly disappear…sometimes you don't want to, you know people say they lock things away and put them in boxes and they come back to it later but it just literally it was like just disappeared, just evaporated, and the thought of that happening of a trauma and the deep past it's a nice feeling to think if that did work that that's how it happened…like in a soft way and not a harsh way, like almost like a magical way…even though it's virtual it feels real, cause its like, as I said before, everything moving at a slow calming pace….you want when you've had a trauma, you want calm in your life…the motion of it is almost like waves and everyone knows like the sea is calming (P020)	The Timeline offers something you can physically move past, i.e. visible, tangible things and using those doors is almost like, you pushing your way through those walls and thinking it's not going to stop me from moving forward, I can get through it acknowledging, processing trauma is always difficult for any client, erm, but, being able to be supported in that and then to be able to know that there is something that you can move past and to kind of look forward to I felt that because there was a prompt there that I was expected to talk about it, rather than me thinking should I say this like almost like a magical way…even though it's virtual it feels real, cause its like, as I said before, everything moving at a slow calming pace….you want when you've had a trauma, you want calm in your life…the motion of it is almost like waves and everyone knows like the sea is calming
4.3 **The experience of closing a door on the Deep Past in The Timeline what was the experience of that?** **Could the experience of closing a door in The Timeline in virtual reality have any effect when a person leaves the room?**	
Yeah…you were physically kind of shutting the door… which kind of makes you feel like you'd shut it more than just talking about it…Obviously, when I went to therapy myself, like still after therapy it would come up now and again where I'd get like outbursts of… it would make me feel quite anxious, but I feel like, 'cause it wasn't really finished with, where if I did something like that, physically shutting the door, like on the wall if you like, you'd feel like it is finished with (P013) To me, that's what you want to be able to do rather than keep it open and for it to affect your life. And I think having that visual…this is not where you are…I'm not 16 any more, you know I mean, it was a horrible thing that happened to me when I was 16 but I am no longer 16 I am…a grown woman, having to kind of move on with my timeline and I think very much for me personally sometimes I feel, very much stuck in certain areas as that 16 year old girl that can't move on that's just lost her mam…so I think having that door to physically close would help with that. It really helped me to kind of think about, that I need to close the door, because I've had quite a few lots of therapy… of counselling, I feel like I just go around in circles, like on a roundabout and I don't ever get off that roundabout, where actually I just need to just get off and close the door rather than continuing on that roundabout all the time because it's not healthy for me (P014)	you were physically kind of shutting the door… which kind of makes you feel like you'd shut it more than just talking about it physically shutting the door, like on the wall if you like, you'd feel like it is finished with having to kind of move on with my timeline and I think very much for me personally sometimes I feel, very much stuck in certain areas as that 16 year old girl that can't move on that's just lost her mam having that door to physically close would help with that. It really helped me to kind of think about, that I need to close the door, because I've had quite a few lots of therapy… of counselling, I

	That is probably one of the highlights of it…obviously in the moment when you are in the session and you are trying to make the most of it you don't realise…and it's not until you come away you think I've opened up about the deep past now; we've closed the door and the door's gone. To be able to have the ability to go into the other doors is great as well, but you've spoke about it now, it's almost like let this be the last time that you open up about it and lets focus on moving forward…so not having the ability to go back through the door has got like immense psychological power that you probably wouldn't realise (P015) I thought it was a good metaphor to be able to close the door on things (P016) I liked it because it was kind of like putting it to bed, it's like right I've looked at this now I've went through it but it's gone now… I don't think it would have been like that in the past but definitely at the minute (P017) I liked how you didn't close the door but the door just like, disappeared. I liked that part better than actually closing a door. It was nicer how it just removed itself…because sometimes you want the deep past to just disappear and that's how it felt (P020)	feel like I just go around in circles, like on a roundabout and I don't ever get off that roundabout, where actually I just need to just get off and close the door rather than continuing on that roundabout all the time because it's not healthy for me we've closed the door and the door's gone immense psychological power that you probably wouldn't realise a good metaphor to be able to close the door on things it was kind of like putting it to bed the door just like, disappeared Immensely powerful sometimes you want the deep past to just disappear
4.4	**How many visits to The Timeline might someone who has experienced trauma have?**	
	…maybe two or three (P013) I suppose that depends on the amount of time you are going to spend in each section and whether you could move them through the whole process within one session, so it would be about acknowledging and allowing them to process those xxxxxx in the deep past and the past, looking at the present and being able to move forward to the future, but not leaving them stuck in the deep past to return to another session…making sure they are safe and not exploring lots of difficult things and then going home to then have to come back and relive all those things. It would be ideal if it could be in one session, but you wouldn't want to rush somebody through a process either (P016) …it depends on the severity of the trauma of the individual (P017) I don't think they'd really need loads because it has a really good impact (P020) I think you'd go back loads…(021) I think the closing door part, maybe like three sessions, maybe. But if by the end of a session, or a couple of sessions you were able to close a door on a particular part of The Timeline, and then at the end of the session, so I think realistically seventy minutes is quite a lot of time and its more, I think you get more of a brain chemical affect…I think your brain receptors would work more effectively in the immersive room…I would say two or three sessions might do it you know (P022)	maybe two or three I suppose that depends on the amount of time you are going to spend in each section not leaving them stuck in the deep past it depends on the severity of the trauma I don't think they'd really need loads I think you'd go back loads maybe like three sessions, maybe I would say two or three sessions might do it
4.5	**Are there any limitations with the immersive technology or The Timeline as anything you would change or add?**	
	Just about the grounding and stabilisation (P017)	grounding and stabilisation
4.6	**What age group might use The Timeline in your view?**	
	…when you are thinking about the generations of people…anybody below the age of about fifty to sixty, has an amount of digitalization in their life. Anybody of a younger generation, they are so used to having, erm, an immersive experience when they're watching Netflix or when they're gaming or, when they're Instagramming, so to me it's a natural progression to seek therapeutic help in that way (P022)	so used to having, erm, an immersive experience when they're watching Netflix or when they're gaming
4.7	**It is said that VR technology has potential to revolutionize mental healthcare – what are your thoughts in relation to this statement?**	
	I think that there are lots of things technology can help with and support mental health and, like, the progression of clients in the future, but I don't think that it would work without the support of that human connection. I think that having that support of a human is invaluable and I think that, kind of leaving people to technology, can be quite, disconnected, without that human experience alongside them (P016) I think it could. I think it's brilliant…amazing, erm, and I would definitely like to do it again but like a proper session, you know, where you talk about the actual trauma and closing the door and seeing if it did make a difference which I'm sure it would because I did actually come away and think: That's amazing! And I would like to see it revolutionize healthcare because sitting in a room with a counsellor and just talking all the time, it's not the same, it's nice to be able to, physically feel like you are doing something to help yourself (P020)	lots of things technology can help with and support mental health I don't think that it would work without the support of that human connection support of a human is invaluable disconnected, without that human experience alongside them it's nice to be able to, physically feel like you are doing something to help yourself

Considered Theme 4: Sensemaking	
5.1	**Are there any features of The Timeline that offer opportunity for people to make sense of trauma?**	**CODES LEADING TO THEMES**

	Sometimes I feel that people don't understand where like, maybe traumas, like, come from, so I feel like ==when you are going into your deep past you are opening it up== to like more things that you didn't realise affected you…(P013) I think ==it would help them to kind of understand what they've been through, the enormity of what they've been through==, because when we say it about ourselves we tend to, almost belittle the experience we've had…because it's me I tend to belittle that experience…I have a go at myself and kind of critical of myself…so I definitely think it would help in that respect, just being able to understand it (P014) I think making sense of it is obviously, with the doors and things, when you come to speak about it with the facilitator and obviously you explain that the deep past, gives you that option of whether its an event or a person, then you are going in each door…==it makes you realise, so the trauma happened, then at this point in my life this was me trying to live after the trauma,== then at this point this was me living now, then at this point this is how I'm going to move going forward (P015) I think if a person was in there on their own, they might struggle to make sense of that experience, if it was just purely the VR…making sense, kind of putting pieces together and structuring it in their mind in a way that they can comprehend it and manage it and see it for what it is rather than bits and pieces here and there kind of memories and feelings and bits missing or bits kind of everywhere, but yeah ==The Timeline does structure it== (P016) Definitely, so I liked the Cognition Room that was definitely one of my favourites…'cause you are looking at so many different factors as well, like as well as like looking at like the past experiences because obviously you know how ==your experiences can traumatise you to an extent and then sometimes there's things that you don't realise has traumatised you==, but like, ==you can kind of make sense of them 'cause you can remember them or you can start to put the pieces together==, whereas with the Cognition Room I liked the fact that you look at more than just like the memory itself or that experience, and you start like looking at how you feel about yourself because of it which can then bring out any, core beliefs, which obviously affects yourself and the people and the world around you, the future. I like the fact that ==it addresses stuff that you wouldn't normally think of==, so when I mentioned like to sociocultural side of things, your biology…I just really liked the fact that ==it give you different parts to think about, which helps in terms of like, putting it all to bed== (P017) Yes, because the words were prompted so ==it made the trauma because of the prompted words feel normal==, as in other people experience it so a lot of time you think it's only you that's going through that where actually, the words are telling you that other people are…obviously go through that as well…so you are more likely to discuss it rather than hold it in. I think the room itself and the environment and the pictures…and ==there was a purpose to it==…where sometimes you sit in the room and you are sat in a room and sat opposite somebody else and you don't understand what the purpose is because you don't understand what you want to talk about, where, ==I felt that there was a purpose to the room== (P018) …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) ==I think it helps you make sense because you're actually doing something==, like I just said before, like you are physically stepping forward, touching a wall, so as a person who, you know, sometimes you don't even want to go out your front door, ==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==. I think it's, er, yeah, I don't know if that makes sense (P020) I think ==it kind of puts it into perspective doesn't it?== For me I'm really visual so if I can see it and then it all links to how, ==if it's all linked out in front of me then it would make more sense in my brain==, erm, as to why certain things have happened…that's why I thought them doors and stuff were brilliant…I just felt like the headings were good like the deep past…and it just meant that ==you could separate them into different categories== and then just go back into them if you wanted to but then come back out if you didn't (P021) I think that the cognitive part of The Timeline, I think that's a real opportunity for you to sort of, with a little bit of facilitation, ==help you order your thoughts== around the sort of bits you've already discussed (P022) I think in the way its set out…I think the fact that its got a natural progression so in some ways ==its got a structure==…if there's a structure there it helps you to make sense of things…and I think how an individual uses that structure depends on what kind of sense they can make of it, but I think the structure's there in order for that to happen. This is why timelines are used in therapy because they are so helpful and effective and it helps to give perspective on things that have happened in a particular trauma or in life…it's a really helpful way to be able to do that…so I think ==having that in that way in this immersive way of course it gives opportunity to make sense==… (P023) I think it would ==help them more so differentiate between… the deep past and the recent== to think they've actually moved there in the present, so I think that for me that would really help them understand that this trauma isn't there, just behind them now. It is in their past but it's because they're carrying it, so I think it would be really helpful, to sort of say well this is your deep past here on this wall, this is your recent past and kind of when they come to the present	You are opening it up Help to understand the enormity and what they've been through The Timeline does structure it You can start to put the pieces together Addresses stuff you wouldn't normally think of There was purpose to it It helps you make sense because you are actually doing something If it's all linked out in front of me then it would make more sense …it gives opportunity to make sense Helps you order your thoughts It's got a structure …it's an interactive therapist

	to notice that there is, there's a gap isn't there, there's space. And I think <mark>seeing and experiencing that space between one and then the other, then the other as we travel around the room</mark>, shows them that yeah they may be carrying it but it isn't as close as they think, it's been (P024)	
	How important is reflection to trauma?	
	It's learning… P024	

	Emerging from the codes, building towards themes:	Themes
	- A really visual, different, interactive environment evoking curiosity and is away from everything else - A space that encourages movement, as a process, that carries you and promotes control and choice - The Timeline presents opportunity to visualise and deal with past, present and future, as parts of a person's life, in one setting - Potential to alter the dynamic of the therapist-client relationship - In The Timeline you are visually and haptically interacting with trauma, both verbally talking as well as visually and kinaesthetically connecting with it as a multisensory, therapeutic experience - The Timeline is an active, participatory, through-experience; an active one, not static - The Timeline can be seen as a therapy offering choice and autonomy and personal freedom - The Timeline is a process that offers prompts and cues, to address, compartmentalise and move past trauma - A new way for people who struggle with social interactions to experience therapy - A person-centred, client led experience where the person takes charge and leads their own therapy - Less a passive receiver of treatment, more an active agent - Moving around might literally disperse some of those physiological reactions to the thoughts that are in your head - The Timeline process could require less of a therapist, more a facilitator - The Timeline offers visual metaphors that encourage users to open up about things and opens up a different dimension to therapy – The Timeline: A new dimension to trauma therapy	<mark>Movement and Control</mark> <mark>Actively taking part in a person centred therapeutic process</mark> <mark>Trauma as unfixed; Moving through and past trauma</mark> <mark>Sense making</mark> <mark>Experience of The Timeline</mark> <mark>Movement through a problem not static as a physical experience; a through experience; carrying</mark> <mark>Having control; having choice</mark> <mark>A different relationship with therapist in The Timeline</mark> <mark>Experience of features of the immersive technology</mark> <mark>Making sense of trauma</mark>

AN ENACTIVE SYSTEM IN MENTAL HEALTHCARE

AN ENACTIVE SYSTEM THAT AFFORDS PHYSIOLOGICAL-TECHNOLOGY EMBODIMENT AS A SENSORIMOTOR EXPERIENCE

COGNITION ARISES AND REALITY CREATED THROUGH UNIFIED INTERACTION BETWEEN ORGANISM AND ENVIRONMENT

A DYNAMIC SENSE-MAKING ENVIRONMENT

A INTERACTIVE SETTING WITH TACTILE-HAPTIC FEEDBACK

PARTICIPANT AND ENVIRONMENT ARE COUPLED

MULTI-SENSORY AFFORDANCES WITH DIGITAL INFORMATION APPEALING TO: VISUAL; AUDITORY; KINAESTHETIC