Northumbria University NEWCASTLE

IMMERSIVE ENVIRONMENTS, ENACTIVE SYSTEMS

THE TIMELINE: DESIGNING A DIGITAL EXPERIENTIAL INTERVENTION FOR TRAUMA

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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.

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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.

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

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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

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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.

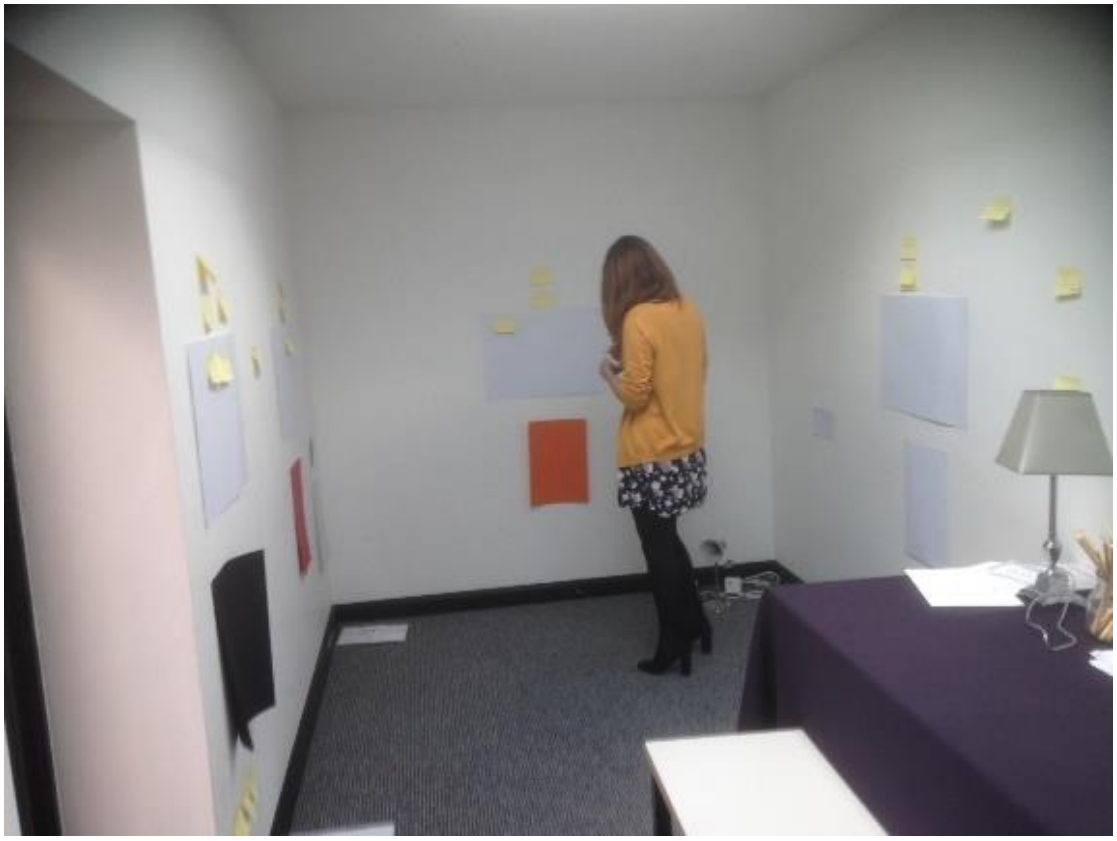

Figure 1: Original Prototype (2018)

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.

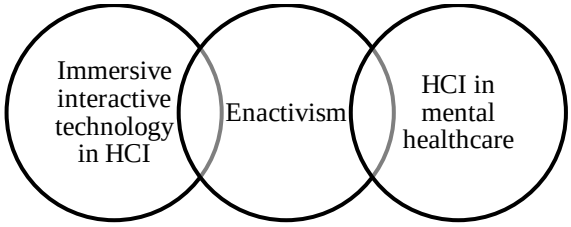

Figure 2:Literature Synthesis

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.

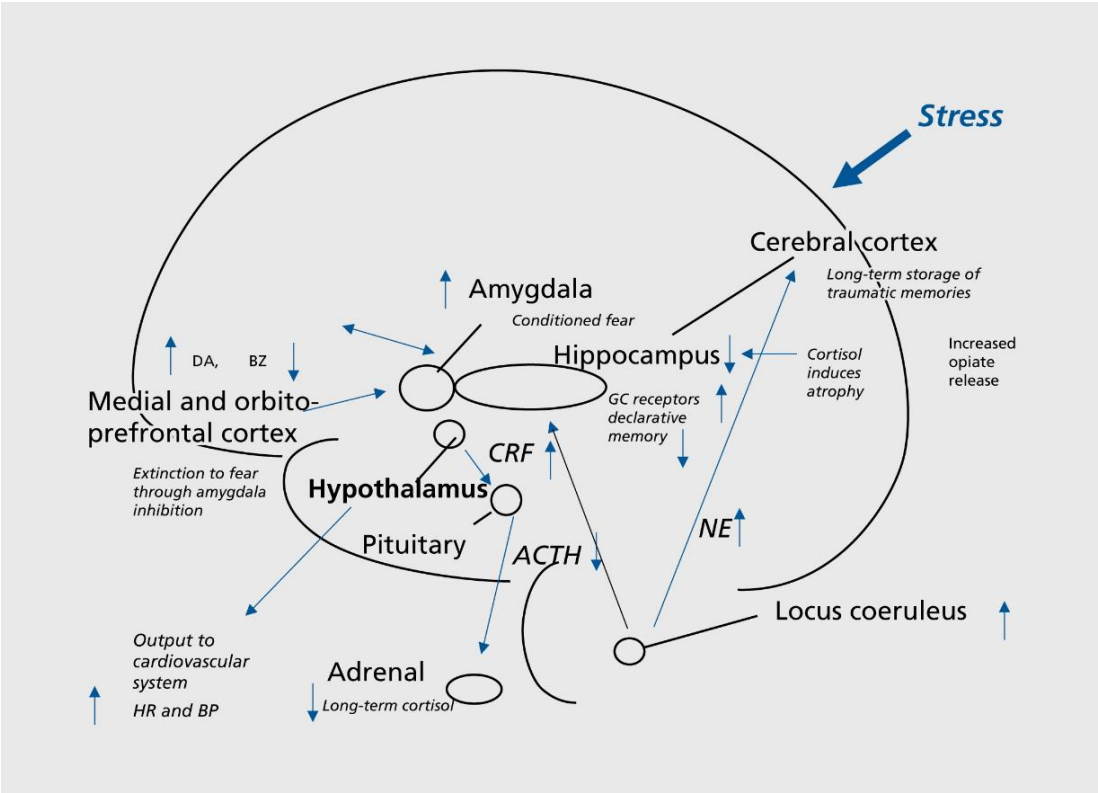

Figure 3: Brain Image (Trauma): Bremner

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).

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[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.

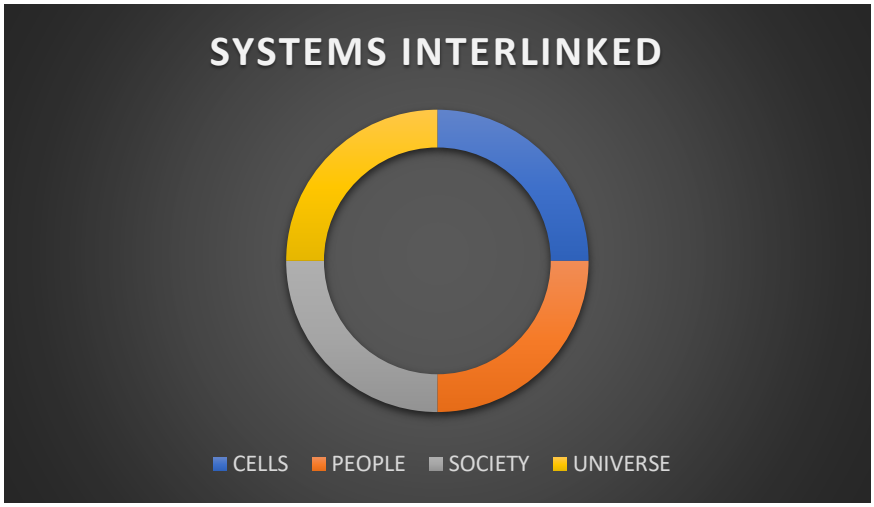

Figure 4: Cells within cells; systems within systems

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)

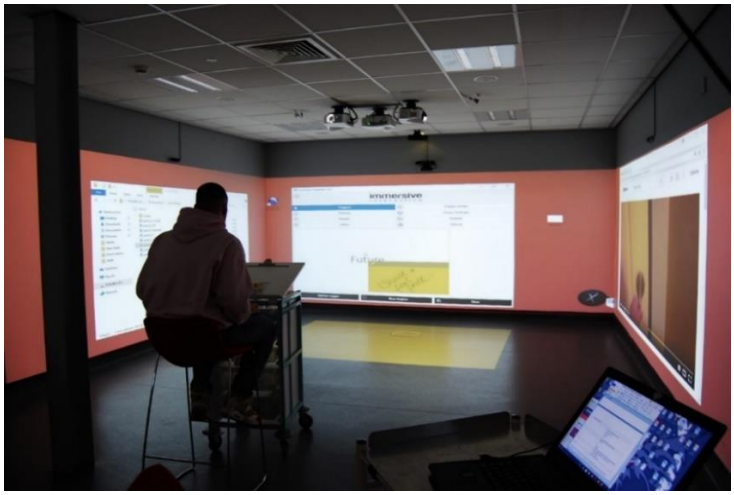

Figure 7: The Immersive Interactive

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:

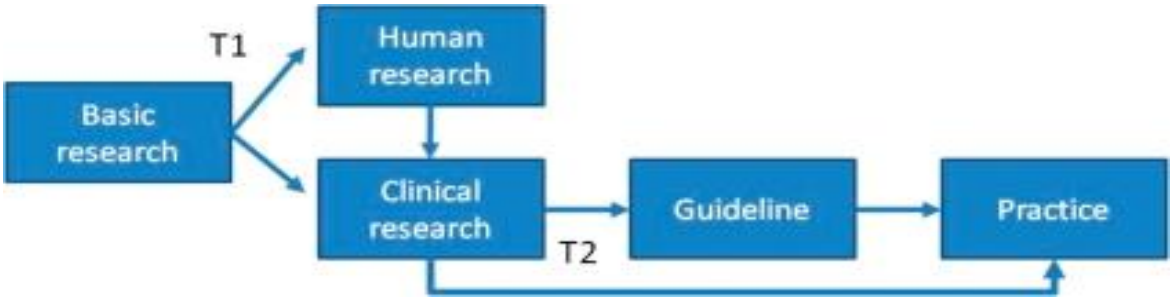

Figure 8: A summary of the translation process. A conceptual model of the journey of health (biomedical) research from research into benefit, as derived from the literature (Morris, Wooding and Grant, 2011: 512)

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 ≠ 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.

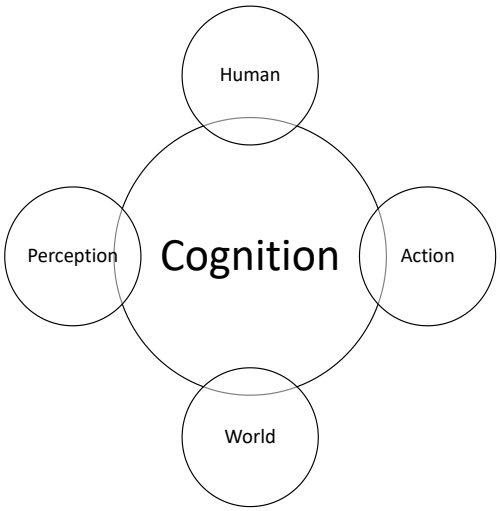

Figure 9: Cognition as resulting from perception and action

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.

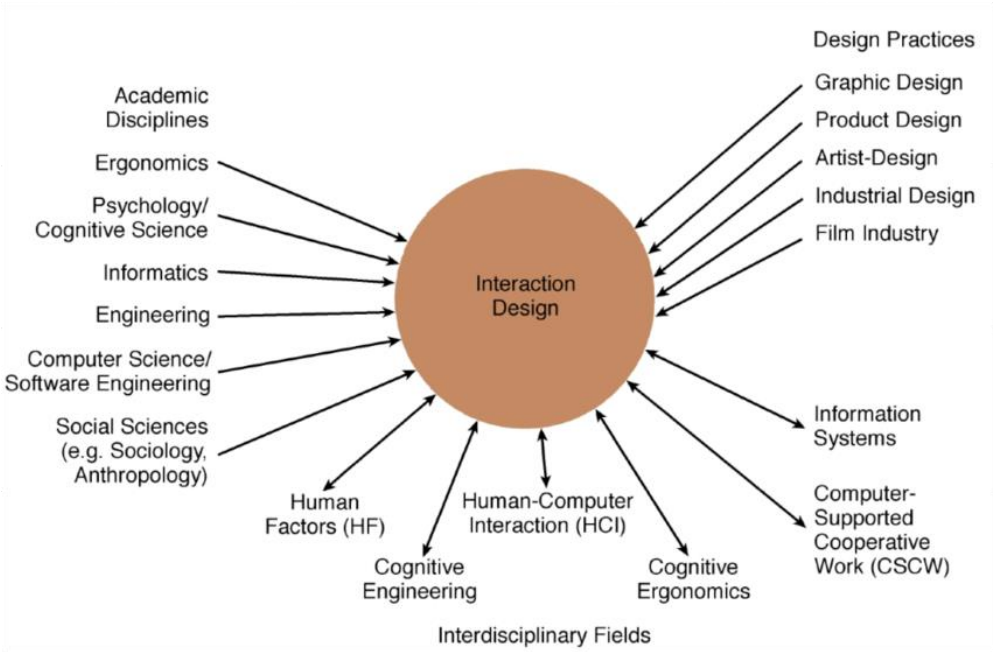

Figure 10: The transdisciplinary nature of interaction design
(Rogers, Sharp, Preece, 2011: 10)

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).

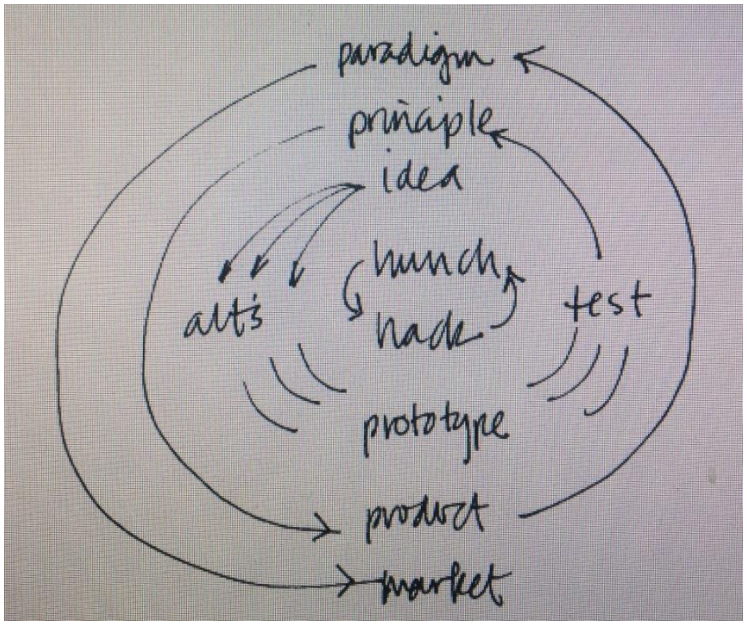

Figure 11: Verplanck's Spiral

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.

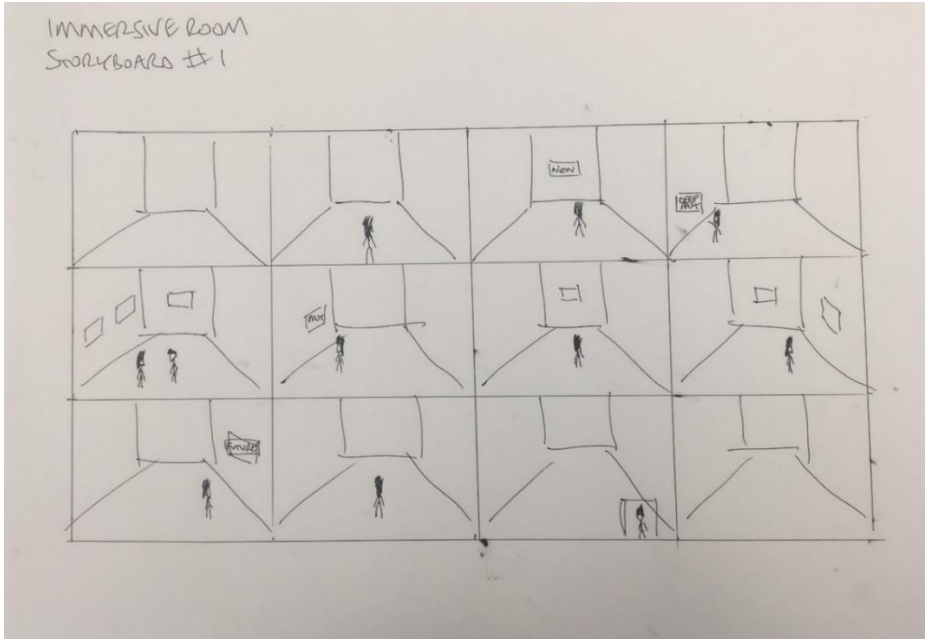

Figure 12: Original Storyboard from Rapid Prototype

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.

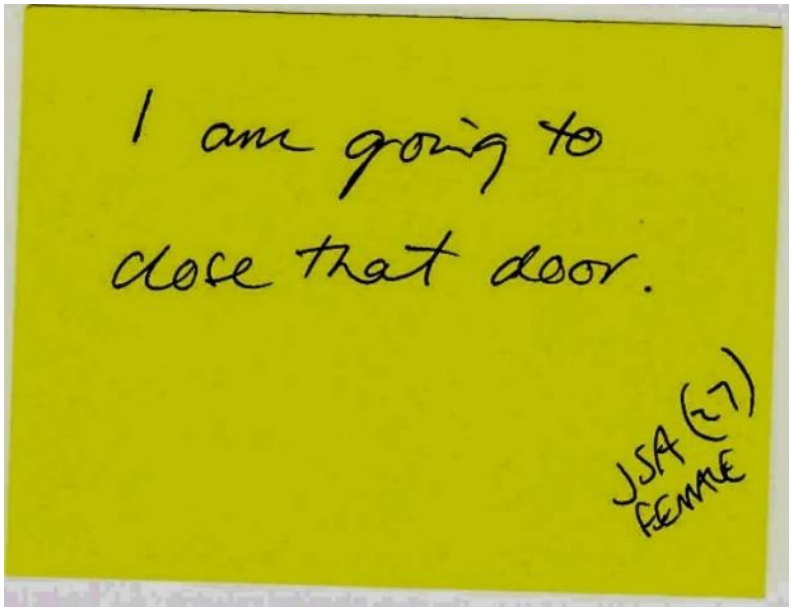

Figure 13: A Jpeg scan of a Post-It note

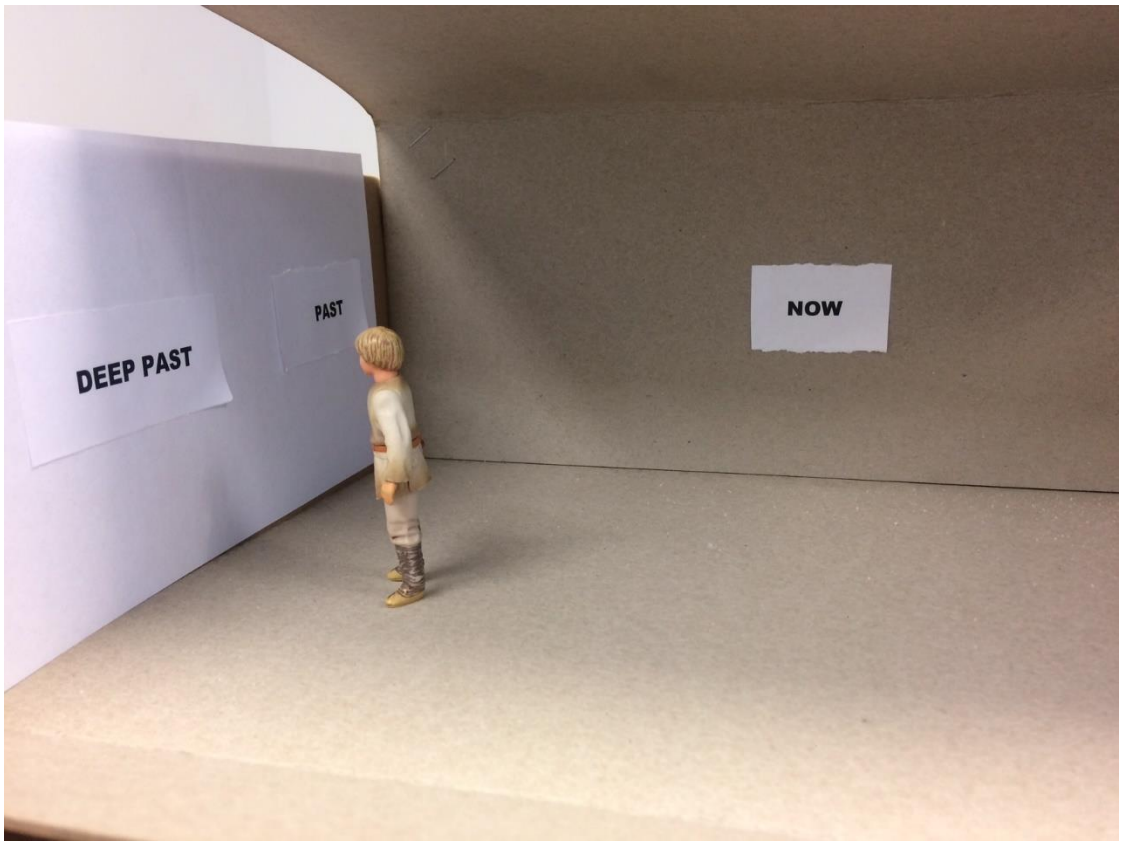

Figure 14: Lo-fidelity prototype model from cardboard show box and plastic figure

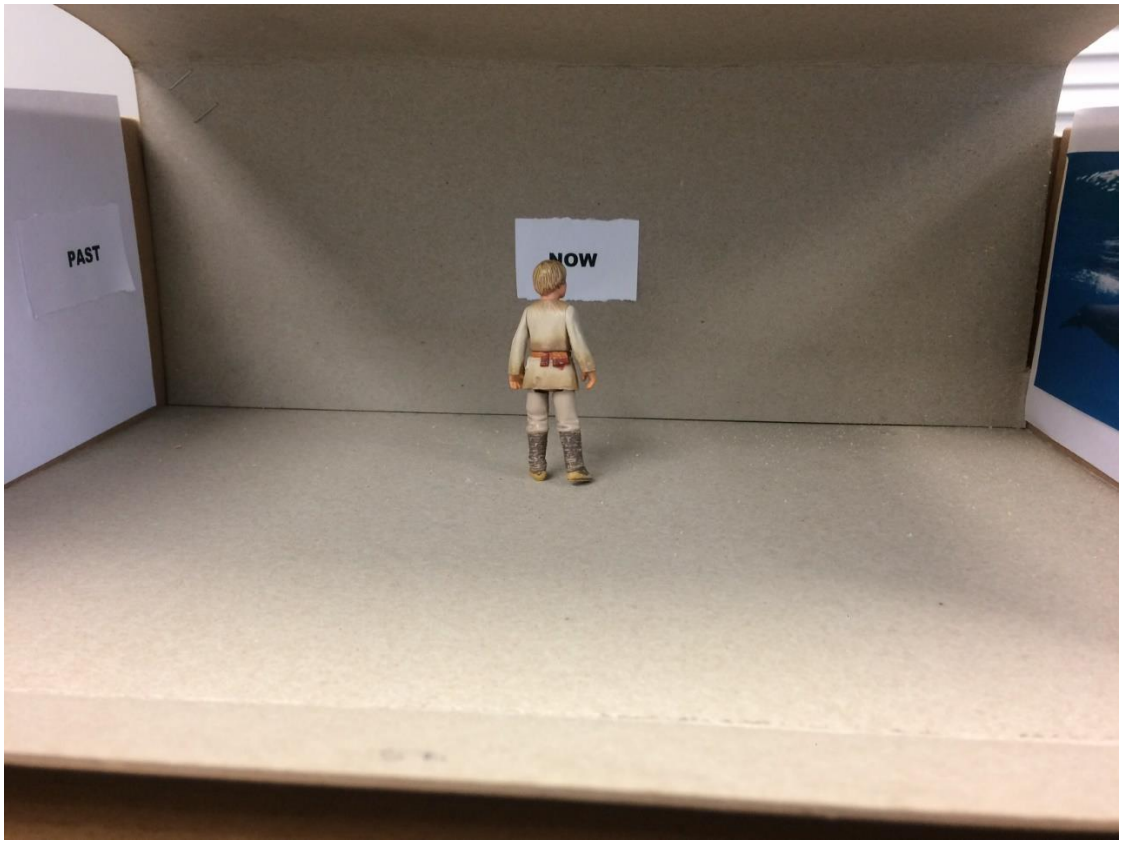

Figure 15: Lo-fidelity prototype model from cardboard show box and plastic figure

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

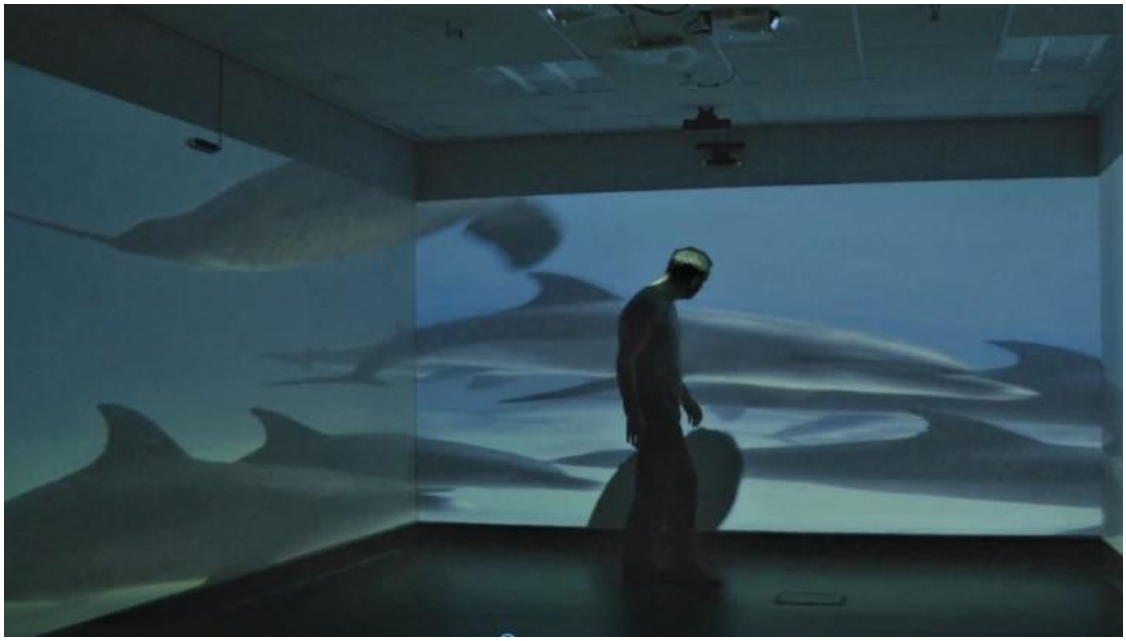

Figure 18: Actor interacting with a panoramic 270 degree video file

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.

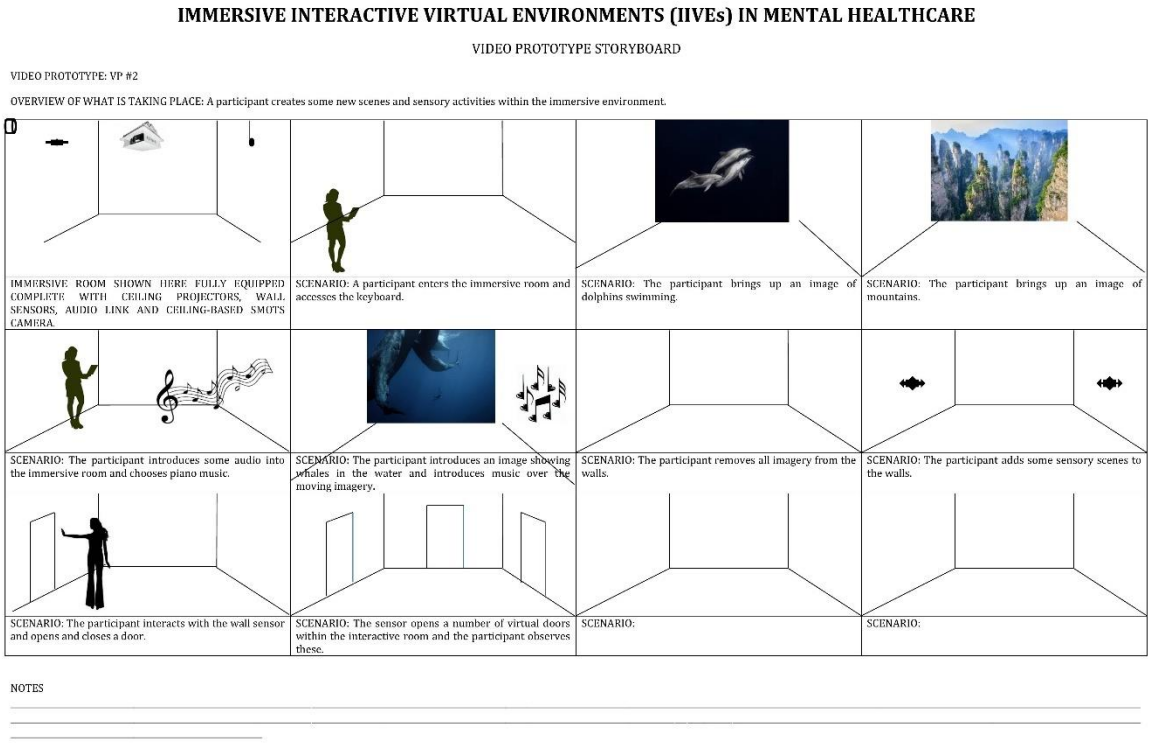

Figure 19: Storyboard (Hi-fidelity model)

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.

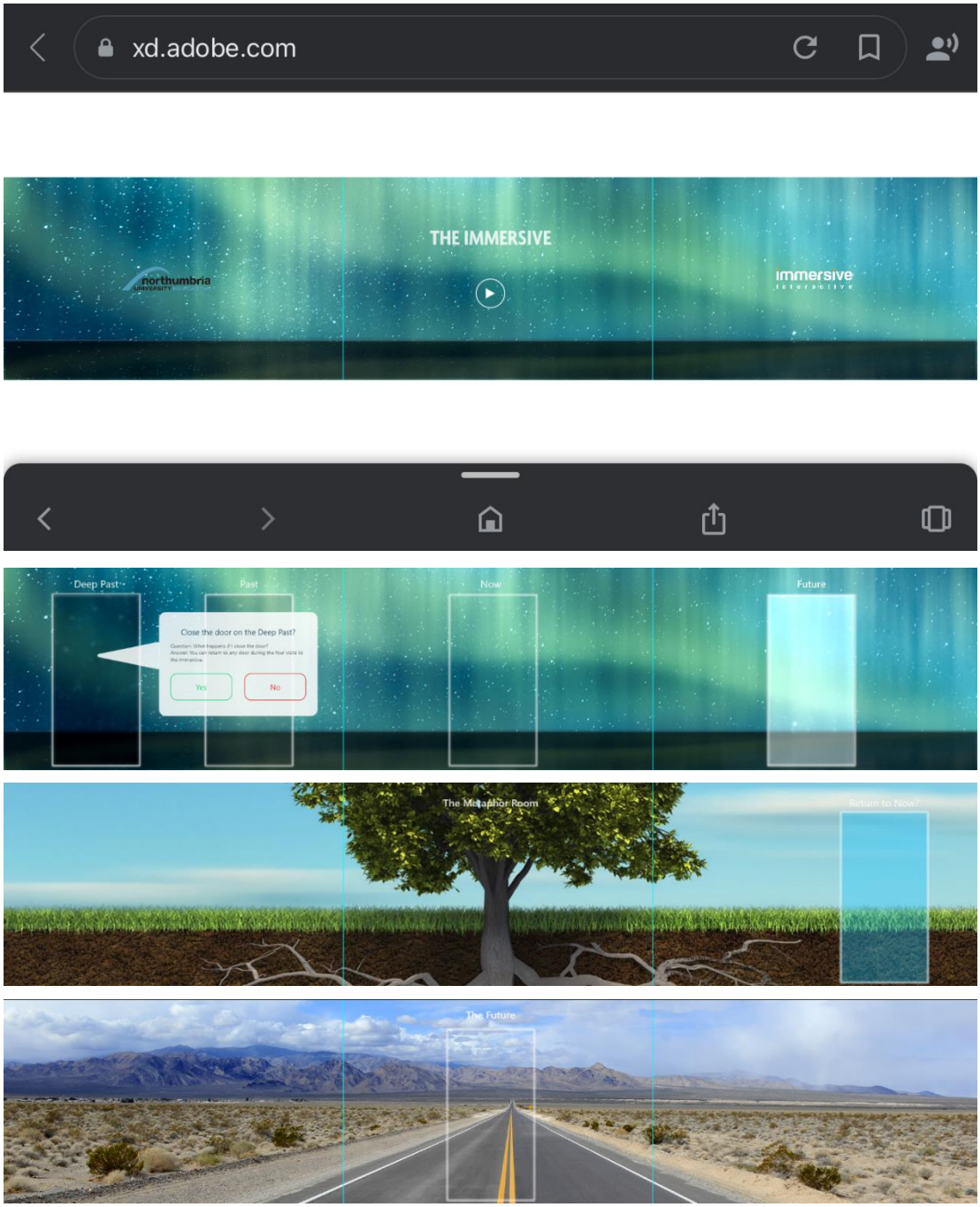

Figure 20: Wireframe imagery created using Adobe XD

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

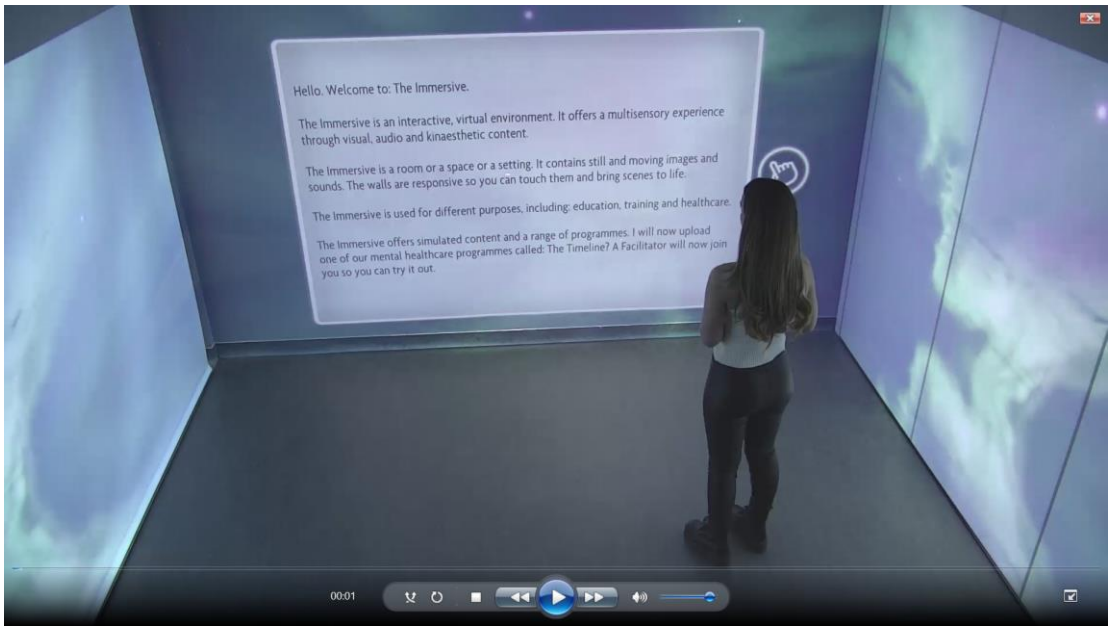

Figure 22: Participant at James Cook Hospital listening to audio instructions

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*

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

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.

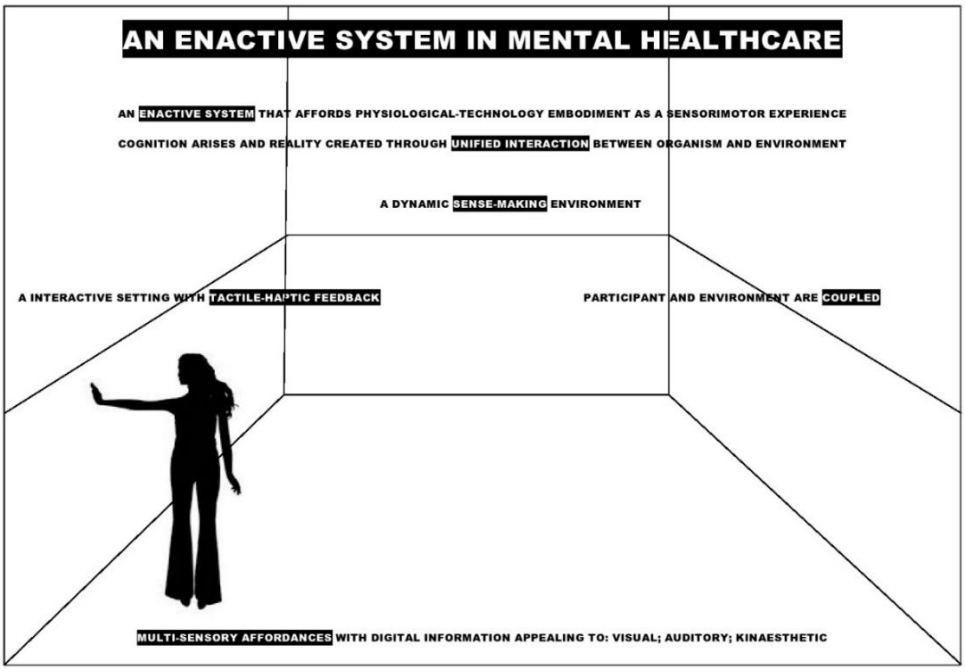

Figure 25: An enactive system

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.

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