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The PENSIEVE: Psychological quasi-Experimental Neural Study of Induction Efficacy of Virtual Environments

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Declaration

I declare that the Master's dissertation, which I hereby submit for the degree MIS (Multimedia) at the University of Pretoria, is my own work and has not been previously submitted by me for a degree at another university.

Signature: Date:

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Adolf Weich Malan

Abstract

Virtual reality contributes to the successful treatment of patients by assisting those who have difficulty with the process of imagining the required visual images needed during psychotherapy. It has been used in tandem with exposure therapy and has been as successful as in vivo exposure therapy in the treatment of various phobias and for trauma. According to SHIP®, a form of psychotherapy that promotes the idea that spontaneous healing is a predominant tendency that emerges from within a person, there are certain necessary activator images that provide an avenue into unconscious trauma material that needs to heal. The purpose of this study is to examine whether a simulated virtual environment can be used as a medium to induce memories through the utilisation of neutral images based on the SHIP® Frame. The door image of the SHIP® Frame will be used during this human-computer interaction (HCI) study to determine whether a virtual environment can serve as a medium during the SHIP® process. Participants will be gathered and divided into two groups: one group will undergo a traditional, imaginal SHIP® session and be tasked with imagining the required visual stimuli while the other group will undergo the virtual induction with the aid of a head mounted display (HMD). A qualitative method approach will be used to determine the level of induction in both groups and identify the helpful aspects in both groups that contributed to the induction. The results of both groups will then be compared to determine how virtual reality could aid as part of an effective therapeutic method and to identify where the technology can be improved in the future.

Keywords

Virtual Reality (VR); neutral images; simulated; virtual; stimuli; imagine; SHIP®; human-computer interaction (HCI); image-creative; neural-visual; head mounted display; HMD; qualitative

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Abbreviations and acronyms

ALS	Advanced Life Support
ANS	autonomic nervous system
AR	augmented reality
AV	augmented virtuality
BVS	Blueprint Visual Scripting
CAVE	Cave Automatic Virtual Environment
CBT	Cognitive Behavioural Therapy
CI	change interview
C-PTSD	complex-PTSD
CV	control variable
DV	dependent variable
EA	experiential avoidance
EBIT	Engineering, Built Environment and IT
EPT	emotional processing theory
ET	exposure therapy
FOV	field-of-view
GUI	graphical user interface
HAT	Helpful Aspects of Therapy
HCI	human-computer interaction
HMD	head-mounted displays
HPCSA	Health Professions Council of South Africa
HTML	HyperText Markup Language
IP	Internet Protocol
IV	independent variable
LIP	Level of Imaginative Potential
MAMP	acronym for macOS; Apache; MySQL or MariaDB; PHP, Perl, or Python
MR	mixed reality
MV	moderator variable
PENSIEVE	Psychological quasi-Experimental Neural Study of Induction Efficacy of Virtual Environments
PHP	Hypertext Preprocessor
PI	primary images
PM	phenomenon map
POV	point-of-view
PSA	public speaking anxiety
PTSD	post-traumatic stress disorder
RCT	randomised clinical trial
SHIP®	Spontaneous Healing Intra-systemic Process®
SHR	spontaneous healing reactions
SI	secondary images
TA	thematic analysis
TSM	trauma-spectrum manifestations
UE4	Unreal Engine 4[.27.2]
VE	virtual environment
VR	virtual reality
VRE	VR exposure
VRET	virtual reality exposure therapy
VRI	Virtual Reality and Interaction
VRISE	VR-induced side effects (VRISE)
VRS	Virtual Reality SHIP®
XR	extended/cross reality

1. Chapter 1: Introduction

Exposure therapy (ET) and **Spontaneous Healing Intra-systemic Process** (SHIP®) are both psychotherapeutic methods that are effective in treating individuals for various psychological disorders and/or **trauma-spectrum manifestations** (TSMs) (J. O. Steenkamp 2018:273–284; Bryant et al. 2019; Levinson et al. 2020). Both these treatments rely heavily on the individual's ability to visualise certain stimuli effectively. If the patient is unable to visualise what the therapist requests them to, the treatment may be less effective, or it might not succeed at all (Friedrich 2016; J. O. Steenkamp 2018:263). **Virtual reality** (VR) could provide a solution to this problem by helping a patient see the required stimuli.

VR has already contributed to the successful treatment of psychotherapeutic patients when used in tandem with ET (Hodges et al. 1995; Donker et al. 2019). This success can be partly attributed to VR's ability to simulate **virtual environments** (VE) through stereoscopic displays that envelop the patient's view (Vienne et al. 2020). These virtual environments are designed for exploration and allow users to manipulate and move objects within the VE as if it were the real world (Riva, Wiederhold & Mantovani 2019). This enables the user to feel present or have the sense of 'being there', which differentiates VR from other traditional media (Høeg et al. 2021; Riva 2022) and can help with therapy by allowing patients to respond naturally to their environment (Wilson & Soranzo 2015; Albakri et al. 2022). There are various studies that have focused on VR and its potential applications and effects in the realm of ET. However, in the realm of SHIP®, research on VR and its potential applications has not received much attention within the scientific community. This lack of knowledge regarding SHIP® and VR motivates this study. Its goal was to investigate whether VR can be used alongside SHIP® to induce the unique memories and responses needed to assist in the process.

1.1. Background

Emotional processing theory (EPT) describes fear as structures in a person's memory that are made up of different stimuli and their connected learned responses. These responses are triggered once the person finds themselves in a dangerous situation and needs to protect themselves (Lang 2016). For example, there are pathological fear structures that distort reality; as a result, these structures consist of extreme responses (Rauch & Foa 2006) and are more resistant to change (Foa & Kozak 1986). Individuals with **post-traumatic stress disorder** (PTSD) and phobias tend to have

such pathological fear structures within their memories. One of the treatments used to change these fear structures is ET, which is the application of EPT (Rauch & Foa 2006).

1.1.1. Exposure therapy

ET works by repeatedly confronting the patient with stimuli that trigger the pathological fear structures that lead to unwanted extreme responses (Rauch & Foa 2006). ET is based on systematic desensitisation therapy, which in turn is based on the classical conditioning principle (Markowitz & Fanselow 2020). During this treatment, the patient tries to replace their unwanted reaction to feared stimuli with a more relaxed reaction. The therapist slowly exposes the patient to higher degrees of the feared stimuli and encourages them to respond with taught relaxation techniques (McLeod 2021b).

Exposure is achieved through either imaginal exposure—where patients are asked to imagine the environment that first caused the trauma, or real-life *in vivo* exposure—where the patient is immersed within the real environment that first caused the trauma (Friedrich 2016); the patient is then given information that goes directly against the pathological elements inside the fear structure (Rauch & Foa 2006). It has been proven that *in vivo* and imaginal ET are effective in the treatment of various psychological disorders (Levinson et al. 2020) and of PTSD (Bryant et al. 2019).

Imaginal ET involves asking the patient to imagine events or recall memories that trigger trauma. However, this method of treatment has some shortfalls:

- Some patients have difficulty with the process of imagining the traumatic events (Friedrich 2016).
- The therapist has less control over whether the patient is visualising the necessary images or stimuli (Beidel et al. 2019).
- It is not guaranteed that the patient will have a realistic or authentic experience that transports them back to the traumatic event to experience it as they did the first time (Beidel et al. 2019).

Research suggests that such shortfalls can lead to unsuccessful treatment (Bryant et al. 2019). This has motivated the use of VR to administer (Beidel et al. 2019), leading to what is termed as virtual reality exposure therapy (VRET) (Friedrich 2016).

1.1.2. Virtual reality exposure therapy

The concept of VRET is based on EPT (Rizzo et al. 2015) and stems from the issue that avoiding a scenario that causes anxiety or triggers a phobia only strengthens the phobia (Riva 2005). In VRET, the therapist uses a simulated **virtual environment** (VE) to continuously confront the patient with the stimuli from which the phobia stems in order to reduce the anxious effect of the stimuli (Riva 2005). In combination with **head-mounted displays** (HMDs) and other technologies, it can be used to control the VE with more precision and accuracy (Friedrich 2016; Beidel et al. 2019), establishing a more realistic and safer environment (Kothgassner et al. 2019). VRET has been successful in the treatment of various psychological disorders (Hodges et al. 1995; Donker et al. 2019), PTSD (Rizzo et al. 2015; Beidel et al. 2019), and patients with autism spectrum disorder (Johnston, Egermann & Kearney 2020).

While ET has been shown to be effective, there are many PTSD patients that do not benefit from it (Foa & Mclean 2015; Markowitz & Fanselow 2020). Another PTSD treatment method, SHIP®, differs from this approach and does not attempt to desensitise a client, but rather attempts to heal the client through completing a frozen traumatic memory (J. O. Steenkamp 2018:253).

1.1.3. Spontaneous Healing Intra-systemic Process (SHIP®)

Developed in South Africa, SHIP® is a psychotherapy for healing pathological fear structures, referred to in SHIP® as trauma-spectrum manifestations or TSMs (J. O. Steenkamp 2018:29–32). The patient undergoing SHIP® treatment is referred to as the 'client' in SHIP® terminology. Similar to ET, SHIP® treatment involves asking the client to imagine events or memories that trigger trauma. The main difference, however, is that SHIP® does not attempt to desensitise a client, but tries to help the client heal through completing a frozen traumatic memory (J. O. Steenkamp 2018:253). TSMs are an integrated SHIP® diagnosis related to trauma (J. O. Steenkamp 2018:33) and rather than continually directly confronting the TSMs, SHIP® concerns itself with generating awareness of internal processes within a client in order to facilitate change by validating those processes (Hoffman & Steyn 2010). The healing and the integration of trauma material has been experientially proven to result in flow—i.e. a state where the client's psychobiological configurations or potentialities are available to them to successfully interact with the external world—and the reciprocal relief from TSMs (J. O. Steenkamp 2018:273–284). As with ET, SHIP® is limited by clients having difficulty imagining the required stimuli, potentially making treatment unsuccessful (J. O. Steenkamp 2018:263).

1.2. Problem statement

As mentioned above, therapy using SHIP® faces obstacles when clients are unable to imagine the required stimuli, which makes healing difficult (J. O. Steenkamp 2018:263). Because both SHIP® and ET rely on an individual's ability to imagine the necessary stimuli, it is reasonable to assume that SHIP® could share other limitations with ET, such as:

- ensuring that the client is in fact imagining the requested stimuli
- ensuring that the client is experiencing a realistic and authentic imagined environment to the same degree that they experienced it the first time.

1.3. Purpose of this study

SHIP® and ET both rely strongly on the client or patient's ability to imagine an event or recall a memory. As stated above, VR has been used in tandem with ET to successfully treat various psychological disorders. At the time of writing, the researcher was not aware of any studies investigating VR working in tandem with SHIP® for psychotherapeutic interventions. This research attempts to address this gap by investigating the efficacy of VR induction and standard induction as mediums for facilitating the SHIP® process, as well as which attributes of the mediums influence their effectiveness, if there are any.

1.4. Significance of this study

The knowledge gained from this study could contribute to the research on VR in a therapeutic environment and serve as a starting point for future research into the potential of combining VR and SHIP® for psychotherapeutic interventions. Research into the application of VR within SHIP® could lead to improved therapeutic treatment within the realm of SHIP®, and contribute valuable insights into VR as a treatment method for other psychotherapeutic treatments. This study could provide a better understanding as to why VR is beneficial to existing VR psychotherapeutic treatments such as ET, and where such interventions can be improved.

1.5. Research questions

The following research questions were used in the research study. Sub-questions were also obtained from the primary research question and were addressed using various sources.

1.5.1. Primary research question

How can a simulated VE stimulate and enhance the participant's image-creative neural-visual facility—i.e. the participant's imagination—to assist participants who find it difficult to imagine the requested images?

1.5.2. Sub-questions

Table 1.1: The sub-questions derived from the primary research question and the sources used to answer each

Question	Description	Source
1. Which specific visual qualities of virtual reality contribute to improving the neural-visual facility of participants?	Uncovering these attributes would motivate whether or not VR could be used in tandem with SHIP® to administer treatment and if they could improve upon traditional methods.	Literature and empirical
2. What effect do simulated environments have on the induction of memories within participants?	To answer this question, the researcher needed to observe how responses to the stimuli simulated within a VE contributed to or hindered the process of SHIP®. The empirical research conducted provided the data to address this question. It was also necessary to review existing literature surrounding VRET systems and their effects on patients to answer this question effectively.	Literature and Empirical
3. How does the induction of memories in participants experiencing a simulated environment compare to the induction of memories when stimuli are imagined?	Two sets of data, one pertaining to the standard SHIP® induction method and the other to a VR SHIP® induction method, were compared to extrapolate insight into the induction memories.	Empirical

1.6. Research design

As the current study required identification and evaluation of factors that bring about certain outcomes, and it was based on observing and assessing objective reality, it falls within the postpositivist paradigm (Creswell & Cresswell 2018:26). The standard design for determining the efficacy of psychotherapeutic treatments is the **randomised clinical trial** (RCT) design (Hoffman & Steyn 2010; Hariton & Locascio 2018; C. J. H. Steenkamp 2018). Therefore, the RCT design was chosen for the current study to evaluate and compare the identified factors between two randomised groups—a Control group and a VR group—with each group consisting of 10 participants. Data was gathered through observation of the subjective experiences of the participants in each of the two groups, meaning that the current study used a qualitative method approach (Welman et al. 2005:6–7; Pickard 2013:16).

The data were collected during the RCT trial using the following data collection techniques (as discussed in Section 3.3):

- observations
- qualitative interviews
- questionnaires.

Even though the focus of the current study was on collecting qualitative data, some quantitative data were also gathered to be integrated with the qualitative data in a joint display, providing additional insight into the phenomenon being researched (Richards et al. 2019). The qualitative data gathered needed to be analysed using appropriate methods such as:

- narrative and discourse analysis (Pickard 2013:269)
- identification of themes (Welman et al. 2005:212)
- constant comparative analysis (Pickard 2013:269–273).

These qualitative methods were applied to the gathered data by means of **thematic analysis** (TA) (Braun & Clarke 2006), an approach that comprises elements of all these methods. This analysis approach helped the researcher identify, investigate, and define themes that reoccurred. It also enabled the researcher to produce a document describing the data gathered and its analysis effectively (Terry et al. 2017:23–33; Nowell et al. 2017; Kiger & Varpio 2020), as shown in Chapter 5, and the main findings of the study, presented in Chapter 6. It is important to emphasise that the focus of the analysis in the current study was on the qualitative data collected, so the quantitative data were not compared or analysed using inferential statistics.

1.7. Limitations

The nature of this study presented various limitations within which the study was carried out. These included:

- the subjectivity of human experiences, which affected the study's implementation
- logistical limitations such as scheduling, session duration, and travelling
- limited generalisability.

1.7.1. Implementation limitations

Individuals experience reality differently, and this subjective nature of the human experience also applies to VR. Therefore, the main limitation of this study was that each VR participant would

experience their VE environment differently, while each Control group participant would experience their traditional intervention differently as well. The study needed to ensure that the VE and imagined stimuli connected with each participant on a personal level, but building a system to simulate unique experiences for each participant would not be feasible within the timeframe of a Master's research study. Instead, a single scenario was chosen that could be simulated for all the participants in the VR group and imagined by the Control group. This scenario had to be specific enough that each of the participants could relate to it on a personal level to elicit a unique response, but not so specific as to hinder the induction of unique memories and unique responses in other participants. To address this limitation, the door image in the SHIP® Frame (as discussed in Section 2.7.4.2) was selected as the chosen stimuli for the study. Each control participant was asked to imagine their name on the door, while VR participants' names were simulated on their doors, to form a unique connection with each participant.

1.7.2. Logistical limitations

Typical SHIP® sessions tend to take up to an hour to complete. However, this was not feasible for a study with 20 participants because of the timeframe of the study, as discussed above. To ensure that all the participants had sessions, the researcher and facilitator scheduled batch days where multiple participants had their sessions in one day. They also organised individual sessions for specific participants that could not attend on the batch days. All of these sessions needed to be significantly shorter than a typical SHIP® session, so a more condensed SHIP® process was administered during each session to gather the necessary data.

Participants had to be able to travel to and from the controlled environment for the study. The University of Pretoria's Virtual Reality and Interaction (VRI) lab provided the ideal location for the sessions to take place. However, SHIP® typically requires a comfortable bed or chair (such as a sofa) for the client to sit in or lie on. Supplying such furniture within the labs proved to be challenging, so the current study was limited to using an air mattress and office chair for the sessions. This limitation led to the facilitator spending extra time ensuring participants' comfort, which leaves room for future research with better furniture options.

1.7.3. Generalisability

The goal of the current study was not to extrapolate the results to a larger population, but only to investigate and gain understanding about the phenomenon being researched and refine the results to add to the existing knowledge for future studies. The focus was on qualitative data, where the sample being investigated is usually small, to assist with analysis that is in depth and case-focused

(Sandelowski 1996; Vasileiou et al. 2018). The current study opted for non-probability sampling—where the probability of a participant being recruited for the sample cannot be specified—so the findings are not generalisable to a larger population.

1.8. Outline of chapters

This chapter has provided an overview of the current study. It introduced the phenomenon being researched and the approach taken. It described the main research method, namely the RCT, along with the method of analysis that led to the main findings of the research, namely TA.

The context of the current study will be examined further in the literature review in Chapter 2, which introduces and discusses the main topics, terms, and theory of the phenomenon being researched. Chapter 3 introduces, defines and discusses the paradigm of the research, as well as the methods of research, data collection, and data analysis. Chapter 4 explains the implementation of the prototype (i.e. the VR system) that was used during the RCT, called the Psychological quasi-Experimental Neural Study of the Induction Efficacy of Virtual Environments, or the PENSIEVE prototype. The chapter details the hardware and software considerations used to induce unique memories and unique responses within participants, and also motivates the choices made. The data gathered during the course of the study is then analysed in Chapter 5, starting with the results from the imagination exercise and how it led to the two randomised groups that were observed during the RCT. Using the data gathered across the various data collection techniques, the results of the RCT are then discussed by identifying and comparing themes through TA. Lastly, each research question is answered in Chapter 6, and a discussion surrounding future research then follows.

2. Chapter 2: Review of literature

2.1. Introduction

This chapter reviews the literature on EPT, ET, VR, and SHIP®. The next section starts by discussing trauma in terms of EPT, the concept of fear structures, PTSD, and how modifying pathological fear structures can help patients overcome various mental disorders. The chapter continues by explaining why mental imagery plays such an important role in psychotherapy today. It defines propositional images and how they are viewed as neural events rather than just images, to bridge the gap between EPT and its practical application in ET.

The chapter then looks at ET. *In vivo* and imaginal treatments are briefly examined as effective treatments for various mental disorders based on the concept of EPT. Following this, the chapter discusses the history of VR in psychotherapy, with a detailed examination of VR systems. Everything that is required for a successful VR experience is described in detail, starting with the history of VR, the five pillars of a successful VR experience, and the hardware required. The chapter defines and explains the concepts of immersion and presence in VR.

A discussion of VRET follows to connect ET with VR. It reviews VR as an effective alternative for both *in vivo* and imaginal exposure. The section concludes with the advantages and disadvantages of administering ET through VR.

The chapter then introduces SHIP® and how it differs from ET. It discusses the SHIP® Frame in detail to highlight the importance of mental imagery within SHIP® and how it relates to other psychotherapeutic treatments that have used VR. Section 2.8 introduces guidelines for designing a SHIP® VR system to assist SHIP® clients during treatment, based on analyses of different VRET systems. Various VRET systems are discussed, focusing on components that could be used within a SHIP® VR system. The chapter concludes by discussing the main problem with ET and why SHIP® has been chosen as psychotherapeutic method to be combined with VR.

2.2. The emotional processing theory (EPT)

EPT expands on the fear structure concept as described by Lang (2016), which describes fear as a representation of structures or a network consisting of various stimuli, and their accompanying reactions and meanings in an individual's memory. These are laid out as an algorithm that works to protect the individual from dangerous situations (Lang, Melamed & Hart 1970; Cooper, Clifton & Feeny 2017; Held et al. 2018; Watkins, Sprang & Rothbaum 2018; Alpert et al. 2021). For example, if a fear structure contains 'a gun' as one of its elements, it could be connected to physiological reactions such as running away, an increase in heart rate, or hiding, or it can derive some meaning such as 'I am going to die' or 'guns are dangerous' (Rauch & Foa 2006; Cooper, Clifton & Feeny 2017). EPT has also suggested that the perceptual processing that took place during the traumatic event was interrupted, leading to the fear-associated memories being more fragmented than other memories, and increasing the likelihood of incorrect connections being formed along with invasive sensory experiences (Cooper, Clifton & Feeny 2017).

The therapeutic aspect of emotional processing takes place when a fear structure is triggered, and information that contradicts what exists in the structure is provided to adjust or correct the existing information (Foa & Kozak 1986; Craske et al. 2012; Bluett, Zoellner & Feeny 2014; Alpert et al. 2021). Bluett et al. (2014) elaborate on three other signals that indicate that emotional processing has occurred:

- The fear structure must be triggered (as discussed in Section 2.2.1).
- The amount of fear experienced during sessions decreases.
- Less fear is experienced at the start of the sessions when exposed to the feared stimuli.

2.2.1. Fear structures

There are normal fear structures and pathological fear structures (Rauch & Foa 2006; Held et al. 2018). Normal fear structures are adaptive, meaning the associations made by a person about certain stimuli reflects reality accurately (Foa, Huppert & Cahill 2006; Watkins, Sprang & Rothbaum 2018). When triggered, a normal fear structure is activated and leads to the person adapting to the situation to steer clear of the danger (Rauch & Foa 2006). For example, if a projectile is thrown towards a person's head, it triggers a fear structure and leads to the person ducking to avoid being hit by the projectile. When an element in an individual's environment matches an element contained within their fear structure, it is set off, and that trigger spreads throughout the structure and evokes all its connected meanings and responses (Rauch & Foa 2006; Held et al. 2018).

Pathological fear structures, on the other hand, distort reality based on the connections made by the person between the stimulus, response, and meaning representations (Rauch & Foa 2006; Held et al. 2018; Watkins, Sprang & Rothbaum 2018). These differ from normal fear structures because the reactions to triggers are far more extreme (Rauch & Foa 2006), and the structures themselves are difficult to change, without any specific explanation as to why (Foa & Kozak 1986). Research suggests that this difficulty stems from the person avoiding situations that might trigger the fear structure on a behavioural and cognitive level (Foa, Huppert & Cahill 2006; Cooper, Clifton & Feeny 2017; Held et al. 2018). This is known as **experiential avoidance** (EA), a reluctance to undergo certain experiences, and involves efforts to avoid such experiences (Ghafoori 2018), which is a common symptom of people with PTSD (as discussed in Section 2.2.2). EA leads to increased anxiety and impedes the functioning of those who suffer from it (Bluett, Zoellner & Feeny 2014; Lobban & Murphy 2018). Individuals who suffer from severe EA might struggle with the following (Ghafoori 2018):

- processing important events, feelings, or data (Greenberg & Pascual-Leone 2006)
- participating in an optimistic therapeutic relationship (Horvath & Bedi 2002:37–69)
- engaging in the methods presented during therapy to confront incorrect information within the fear structure (Beck 1995:6)
- becoming accustomed to stimuli that are present within their fear structure (Craske et al. 2012).

Thus, reality is often also misrepresented in the associations that trigger these extreme reactions (Rauch & Foa 2006). These pathological fear structures are elemental to many anxiety disorders (Foa & Kozak 1986) and each anxiety disorder has elements that are shared with other anxiety disorders (Foa, Huppert & Cahill 2006).

2.2.2. Post-traumatic stress disorder (PTSD)

PTSD is a crippling mental health condition that affects hundreds of millions of individuals every year (Mitchell et al. 2021). It is a mental disorder that often impairs those who suffer from it persistently, and it usually stems from a life event that was traumatic for the individual (Watkins, Sprang & Rothbaum 2018). PTSD is especially persistent when it is expressed along with other disorders that affect an individual's emotions (Mitchell et al. 2021). PTSD originates when a traumatic event (an unconditioned stimulus) connects with the context of the event and the senses involved (the neutral stimulus) and becomes a conditioned stimulus, in such a manner that when the individual is exposed to the previously neutral stimulus, it indirectly triggers the traumatic memory of the event (Cooper, Clifton & Feeny 2017). The traumatic event experienced can be anything from a

natural disaster to sexual assault (Watkins, Sprang & Rothbaum 2018). The fear structure of PTSD encompasses both of the following (Foa & Rothbaum 2001:74):

- overwhelming stimuli accompanied by extreme reactions
- pathological interpretations of the event's significance.

People who suffer from PTSD have at least one fear structure where there is a pathological connection between essentially safe (but trauma-related) memories, in the form of images or situations, and a feeling of danger or of being inept (Rauch & Foa 2006). A hypothetical example of this would be a motorist who has been in a car accident with a speeding blue car: the motorist correctly associates danger with driving their car fast, but incorrectly associates danger with blue cars (Rauch & Foa 2006).

Another example presented by Foa and Rothbaum (2001:76–77) is of a 'gun' connected to a 'bald man' because of a traumatic event suffered by a woman who was raped by a man with no hair. The concept of a pathological trauma memory structure for this rape victim is illustrated below in Figure 2.1, where accurate connections are represented with solid lines and misinterpreted connections with dashed lines (Foa & Rothbaum 2001:76). The model depicts various elements of the pathological trauma memory structure (Foa & Rothbaum 2001:77):

- Excessive responses, such as 'run away', are represented by diamond labels, for example "PTSD symptoms" in the figure.
- Alongside realistic connections, there are incorrect connections that do not represent reality accurately, such as a gun being connected to a bald man.
- These incorrect or flawed connections that have formed have also started to be associated with danger, and as the rape occurred at her home in the suburbs, she feels more threatened at home than before.

The incorrect connections are further connected to the excessive responses associated with PTSD symptoms (Foa & Rothbaum 2001:77), causing the woman to avoid or run away from bald men.

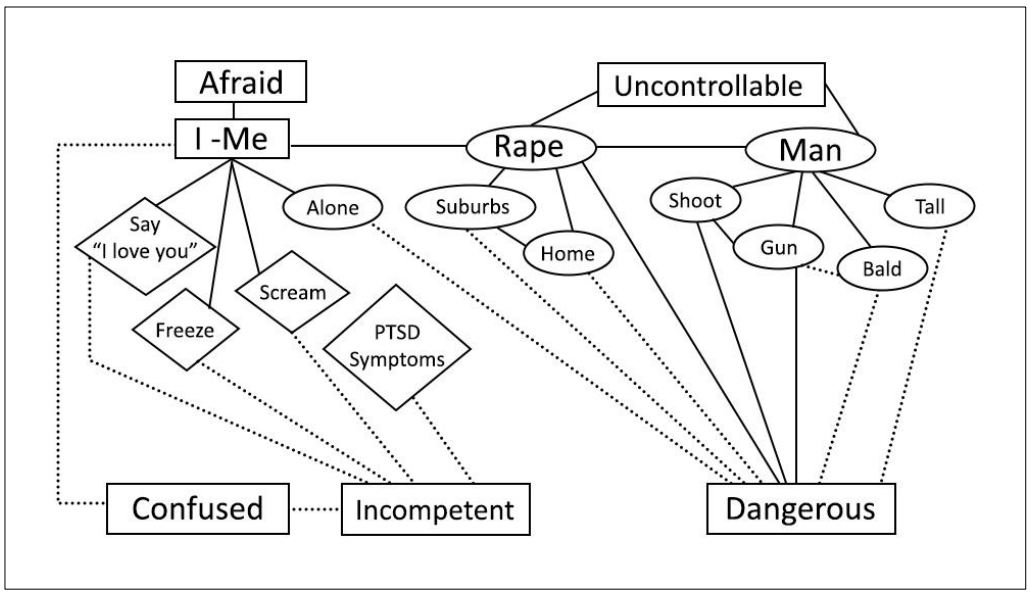

Figure 2.1: Schematic model of pathological rape memory (Foa & Rothbaum 2001:76)

2.2.3. *Modifying the fear structures*

To achieve psychosocial intervention effectively, the pathological elements of the fear structure need to be changed (Foa & Kozak 1986; Held et al. 2018; Watkins, Sprang & Rothbaum 2018). To accomplish this, two conditions must be met (Foa & Kozak 1986; Held et al. 2018; Watkins, Sprang & Rothbaum 2018; Alpert et al. 2021):

- The fear structure must be triggered.
- More realistic information with regards to the triggering element must be integrated into the fear structure to replace the misinterpreted information.

Research suggests that old information competes with new learning when attempts are made to remove or substitute old connections, leading to both new and old information being stored in memory (Bouton 2000; Rescorla 2001:124; Rauch & Foa 2006; Cooper, Clifton & Feeny 2017; Alpert et al. 2021). The context in which the individual finds themselves triggers the specific structure, new or old (Bouton 2000; Rauch & Foa 2006; Foa & Mclean 2015; Markowitz & Fanselow 2020). Because of this reconceptualisation, therapeutic treatment should be changed to occur in various contexts to enhance the possibility that the fear structure gains new associations, which are not pathological, and that these are triggered instead of the old pathological structures (Bouton 2000; Rauch & Foa 2006; Craske et al. 2014; Alpert et al. 2021).

Most trauma survivors correct these pathological elements by engaging in activities that disprove their unrealistic perspectives (Rauch & Foa 2006; Rizzo & Shilling 2017; Cooper, Clifton & Feeny 2017). Generally, the change in a patient happens when the patient explores an experience thoroughly, to re-experience important events and the emotional, behavioural, or motivational

impacts they may have (Wolfe 2002). These events and their elements are then freed up to be reorganised and to alter the patient's perspective (Wolfe 2002). Safran et al. (1991) identify two different models of change behind a certain therapeutic approach, namely top-down and bottom-up.

- **In the top-down model of change**, the focus is on investigating and taking on protocols and ideologies that control the processes that plan emotional and behavioural experiences.
- **In the bottom-up model**, the focus is on evoking a certain emotional experience and amplifying it.

A therapist usually requires both of these models, as patients who use top-down processing in order to start with their therapeutic work may later be able to use bottom-up emotional processing (Wolfe 2002). There are, however, traumatised individuals who actively avoid any activities or even thoughts that might be triggering (Difede & Hoffman 2002; Rauch & Foa 2006; Rizzo & Shilling 2017). Exposure therapy (ET), the practical application of EPT, involves continually confronting these trauma-triggering elements with information that contradicts the pathological elements in the fear structure, thereby improving PTSD symptoms (Rauch & Foa 2006; Held et al. 2018; Watkins, Sprang & Rothbaum 2018).

2.3. Mental imagery in therapy

Mental imagery has had an important and long-standing role to play in the way we understand and treat different conditions that affect our daily lives (Jiang & Greening 2021; Blackwell 2021). Since clinical psychology was conceived, most of the psychotherapeutic methods developed to treat patients have been grounded in exploring and altering mental images (Riva, Molinari & Vincelli 2002). There has been significant evidence to suggest a connection between the physiological responses of a patient and the images perceived during therapy (Lang, Melamed & Hart 1970; Wicken, Keogh & Pearson 2021).

2.3.1. Defining mental imagery

Mental imagery, or our imaginations, can be defined as portrayals of information gathered via our senses and the events and/or memories that go with them, without a direct external stimulus (Rosario 2015; Heotis 2019; Pearson 2019; Blackwell 2021). Mental imagery plays an important part in the manner in which our brain processes events and stimuli and how these events and stimuli are presented within our memories (Heotis 2019). Emotions and experiences can be induced very well by our imaginations, and we can use our imaginations at any time to reproduce traumatic or pleasing events from memory, as well as certain feelings or actions (Rosario 2015). Many psychologists see the description of an imagined image by a patient as the product of the patient processing the image

with no external stimulus (Pearson et al. 2015; Lang 2016; Heotis 2019). This subjective nature of images raises a problem when used in therapy because the patient's previous experience of that image is unique, and therefore the observation of it cannot be shared and the attributes of the image cannot be measured (Lang 2016). This makes it difficult to gain accurate data from the patient's experience of an image in a scientific analysis (Lang 2016), and it can lead to identifying and analysing irrelevant data, making it more difficult to answer the research questions.

To help solve this problem, a researcher needs to decide on a theory for understanding and approaching the concept of mental imagery (for example, bio-informational theory versus depictive theory), and then develop a targeted approach to research the phenomenon. Some research suggests that mental imagery and the subsequent processing of information is mainly propositional, meaning that mental imagery does not only contain information gained via the senses, but also additional information gained through past experiences of the image (Lang 2016; Jiang & Greening 2021). However, there is considerable research to suggest that mental imagery is essentially a visual representation that resembles real life objects but is subject to interpretation (Kosslyn 2005). Before these theories can be examined, the difference between visual mental imagery and visual perception needs to be clarified (Kosslyn 2005):

- **Visual perception** occurs when one is looking at a particular stimulus (Kosslyn, Ganis & Thompson 2001; Kosslyn 2005). This act of 'looking at' includes recognising and identifying what one is 'looking at' (Kosslyn, Ganis & Thompson 2001; Kosslyn 2005).
- **Visual mental imagery** occurs when one sees something without looking at it physically. In other words, they have the experience of looking at a particular stimulus in their imagination, without the required visual sensory input (Kosslyn, Ganis & Thompson 2001; Kosslyn 2005). This induces the experience of "seeing with the mind's eye" (Kosslyn, Ganis & Thompson 2001).

For the purposes of this study, two theories for mental imagery were considered and are discussed next: the bio-informational theory and the depictive theory.

2.3.2. The bio-informational theory

The bio-informational theory claims that mental imagery contains not only the information that was perceived through one's senses, but also conceptual information about the image in the form of **propositions** (Lang 2016). These propositions include relationships, interpretations, and descriptions that are connected to various emotional and physiological responses evoked by the image. Additionally, they pertain to the observer and their unique experience of the image (Lang

2016). Thus, mental imagery is best understood as propositional descriptions, with 'proposition' referring to the assertion that words make when in a specific order (Lang 2016). For example, the sentence "The coat is hanging over the chair" asserts the current whereabouts of the coat. Emotional images have serial narratives, meaning that they are perceived and subsequently processed together with the response elements associated with them in the patient's experience of the image, which is why these images cannot serve as replacements for objective stimuli (Lang 2016). 'Emotional images' refer to mental representations that evoke emotional responses in an individual, i.e. these images consist of stimulus and response elements (Lang 2016). It is not necessarily a 'visual image' in the traditional sense but can refer to various forms of sensory, cognitive, or conceptual constructs that elicit emotions (Lang 2016). During therapy, these emotional images serve as 'enhancers' of sorts for emotions (Wicken, Keogh & Pearson 2021).

Pylyshyn (1973) notes that mental images that have certain characteristics are more a description of an image rather than an actual image, similar to how one would describe perceived external stimuli. Thus, images in this context are not actual 'pictures', but rather ideas that include and depend on mental descriptions, similar to descriptions fundamental to any language (Pylyshyn 1973; Kosslyn, Ganis & Thompson 2001; Kosslyn 2005). A description contains limited information: symbolic characteristics, tangible characteristics (especially when relating to a specific context), and other words or descriptors pertaining to attributes and existing relationships (Pylyshyn 1973). Descriptions in this context are the outcome of perception, not the input for it (Pylyshyn 1973). The subjects' recollections of images can contain more or less detail than such a representation would be able to offer and could also contain interpretations that are not part of the raw depiction (Lang 2016). Images also share a common neurophysiology with neural events (Lang, Melamed & Hart 1970). Thus, an image could take the place of a specific external stimulus and activate the same responses that have been activated in the past (Lang 2016).

The stimuli used in therapy to trigger the responses engrained by the traumatic event are not the neural events themselves (Lang 2016). Instead, they are directives guiding the patient not to respond in their habitual way to the traumatic event, thus changing the perception of how they ought to respond (Lang 2016). Lang (2016) suggests that an emotional image should contain at least two fundamental classes of statements, namely stimulus and response propositions:

- **Stimulus propositions** are descriptions and assertions about stimuli, such as 'the black spider crawls along the wall.'
- **Response propositions** are behavioural assertions, such as 'my hands are shaking.'

2.3.3. The depictive theory

According to the depictive theory, mental imagery (or the imagination) creates a neural portrayal that is a weaker version of what is or was perceived (Kosslyn, Ganis & Thompson 2001). The theory puts forward six prime components that are each a group of processes; each component has a specific method of accepting input and processing it to create some form of output, and each stores data (Kosslyn 2005). The components are described as follows (Kosslyn 2005):

- **The visual buffer** depicts shape much like a pegboard. A group of symbolic codes are situated at each position in the topographically organised buffer, each of which designate or specify information such as colour at that position (Tye 2000:90–93). This buffer is not passive in nature but aims to organise input in different ways.
- **The attention window** assists with processing the wealth of information contained within the visual buffer. It makes it possible to examine entire images without moving one's eyes.
- **The processing of object properties vs spatial properties:** The information within the visual buffer would serve no purpose if it could not be processed, so the information is processed through one of two different avenues. One processes the object's properties, such as colour and texture, whereas the other processes its spatial properties, such as its position relative to other objects in the same space.
- **Associative memory** refers to long-term memory representation that connects the spatial properties with the object properties. This representation is multi-modal in nature, so it doesn't just connect an object to its spatial properties but also any other information such as touch and smell.
- **Information shunting** occurs when one perceives something but cannot quite discern the object immediately. The incomplete connection made to stored representations serves as a kind of theory as to what is being perceived. If some input requires more information, it is sent or "shunted" back to object or spatial processing (see the third point above).
- **Attention-shifting and top-down priming** are the parts of the system that move one's attention to a position where a potential, recognisable part of the perception is located, allowing one to encode it. Parallel to this attention movement is the preparation of the specific part's representation within the object-properties processing system (as discussed in the third point above).

Figure 2.2 (Kosslyn 2005) below illustrates the six major components and how they interact with one another. In summary, this theory posits that to generate a representation or image of an object within the visual buffer, based on the information stored in memory, the brain accesses the portrayal of the object's structure stored in associative memory, and communicates with the object-processing system

to trigger a visual representation of the object (Kosslyn 2005). Because imagery or imagining (as opposed to seeing) uses most of the neural processes that are fundamental to perception, imagery can substitute for a real-life stimulus or event in many ways (Kosslyn, Ganis & Thompson 2001). Evidence shows that imagery of emotional experiences can activate the **autonomic nervous system** (ANS) in the same manner as actually seeing the stimulus in real life (Kosslyn, Ganis & Thompson 2001).

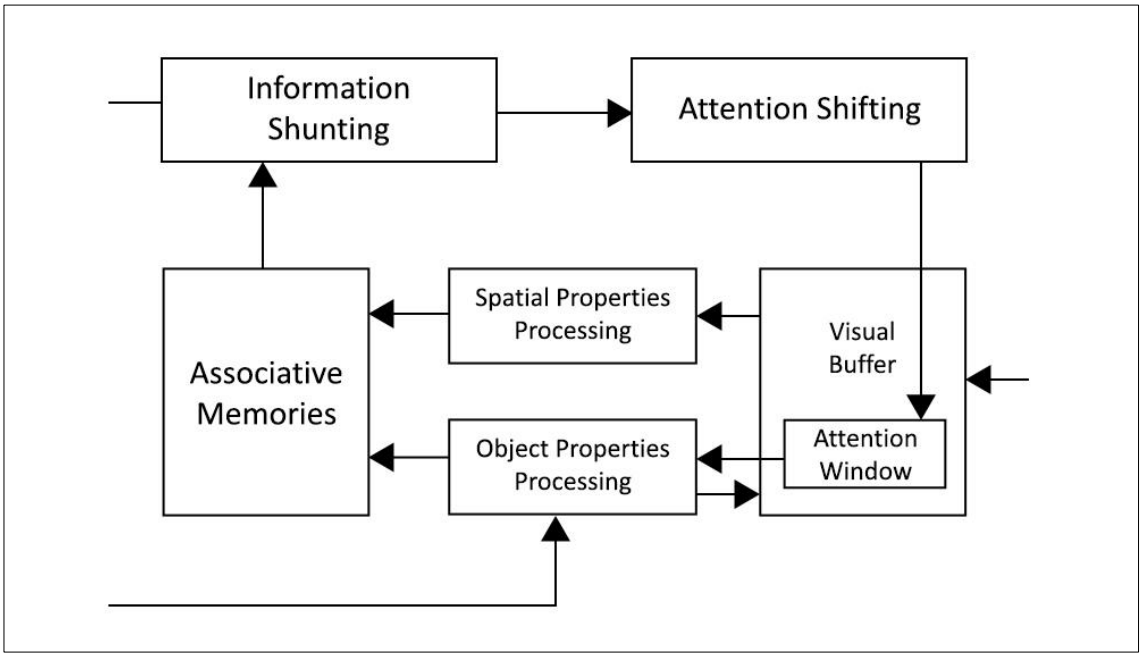

Figure 2.2: The major processing systems posited to be used in visual imagery and later phases of visual perception (Kosslyn 2005)

Both theories of mental imagery acknowledge that it has the potential to evoke emotions in the same way as visual perception (Kosslyn, Ganis & Thompson 2001; Lang 2016; Jiang & Greening 2021). According to neuroimaging research, mental imagery can also help modify emotional responsiveness in the same way that perception does (Jiang & Greening 2021). However, the definition of 'mental image' for the purposes of this study is best explained as "a network of propositional descriptions, each containing appointed responses" as per the bio-informational theory (Lang 2016).

Individuals who are able to imagine more clearly and vividly will most likely be able to create a more affective emotional image (Lang 2016), which will lead to more detailed verbal reporting, more evident motor acts—i.e. physical responses—and more recognisable physiological responses (Lang, Melamed & Hart 1970). However, it is important to note that the external stimulus is not solely responsible for the activation of either the stimulus or response propositions of an emotional image (Lang 2016).

2.4. Cognitive Behavioural Therapies (CBT): Exposure therapy (ET)

Cognitive Behavioural Therapy (CBT) has been proven to be an effective psychological intervention for various mental disorders (Hofmann, Sawyer & Fang 2010; Gautam et al. 2020; Leahy, Clark & Dozois 2023:149). Cognitive behavioural theories were first introduced as a method for treating depression in the 1960s, and have been developed over the years to facilitate the treatment of various mental and emotional disorders (Hofmann, Sawyer & Fang 2010; Gautam et al. 2020; Leahy, Clark & Dozois 2023:149–159). According to Hofmann et al. (2010) CBT is a collection of interventions and not a single treatment, because all the various approaches are similar in key areas (Ellis 1980). One crucial characteristic shared in this collection of interventions is that all of them assume that maladaptive thoughts or behaviours are connected to emotional distress (Hofmann, Sawyer & Fang 2010). When one alters these thoughts or behaviours, one will reduce both the emotional distress and problematic behaviours (Hofmann, Sawyer & Fang 2010). As defined in Chapter 1, ET is a psychotherapeutic treatment that forms part of this CBT collection (Leahy, Clark & Dozois 2023:157) that works by confronting the patient with the stimuli to trigger the specific disorder or unwanted response until the anxiety symptoms have been lessened. The goal is for the stimulus to no longer trigger the specific disorder (Koch, Spates & Himle 2004; Albakri et al. 2022). ET, an exposure-based treatment, is a particular form of CBT that has been proven to be successful in the treatment of various disorders (Olatunji, Cisler & Deacon 2010; Opriş et al. 2012) including the treatment of PTSD (Cooper, Clifton & Feeny 2017; Loucks et al. 2019).

2.4.1. Types of exposure therapy

There are two methods used in ET (Friedrich 2016; Cooper, Clifton & Feeny 2017; Peterson et al. 2018; Loucks et al. 2019):

- ***In vivo*:** The patient is immersed in real life within the environment that first caused the trauma (Friedrich 2016), thereby revisiting scenarios, objects, or people that are safe to be exposed to in reality, but are avoided because of the traumatic experiences related to them (Cooper, Clifton & Feeny 2017; Peterson et al. 2018; Loucks et al. 2019).
- **Imaginal:** The patient imagines the events where fear and trauma are experienced (Friedrich 2016). The patient processes these imagined, traumatic events by repeatedly returning to them, identifying important themes that arise and discussing them (Cooper, Clifton & Feeny 2017; Peterson et al. 2018; Loucks et al. 2019).

2.4.2. Shortfalls of exposure therapy

It has been proven that *in vivo* and imaginal ET are both effective in treating various psychological disorders, such as eating disorders and related fears (Levinson et al. 2020), PTSD (in emergency service personnel) (Bryant et al. 2019), and nightmares (Kunze et al. 2017).

In vivo exposure, however, is not always practical for patients who suffer from PTSD as a result of war, as going back to the location where the trauma first occurred is usually impossible (Friedrich 2016; Beidel et al. 2019). This shortfall of *in vivo* exposure, i.e. the inability to expose oneself to the traumatic events of one's past, can be addressed by imaginal exposure (Friedrich 2016). By creating new connections to the traumatic event experienced, imaginal exposure triggers the fear structure and teaches patients that the scenarios they fear and that are coupled with anxiety do not necessarily result in disastrous outcomes (Levinson et al. 2020). However, there are some shortfalls to imaginal exposure as well:

- Some patients have difficulty with the process of imagining the traumatic event (Friedrich 2016), or they experience discomfort from evoking emotional memories (Bryant et al. 2019).
- The therapist has limited control over whether the patient is visualising the necessary or described images (Beidel et al. 2019).
- The visualised images do not provide all of the same stimuli that were experienced during the traumatic event, such as the sounds and smells that were present at the time (Beidel et al. 2019).

Research suggests that these shortfalls in ET might lead to unsuccessful treatment (Bryant et al. 2019), which lends support for using VRET (Friedrich 2016). In order to overcome these shortfalls, VRET, combined with HMDs and other technologies, can be used to control the VE with more precision and accuracy, and also provide more possibilities in terms of simulating the environment (Friedrich 2016; Beidel et al. 2019).

2.5. Defining virtual reality (VR)

A solid theoretical basis is required to evolve any new discipline, and the same goes for the use of VR in clinical research (Garrett et al. 2018). The exact definition of VR is still being debated, and existing definitions vary from very precise to very broad (Garner 2018:31; Garrett et al. 2018).

For the most part, VR is a growing field, determined by its technology as well as its effects (Garrett et al. 2018). The core of these definitions revolve mostly around VR as an experience of content created digitally via a computer (Garner 2018:31–32). Also mentioned in these definitions, although

less frequently, is the user interaction with three-dimensional environments and/or objects (Dionisio, Burns & Gilbert 2013). VR aims to generate an experience that is immersive and that feels as engaging as reality when an individual is placed within it (Garrett et al. 2018).

The similarities across definitions start to falter when one starts to look at the various display types used for VR as well as the modalities used to provide data to the various senses (Garner 2018:32). According to a review of definitions conducted by Garner (2018:32), there was no definition that directly referenced graphics or visual media, or even provided insight on whether an HMD or multiple screens were a requirement for VR. From a technology perspective, VR is a set of modern technologies that includes display, feedback, interface hardware, tracking technologies and more (Garner 2018:35). The definition of VR goes even further to include similar virtual mediums, such as **augmented reality** (AR), **augmented virtuality** (AV) (Garner 2018:32), **mixed reality** (MR) (Liontas 2021), and **extended/cross reality** (XR) (Liontas 2021; Morimoto et al. 2022). These are defined below.

- **AR** involves overlays or enhancing reality with digital content (Garner 2018:32; Albakri et al. 2022), for example, superimposing virtual dog ears on your head when taking a photo using a smartphone.
- **AV** is basically the opposite of AR, where parts of reality are displayed within a virtual environment (Garner 2018:32).
- **MR** refers to a virtual world intertwined with reality, or in other words, a virtual environment composed out of both computer-generated objects and real-world objects (Liontas 2021).
- **XR** refers to content that uses all modern, upcoming technologies such as VR, AR, or MR (Liontas 2021). It refers to all environments that merge reality and the virtual into an experience, and the human-computer interactions created by both processed human and computer-generated input (Morimoto et al. 2022).

Another perspective that is important to consider when defining VR is that of virtuality or the organisational perspective (Garner 2018:35; Beer 2019). This perspective includes a wider range of ideas surrounding what VR actually is and in some ways contradicts the technological aspects of VR (Garner 2018:35). VR is contained within the virtual, which is a part of reality but is not equivalent to reality (Garner 2018:36; Beer 2019). Virtual and actual are means through which reality exists (Beer 2019). Reality exists in a virtual state when its potential is dormant (Beer 2019). Virtuality finds itself next to its peer 'actuality', and for something to be considered actual it must be managed by a perceiver in the present moment, or what the perceiver discerns to be the present moment (Garner

2018:36; Beer 2019). The conception (or origin) of the virtual can, however, be seen as technological, created from unbiased and palpable components to make it possible for us to experience certain things beyond reality or resembling reality in a semi-realistic way (Garner 2018:39; Beer 2019).

When recognising both the technological and organisational perspectives, VR covers the virtual, the actual, the psychological, and the physical, all at the same time (Garner 2018:39). VR is a dialogue between virtuality and actuality, made possible by reality being rendered into algorithms through a computer, that are in turn rendered to actuality through the interactions of an individual with the computer's simulations (Beer 2019). For the purposes of this study, VR will be considered as a technology that can create environments and situations that resemble reality or any fictitious reality (Albakri et al. 2022), and that is created by a computer (Høeg et al. 2021).

2.5.1. The five pillars of a VR experience

There are four main factors that make up a virtual reality experience, namely a virtual world, with sensory feedback, immersion, and interactivity (Sherman & Craig 2003:6–12; Albakri et al. 2022). Muhanna (2015) adds a fifth pillar to this list, namely participants, as these five pillars are all required for something to be considered VR (Muhanna 2015). Four of these pillars will be briefly discussed below (the virtual world, sensory feedback, interactivity, and participants). Because of the importance of immersion and how it is often confused with presence, it will be discussed separately in more detail in Section 2.5.3.

2.5.1.1. Virtual world

The virtual world refers to the description of objects within a simulated environment (Sherman & Craig 2003:6–7) or, in other words, the environment simulated through computer software (Albakri et al. 2022). This is a non-physical space represented through some technological medium and accompanied by its own set of rules and relationships (Muhanna 2015). Reality can be effectively simulated within the virtual world to such an extent that immersed users are almost unable to tell the difference between reality and the simulation (Botella et al. 2017).

2.5.1.2. Sensory feedback

In addition to the primary visual input, other input and output devices generally accompany the user within the simulated world to improve the overall experience, such as headphones and handheld controllers (de Regt, Barnes & Plangger 2020). This assists with sensory feedback, such as visual and haptic feedback received from the VE based on the user's position (Sherman & Craig 2003:10;

Muhanna 2015; Albakri et al. 2022). This is accomplished using technologies such as position trackers or HMDs (Albakri et al. 2022).

2.5.1.3. Interactivity

VEs are generally designed for exploration and to allow users to manipulate and move objects within them (Riva 2022). Interactivity makes the VE feel real. It can take two forms: how the user can manipulate the VE, and how the VE convinces the user of their manipulation of the world (Albakri et al. 2022). Interactivity means having the potential to change a virtual world and one's perspective inside that virtual world through interacting with it, such as picking up objects or turning around (Sherman & Craig 2003:10–12; Muhanna 2015). Experiences are made to feel more real by enabling the user and VR system to interact in the three-dimensional world, working not only on the visual senses but all the human senses (de Regt, Barnes & Plangger 2020; Høeg et al. 2021; Albakri et al. 2022).

2.5.1.4. Participants

This pillar refers to at least one person being present in the VE and experiencing it (Muhanna 2015). The interactivity pillar is not possible if there is nobody to manipulate or interact with the environment (Muhanna 2015).

2.5.2. VR technology

A headset is needed for most VR systems (Albakri et al. 2022), except for systems that require users to physically enter a VE generated in an entire room (Cruz-neira et al. 1993; Vienne et al. 2020), or VEs that are shown on a conventional flat screen display (Wilson & Soranzo 2015). Each of these systems are unique with regards to the number of screens they use as well as their level of intricacy (Vienne et al. 2020). Generally, a VR system is an assembly of various modern technological devices (Riva 2022) that may include:

- a computer that can simulate three-dimensional environments that a user can interact with
- an HMD
- multiple position trackers
- pointing devices.

The HMDs consist of two screens that are placed in front of the user's eyes (Bird 2020; Vienne et al. 2020). All visual input from the real world is blocked out by the HMD and the user is only able to see the simulated world (Riva 2022). This simulated world is dynamic in nature and is able to adapt the orientation and position of the simulated environment because of sensors within the HMD (Riva

2022). Stereoscopic displays used by VR systems envelop the user's view (Vienne et al. 2020), and the positional and orientation information of the user is provided to the computer by the position trackers to change the images displayed through the HMD in real time (Riva 2005; Riva 2022).

2.5.3. Immersion

From a technical perspective, the immersion provided by a VR system is an objective account of its ability to simulate reality with high levels of fidelity (Wilson & Soranzo 2015). The level of realism, however, does not depend only on immersion (Schnall, Hedge & Weaver 2012), because the degree to which the representation of a stimuli activates a certain response, whether emotional or physiological, also determines the level of realism experienced by the user in the context of research (Wilson & Soranzo 2015). When VR is able to supplant a user's senses with the sensory stimuli of a simulated world generated by a computer, and metaphorically remove users from the real world, then the VR is considered to be immersive (Riva 2022). Immersion within a virtual world has been described in several ways, including:

- **Mental immersion** involves keeping the user mentally engaged with the VE (Albakri et al. 2022), i.e. the state of being engaged within a VE, where one's disbelief is suspended (Sherman & Craig 2003:6).
- **Physical immersion** refers to the body experiencing the stimuli generated by technology (Sherman & Craig 2003:9) and either improves the senses of the user artificially or replaces them (Albakri et al. 2022).
- **Narrative immersion** refers to the level of which an individual becomes involved with the fictional aspects of an experience, its environment, and its characters (Nilsson, Nordahl & Serafin 2016). According to Nilsson et al. (2016) the sense of presence or "being there" should be enhanced through narrative immersion.

A VR system that uses more sophisticated technologies, such as a wide field-of-view and real-time motion capture through an HMD with head tracking, would thus be seen as having a higher level of immersion (Slater 2018). Environments with higher levels of immersion have the following advantages:

- They are more easily remembered by participants (Sutcliffe, Gault & Shin 2005).
- They evoke greater emotional responses (Visch, Tan & Molenaar 2010).
- They are better at inducing the anxiety related to the specific mental disorder of phobia experienced daily or in the past (Kwon, Powell & Chalmers 2013).

The psychological response of a user to a simulated environment can be seen as the degree of presence perceived by the user (Slater et al. 2009; Wilson & Soranzo 2015) and differs from immersion (Slater et al. 2009). In other words, depending on a specific user's state of mind, as well as other factors, different users might experience the same degree of immersion but not the same degree of presence within a VE (Slater et al. 2009; Wilson & Soranzo 2015).

2.5.4. Presence

Predictive coding is a popular framework for comprehending how messages are passed around in our brains (Friston 2012), and suggests that our brains generate a personified simulation of our bodies that predicts our future objectives and emotions (Riva, Wiederhold & Mantovani 2019). This simulation is generated with the goal of projecting what type of sensory inputs we might receive to prevent us from being caught off guard or surprised (Riva, Wiederhold & Mantovani 2019). This simulation consists of two main attributes (Riva, Wiederhold & Mantovani 2019):

- simulated sensory motor experiences that contain autonomic, sensory, and motor information
- simulations that have manifested the specific effect within the brain because they have happened in the past.

Similarly, VR generates a simulated environment within which a user can explore and interact, akin to the real world (Riva, Wiederhold & Mantovani 2019). The VR environment thus tries to predict the sensory inputs and experiences one would experience in the real world (Riva, Wiederhold & Mantovani 2019). The feeling of presence or "being there" is the characteristic that separates VR from other traditional media (Rizzo et al. 2015; Garrett et al. 2018; Høeg et al. 2021; Riva 2022) and can help psychology in different ways (Albakri et al. 2022). Many studies have investigated the notion of presence, as most of the advantages of VR come about because the researcher is able to put a participant into a specific scenario to such a degree that the user feels like they are "there" in reality (Wilson & Soranzo 2015; Botella et al. 2017; Albakri et al. 2022). It is very important that the participant feels a sense of presence to have them respond to situations as naturally as possible. In other words, the level of presence a participant experiences comes from the degree to which they can respond naturally in the VE (Slater et al. 2009; Kober, Kurzmann & Neuper 2012; Wilson & Soranzo 2015). Two dimensions, one dependent on technology and the other dependent on the individual, are thought to add to the sense of presence (Garrett et al. 2018):

- vividness, or the production of an environment that contains stimuli that enrich the senses
- interactivity, or the individual's ability to manipulate the simulated environment and change things through their actions.

Many studies have researched participants' own experiences of presence and the perceived impact it has on the level to which they engage with the VE (Sylaiou et al. 2010; Giannopoulos et al. 2011; Wilson & Soranzo 2015). However, as this notion of presence is still difficult to measure objectively and requires further investigation, subjective measurements remain the primary method (Slater et al. 2009; Kober, Kurzmann & Neuper 2012).

2.6. The use of VR in psychotherapy

The integration of VE with clinical psychology is becoming more common, and numerous systems have been designed to treat patients with various conditions (Riva, Molinari & Vincelli 2002). Over the last two decades, experimental psychology has seen a growth in the use of VR tools, because of the rapid increase in their availability (Wilson & Soranzo 2015). Review papers found more than 50 studies using VR in psychotherapy, ranging from treating phobias such as fear of flying or social interaction, to coping with stress (Gregg & Tarrier 2007; Macey, Macey & Hamari 2022). These studies into VR and mental health go back as early as 1995 (Rothbaum et al. 1995) and show how the use of the technology increased substantially between 1990 and 2007 (Gregg & Tarrier 2007). For example, a study conducted by Hodges et al. (1995) provided findings of the use of VEs to treat patients with acrophobia (the fear of heights) by creating experiences that evoked a fear of heights in a safe VE.

VR can be used at the start of psychotherapeutic treatments to create a stable and comfortable environment for the patient, or it can be used during the course of therapy to assist with the wider process of empowerment (Riva 2005). Literature pertaining to psychology regards empowerment as a construct with many sides, which illustrates the dimensions of what it means to be 'empowered' in a psychological sense (Menon 1999). Empowerment is formulated as a result of the following three dimensions (Menon 1999):

- **Perceived control** refers to one's perception of their capability to make decisions, how they deal with rules, and their work performance.
- **Perceived competence** refers to one's perception of how well they handle various roles and tasks, and manage situations that are routine or impromptu.
- **Goal internalisation** showcases the motivational aspect of a virtuous cause or a vision provided by a leader.

VR is an "empowering environment", a place where patients can begin to explore and investigate without fear (Riva 2005). The things that the patient fears most cannot happen to them in the literal

sense within VR (Botella et al. 1998), which makes it a useful "middleman" between reality and a therapeutical setting such as a therapist's office (Riva 2005).

VR is seen in some literature as an advanced imaginal system (Riva, Molinari & Vincelli 2002), meaning it is an advanced form of visualisation that induces emotions and experiences as effectively as real-world experiences and stimuli (Riva, Wiederhold & Mantovani 2019). In a meta-analysis conducted by Ling et al. (2014), it was shown that presence and anxiety correlate with each other during VR exposure (VRE) treatment for anxiety. This correlation or connection allows for self-reflection to take place to a degree that is both more controllable and easier to anticipate than what is possible in the real world, and also higher than what a patient's recollection and mental imagery capabilities can provide (Riva, Wiederhold & Mantovani 2019; Albakri et al. 2022). Therefore, as a proven effective treatment method, VR could be a preferred alternative to treat certain mental disorders (Albakri et al. 2022).

2.6.1. What is Virtual Reality Exposure Therapy (VRET)?

The concept of VRET stems from the issue that avoiding a scenario that causes anxiety only strengthens the phobia (Riva 2005) and is based on EPT (Rizzo et al. 2015; Kothgassner et al. 2019). Like ET, VRET confronts the patient with the stimuli from which the phobia stems to reduce the anxious effect of the stimuli (Riva 2005; Kothgassner et al. 2019; Eshuis et al. 2021). VRET establishes a realistic, safe environment (similar to an environment in an *in vivo* setting) that is controlled by a trained therapist, with the purpose of inducing emotional, behavioural, and cognitive responses (Kothgassner et al. 2019). VRET fully immerses a patient within this simulated environment and the feared stimuli is generated through moving imagery, sounds, and sometimes through stimulating other senses such as smell (Eshuis et al. 2021).

It is of the utmost importance that a trained psychotherapist is present to facilitate VRET (Kothgassner et al. 2019), and the psychotherapist needs to be able to control the VEs that the patient is experiencing using a **graphical user interface** (GUI) (Brandt 2013:14). For example, a VRET system named *Bravemind* used such an interface to control various settings of the VE (Friedrich 2016). When using *Bravemind*, the psychotherapist and patient do not speak to each other during the session. Through conversation prior to the immersion, the psychotherapist chooses between different settings to construct the best possible VE for that patient (Friedrich 2016). These settings include the intensity of a particular scenario, for example, the loudness of an explosion or gun shots (Friedrich 2016). Thus, VRET relies less on the individual's ability to imagine the required stimuli, and makes it possible to realistically recreate the traumatic event (Eshuis et al. 2021).

2.6.2. VRET as psychotherapeutic treatment

VRET systems have been as successful as *in vivo* (real-life) exposure therapy in the treatment of various phobias (Hodges et al. 1995; Rothbaum et al. 2000; Emmelkamp et al. 2001; Garcia-Palacios et al. 2002; Suied et al. 2013; Donker et al. 2019). They have been used for PTSD in veterans of war or survivors of the World Trade Centre attacks in 2001 (Rizzo et al. 2015; Friedrich 2016; Beidel et al. 2019), for treating stress management and improving relaxation (Villani, Italiano & Riva 2007; Macey, Macey & Hamari 2022), and also within the field of sports psychology to improve skills and communication between teammates (Zinchenko et al. 2011). This was done by associatively recreating and displaying situations experienced by individuals (Friedrich 2016), thus demonstrating that images that carry strong associations to specific memories and emotions can be represented virtually, coded, and controlled to a certain extent (Friedrich 2016). This is made possible by the patient's sensorimotor channels being engaged and stimulated in a VE generated in tandem with the subject's experienced reality (Riva, Molinari & Vincelli 2002; Wilson & Soranzo 2015; Albakri et al. 2022).

The VE provides a new model for interaction where users can participate in the simulated world (North, North & Coble 1995). VEs are able to provide realistic stimuli that can be used to desensitise patients who struggle to imagine the phobic stimuli or who are too afraid or uncomfortable to expose themselves to the real-life situation (North, North & Coble 1995). For example, Johnston, Egermann and Kearney (2020) presented SoundFields, a virtual reality system that used head-tracked binaural-based spatial audio, within a controlled VE, to expose users with autism spectrum disorder to sounds that cause them discomfort in real life. The users in the study reported lower levels of anxiety towards the sounds after four 30-minute sessions with the VR system (Johnston, Egermann & Kearney 2020).

VRET has proved to be an effective alternative to imaginal exposure treatment for PTSD in combat veterans. This was first found when a veteran being treated for PTSD—as a result of fighting in the Vietnam war—was successfully treated through exposure therapy while immersed in a VE (Rothbaum et al. 1999). This was the first study to indicate that PTSD symptoms in veterans can be decreased with the help of VRET (Rothbaum et al. 1999). In a study conducted by Gerardi et al. (2008), a veteran of 29 years old was selected to undergo treatment for trauma experienced from a decade of service in the army. The treatment consisted of immersing the participant, with the help of an HMD, within a simulated Iraq environment (Gerardi et al. 2008). This shortened exposure treatment led to a decrease in reported PTSD symptoms (Gerardi et al. 2008). Not only can these

virtual replications be controlled with more precision than with imaginal exposure, but it is also more cost-effective and can be conducted in therapeutic areas (Riva 2005).

2.6.3. Advantages of VRET

The growth in frequency of the use of VR within the fields of clinical and developmental psychology is largely due to the unlimited ways in which stimuli can be generated within VR (Wilson & Soranzo 2015) and the ability VR provides to optimise the level of control a therapist can have over an experiment while maintaining a high degree of realism with regards to stimuli and interactive scenarios (Pan & Hamilton 2018). Therefore psychotherapists are able to simulate traumatic events with realistic stimuli (Rizzo & Shilling 2017; Matsangidou et al. 2020) that cannot be achieved with *in vivo* exposure therapy, allowing for traumatic triggers to evoke emotions and experiences (Beidel et al. 2019). VR technology has also evolved from mere visual representations to include multimodal sensory inputs such as audio and haptic feedback (Wilson & Soranzo 2015). Researchers are able to control multimodal stimuli through such mediums to increase the user's sense of presence (Bohil, Alicea & Biocca 2011; Wilson & Soranzo 2015; Rizzo & Shilling 2017). This allows for the creation of complex plots with a wide range of response options (Wilson & Soranzo 2015; Pan & Hamilton 2018) to examine complex behaviour traits exhibited by participants in scenarios that would be considered dangerous, unethical, or impossible to recreate *in vivo* (Wilson & Soranzo 2015; Rizzo & Shilling 2017; Pan & Hamilton 2018). Other advantages of VR in this context include the following:

- VR is able to simulate a multi-sensory experience using various input and output devices (Wilson & Soranzo 2015; de Regt, Barnes & Plangger 2020). Even devices that give off a specific smell, such as diesel, can be used to enhance the experience in combat simulations (Beidel et al. 2019), and physical objects in the real world, such as planks or fans, can be used introduce additional stimuli (de Regt, Barnes & Plangger 2020).
- VR supports remote psychotherapy where the therapist and patient are in two different physical locations and are still able to interact in a VE (Matsangidou et al. 2020).
- VR provides a level of anonymity that traditional treatments cannot, which can make the patients feel safer and more likely to share their thoughts and feelings (Matsangidou et al. 2020).
- Behaviours exhibited are more easily measurable by the researchers, and this decreases the reliance on the verbal recount of a participant (Kozlov et al. 2010).

VR assists in treating assumptions more effectively (Riva 2005). It is difficult for people's assumptions to change, partly because they first need to acknowledge the difference between what they perceive and what they assume (Glantz et al. 1997). The therapist can illustrate to a patient an

assumption that has been mistaken for a perception more easily by using the sense of presence within an artificial, realistic VRE (Riva 2005). This was demonstrated in the study conducted by Matsangidou et al. (2020), where participants found it easy to be truthful about their perceptions about their bodies, and subsequently to accept the intervention from the therapist.

A traditional method for studying social interactions is to introduce an individual to a single scenario or object, giving them a few interaction options to choose from, during an uncomplicated mental exercise (Pan & Hamilton 2018)—for example, asking individuals to distinguish different directions of staring from synthesised and manipulated faces (Mareschal, Calder & Clifford 2013). Traditional methods such as these have limitations that have hampered experimental psychologists for years, such as the compromise between the level of control over an experiment and the degree of realism of everyday scenarios (Blascovich et al. 2002; Pan & Hamilton 2018). VR technology bypasses such limitations by providing a higher degree of realism and more complex scenarios with more responsive options (Pan & Hamilton 2018). It also closes the divide between control and realism by allowing users to respond more naturally to stimuli (Schultheis & Rizzo 2001; Wilson & Soranzo 2015; Parsons et al. 2017) and allowing the psychologist to measure these responses (Wilson & Soranzo 2015). In the realm of rehabilitation, this leads to numerous advantages that benefit rehabilitation treatments and the psychological research thereof:

- VE that reflects the real world more accurately, which might allow the users to disregard the fact that they are busy with an experiment and thus be inclined to behave like they normally would (Schultheis & Rizzo 2001).
- The responses are quick, and the researchers can measure them objectively (Schultheis & Rizzo 2001; Bird 2020).
- VR can provide feedback to reinforce and motivate participation (Rutkowski et al. 2020) by engaging the user (Bird 2020) and also leading them through the exercises with "game-like" elements (Schultheis & Rizzo 2001) to improve the quality of their motor performance (Rutkowski et al. 2020).

2.6.4. Disadvantages of VRET

Despite the advantages of using VR, there are some disadvantages as well. Although what the patient sees and hears can be controlled, their psychological and physiological responses to the stimuli cannot (Friedrich 2016). Due to the physical and psychological side effects experienced as a result of exposure to VR, experts may disagree that it is better to have higher immersion levels (Wilson & Soranzo 2015).

VR-induced side effects (VRISE) (Cobb et al. 1999) such as motion sickness are sometimes experienced by users (Murata 2004; Chang, Kim & Yoo 2020). Symptoms of such VR-induced side effects include nausea, vomiting, sweating, and disorientation (Cobb et al. 1999; Kennedy, Drexler & Kennedy 2010). VRISE affects users in different ways, which makes it difficult to identify the problematic aspects and correct them, although advances in the technology have addressed some of those aspects (Wilson & Soranzo 2015). Chang, Kim, and Yoo (2020) note various methods that could help to reduce VRISE in users:

- limiting the span of the environment that is visible to the user, or the field of view
- using dynamic depth of field to lower the visual stimuli, and shifting focus through blurring specific parts of the VE, instead of all the objects having the same depth
- increasing the level of realism of a VE, although this solution has had inconsistent results in easing the negative effects of VR
- simulating a VE with high levels of visual realism, and including multimodal stimuli with high levels of realism, such as auditory stimuli.

Another method to decrease motion sickness is to take breaks when engaging with a VR system, and to interact with the system for a limited time, for example 20 minutes (Bird 2020). The side effects are mild in most cases and generally users overcome them without much difficulty; studies also suggest that users get used to them the more they are exposed to the VR system (Gregg & Tarrier 2007). It is important to note that VRISE such as motion sickness occurs generally as a result of perceived movement (Chang, Kim & Yoo 2020) or moving visual stimuli (Kennedy, Drexler & Kennedy 2010), which can be caused by movement within the VE. As such, VRISE was not expected to be an issue for the current study, as the participants would not undergo any physical movement or be exposed to any moving visual stimuli.

2.7. An overview of SHIP®

The SHIP® Foundation was established in September 2001 in South Africa as a school where psychologists (in the educational, clinical, and counselling fields) who are registered with the Health Professions Council of South Africa (HPCSA) could be trained in the practice of SHIP® Workshops, a continuing professional development accredited workshop (The SHIP Foundation 2018).

2.7.1. An introduction to SHIP®

Spontaneous healing intra-systemic process (SHIP®), a psychotherapy for healing TSMs, promotes the idea that spontaneous healing is a predominant tendency that emerges from within a person (J.

O. Steenkamp 2018:29–32). The therapeutic model of SHIP® is experiential in nature and focuses on cognitive, behavioural, physical, and emotional experiences (S. The SHIP Foundation 2018). It integrates the idea that pain is an experience that includes both body and mind (Sevenster 2007). The goal of the SHIP® process is to facilitate physical as well as emotional healing by addressing symptoms of both (Sevenster 2007). SHIP® uses the client's unique spontaneous process of expressing emotions and physical responses during therapy (Sevenster 2007). As a therapeutic intervention, SHIP® is concerned with generating awareness of internal processes within a client to bring about change by validating those processes (Hoffman & Steyn 2010). In SHIP® language, the role of the psychotherapist is to facilitate this internal spontaneous healing dialogue so that it can move from a state of dysregulation (out of the space of tolerance) to a **state of flow**, i.e. being able to effectively regulate one's autonomic responses to the external world in an orderly manner (Hoffman & Steyn 2010; J. O. Steenkamp 2018:239–261; J. O. Steenkamp 2018:40–44). This flow state of integration of trauma is expected to reciprocally result in relief from TSMs (J. O. Steenkamp 2018:224–239).

2.7.2. Trauma-spectrum manifestations (TSMs)

SHIP® works in accordance with the trauma-spectrum model, which regards all forms of trauma to be situated on a spectrum (C. J. H. Steenkamp 2018). TSM is an integrated SHIP® diagnosis related to trauma (J. O. Steenkamp 2018:33), which encompasses manifestations such as PTSD—that is, reactions to more recent trauma-activating events, and **complex-PTSD** (C-PTSD)—that is, reactions to trauma during the developmental years (J. O. Steenkamp 2018:33). Examples of TSM include anxiety, memory being fractured, the structure of one's personality being compromised, as well as physical symptoms such as headaches (C. J. H. Steenkamp 2018). Trauma that developed due to perceived trauma-activating events occurs when the person experiences an inability to change the intense experience of a disregard-at-the-expense-of-self to a more successful outcome (J. O. Steenkamp 2018:67–68). Internal activation that is brought about by such trauma-activating events is changed into dissociated or on-hold energy (Steenkamp et al. 2012).

In a personal interview conducted on 4 April 2021, Dr Steenkamp likened this inability to alter the ANS's self-regulatory process at that moment to a wave that has completed 70% of its sequence, but the remaining 30% is on hold and still needs to complete its motion; the energy for the remaining 30% is expected to complete but is "hanging in a vacuum state", and this incomplete 30% makes up the trauma (J. O. Steenkamp 2021, personal communication, 4 April).

Trauma is thus defined as an impediment of the ANS (Kieser-Muller 2016). ANS responses that are not allowed to complete their internal motion sequence have a compounded dysregulated effect on the person's flow, and thus provide the potential for eventual manifestation of TSMs (J. O. Steenkamp 2018:40–56). J.O. Steenkamp (2018:177–185) notes many chronic symptoms in the body and how we project our unfulfilled needs onto others as the direct outflow of trauma.

An example would be a client slicing bread in the kitchen when her new husband comes from behind to give her a surprise hug (J. O. Steenkamp 2018:178). Because her previous husband had viciously abused her, she is immediately associatively triggered by this sudden and unexpected touch and she instinctively spins around and stabs her loving husband (J. O. Steenkamp 2018:178).

Trauma does not disappear, and it has the potential of resurfacing its incomplete energy sequence through associative experiences, similar to the example given above, to the trauma-activating event (J. O. Steenkamp 2018:177–185). Trauma-activating associations are normally connected with the original traumatic event in some manner (Steenkamp et al. 2012). If the trauma-activating associations are triggered again, they could stimulate the unfreezing of trauma and present as **spontaneous healing reactions** (SHRs) (Steenkamp et al. 2012). Therefore, when a person is faced with trauma-related associations such as images, thoughts, and other memories, it can connect with the internal trauma and initiate the on-hold energy to move into action to complete the sequence (J. O. Steenkamp 2018:177). The process of triggering an incomplete ANS response and its release journey towards completing its sequence is known in SHIP® language as an SHR (J. O. Steenkamp 2018:185–205).

2.7.3. Spontaneous healing reactions (SHRs)

As psychobiological responses, SHRs are interactive, interconnected energy patterns consisting of the physical, mental, spiritual, and emotional (Kieser-Muller 2016). SHRs are described as trauma-unfreezing, and are a core part of the autonomic regulatory process in an individual's day-to-day experiences and reactions to external events (J. O. Steenkamp 2018:189–190). Through trauma-unfreezing, the previously incomplete wave is brought from its "hanging in a vacuum state" into the present and allowed to complete its motion sequence (J. O. Steenkamp 2018:190–191). These ANS responses encompass typical uncomfortable symptoms of PTSD and C-PTSD (J. O. Steenkamp 2018:190), which include neurological symptoms such as pins and needles and pain in the client's chest (Sevenster 2007). In SHIP® terminology, the role of the psychotherapist is to facilitate a space for this internal spontaneous healing dialogue state in which the client fully experiences the exposed trauma of their past during the SHIP® process (J. O. Steenkamp 2018:224–239). The healing and the

integration of trauma material has been experientially proven to result in flow and the reciprocal relief from TSMs (J. O. Steenkamp 2018:273–284).

Autonomic regulation and criticality are the two components that determine whether or not an individual is in a state of flow (J. O. Steenkamp 2018:40). **Autonomic regulation** refers to the way in which we adapt and respond to the external world, and **criticality** refers to the state of those autonomic responses, i.e. orderly or disorderly (J. O. Steenkamp 2018:40–44). The opening of the natural self-regulatory sequence leads to eventual integration of the trauma and resulting psychobiological flow (J. O. Steenkamp 2018:273–284). One clinical case comes from a 43-year-old client undergoing SHIP® (J. O. Steenkamp 2018:192): the client had a session where her memory opened to when she was seven and her mother would lose control and beat her mercilessly with a stick. The next day, she experienced symptoms, and scheduled an extra session the day after. She arrived at her extra session with a bruised body resembling that of a person who has been physically beaten, which was not the case prior to her session the day before. The psychobiology of the client had protected her all this time by freezing those SHRs and never allowing them to complete. During the initial SHIP® session, the disconnected experiences were facilitated, to start healing the incomplete pain by opening its natural self-regulatory sequence towards eventual integration and flow (J. O. Steenkamp 2018:192).

2.7.4. The SHIP® Frame in practice

Trauma-activating associations, or **activators**, which carry resemblances to the person's traumatic experiences, are at the core of the spontaneous healing process facilitated through SHIP® (J. O. Steenkamp 2018:189–190). The trade-off of psychotherapy, or at least a portion of it, is that to be able to live, one needs to bare their vulnerability (Steenkamp 2010:204). The SHIP® facilitator can select appropriate associations to induce opening of the trauma memory and the subsequent motion completion/healing thereof (J. O. Steenkamp 2018:239). The process of SHIP® requires that clients lie on a bed with their eyes closed and are asked to visualise a particular image and/or memory (J. O. Steenkamp 2018:248–249). The SHIP® Frame is a medium to transport clients to their internal process of spontaneous healing, and is thus an induced activating medium that makes the process of psychotherapy faster (Steenkamp 2010:204). The SHIP® Frame consists of a variety of activators or images used to unmask the vulnerabilities mentioned above. These were selected over 16 years of inductive observation of clients during their SHIP® therapy sessions, finding similarities between clients, cross checking these similarities, and then exploring them in more depth (Steenkamp 2010:204). Therefore, the selected activators were provided by clients who were in their process of spontaneous healing (Steenkamp 2010:204).

Images of the SHIP® Frame contain a wealth of associative information relating to trauma-material and are used primarily as associative activators (Steenkamp 2010:204). Examples of images used are:

- images of artificial objects, such as a door with words such as "Emotions" and "Identity" on the door (Steenkamp 2010:230–246)
- natural images such as a "tunnel" or a "well" (Steenkamp 2010:247–252).

Considering the Frame graphically as seen in Figure 2.3 below (Steenkamp 2010:205), five distinct phases can be observed, each representing a different stage in psychotherapy, with the last step combining the previous four (Steenkamp 2010:205).

The phases indicate how a client will progress throughout the SHIP® journey by starting out with 1st order activators (as discussed below) and then continue step by step through other phases of activators to experience all the trauma-related emotions and feelings that were never allowed to be completed because of the trauma event (Steenkamp 2010:205). Most clients follow the phases in order, from start to finish; however, sometimes clients might skip a phase spontaneously (Steenkamp 2010:205). In the event of this, the client is allowed to complete the phase and then later return to the skipped phase (Steenkamp 2010:205–206). Because the phases were chosen from clients in psychotherapy, the phases are based on and are in accordance with what happened during previous therapy sessions with SHIP® clients, while they were healing, during their SHIP® journey (Steenkamp 2010:204). This means that a client might connect or resonate with an image from a specific phase above another (Steenkamp 2010:206). These phases are beneficial to the process, because the client feels as if their treatment is progressing when they finish a phase and move on to the next one (Steenkamp 2010:206).

Once an emotion or experience within the client gets triggered, it is not necessary to revisit that experience or trigger that emotion again (Steenkamp 2010:206). For example, if the psychotherapist and client are currently busy with the images of phase 3 and the client schedules an emergency appointment because some external or internal stimuli triggered their anxiety, the psychotherapist can just focus on that anxiety and not attempt to trigger the anxiety with the image of phase 3 (Steenkamp 2010:206). The moment the client can connect these feelings to the related trigger, the psychotherapist can proceed onward to the more common trauma activators (Steenkamp 2010:206). These activators are as follows (Steenkamp 2010:206–208):

- **1st order activators:** The client presents a discomfort that already exists and the intrusion that triggered it.

- **2nd order activators:** The psychotherapist uses the data gathered during the Life Sketch, a written description compiled by the client after the initial consultation detailing all of their discomforting and distressing moments remembered (Steenkamp 2010:209), and the images of the different steps to attempt and trigger the client.
- **Testing the limits:** This is done to focus the client's attention on the disconnected feelings that keep eluding the client, because they have started to have neutral responses to the images and therefore distract themselves from the disconnected feelings.

The phases of the funnel depicted in Figure 2.3 are as follows:

- Phase 1: Initial consultation
- Phase 2: The Door
- Phase 3: The Tunnel
- Phase 4: The Well
- Phase 5: Integration

2.7.4.1. Phase 1: Initial consultation

During the initial consultation, it is determined whether or not the client is suited for SHIP® and is willing to commit to SHIP® (Steenkamp 2010:209). During this consultation, the Life Sketch (as mentioned above) is also compiled (Steenkamp 2010:209).

2.7.4.2. Phase 2: The Door

Images contain a wealth of information and are used primarily in this phase as activators, imagined by the clients, to access disconnected memories (Steenkamp 2010:230). The client is asked to lie on a bed with their eyes closed and to imagine a door with different words written on it, such as the words "Emotions" or "Identity" (Steenkamp 2010:230). This door image is used frequently, and the words written on the door can be substituted with any word that is relevant to the client's current state and that might trigger them and help them reconnect with the disconnected emotions (Steenkamp 2010:231–232). The client should experience each image in full, and only once a neutral feeling is experienced in front of the door, should they be allowed to go beyond it (Steenkamp 2010:232).

Once the client 'enters' the door, they must describe the image that realises in front of them and the accompanying feelings (Steenkamp 2010:232). After the client has finished their description, they must imagine themselves sitting down in the middle of the imagined environment with their eyes closed, to surrender all forms of control and experience all the feelings that are being projected

through the imagined images (Steenkamp 2010:232). When the client reaches a feeling of neutrality, the remainder of the imagined environment must be explored (Steenkamp 2010:232). Any and all associations, whether from the past, present or future, must also be identified and acknowledged (Steenkamp 2010:232). The imagined environment must be experienced fully in the end while the client is in a passive state, except for when they verbally describe images and emotions (Steenkamp 2010:232). In doing so, the imagined environment will soon correct itself in such a way that the client can experience it in a positive light (Steenkamp 2010:232).

2.7.4.3. Phase 3: The Tunnel

During this phase, the client is asked to imagine a tunnel they might find in nature (Steenkamp 2010:247). The client is then asked to stand in front of the tunnel and stare into it (Steenkamp 2010:247). The same process is then followed as mentioned above in phase 2. Some clients imagine themselves falling into an abyss or being attacked by a wild animal, while others might imagine the journey as short and pleasant, ending with a light at the end (Steenkamp 2010:247). When the client is in the middle of the tunnel, they must sit down and allow the discomfort to wash over them (Steenkamp 2010:247). Here the 2nd order activators are allowed to connect or are given by the psychotherapist (Steenkamp 2010:249). For example, asking the client to focus on a specific feeling they have described in past sessions or that came up in their Life Sketch, such as the feeling of isolation, is one way of connecting these 2nd order activators. Afterwards, the client is instructed to get up and move towards the other side of the tunnel (Steenkamp 2010:248).

One interesting case involved a client who went to see a SHIP® psychotherapist regarding instances of depression (Steenkamp 2010:248). They were prone to epileptic seizures at their place of work, where they would walk down a long corridor lined with windows (with light piercing through), and also while driving on roads with rows of trees on either side of the road (Steenkamp 2010:248). In both scenarios, the flickering of lights would cause the epileptic seizures (Steenkamp 2010:248). When the client reached the Tunnel phase, they re-experienced their own birth, with the doctor's forceps inflicting incredible pain as they grabbed the client by the head to pull them out (Steenkamp 2010:248). During this birth, people would constantly move past the theatre light, mimicking the flickering lights that result in the epileptic seizures (Steenkamp 2010:248).

Working through this phase, and fully experiencing the pain stemming from their birth, the client was able to cure themselves from epileptic seizures (Steenkamp 2010:248). It should be noted that the general purpose of SHIP® is not to cure physiological disorders such as epilepsy, but rather to

assist the client to fully experience a trauma's physiological and emotional responses that have been kept from them for so long (Steenkamp 2010:248).

2.7.4.4. Phase 4: The Well

This image represents the prenatal phase of being inside one's mother's womb (Steenkamp 2010:250). Some SHIP® clients have prenatal experiences, and in this phase, they are asked to imagine a well (Steenkamp 2010:251). After the image has been imagined, they are asked to look down into the well and describe all the feelings that they experience as well as the image itself (Steenkamp 2010:251). They are then asked to imagine themselves floating down into the well and then the process is similar to that of phase 2—to sit down in the middle of the imagined environment with their eyes closed and experience the image in full (Steenkamp 2010:251). While the client is seated at the bottom of the well, the psychotherapist presents them with the Prenatal phase activator, i.e. imagining being inside the womb of one's mother or being surrounded by one's mother (Steenkamp 2010:251–252). The following is an interaction between Dr Steenkamp (Steenkamp 2010:252) and a client experiencing The Well:

> **Client:** *When I'm in the water* (of the well) *there is an aloneness that saddens me, and there is a shortage of love, of the giving of it and the accepting of it.*
> **JOS (JO Steenkamp):** (once sadness has dissipated) *Focus on being in the water as if inside your mother's womb.*
> **Client**: *It threatens me and makes me very sad that this safe haven I'm experiencing now might explode at any moment. My first reaction is that I cannot breathe—there are feelings of claustrophobia.*
> **JOS:** (when feelings have gone) *Do you experience your mother as near or far?*
> **Client:** *Far.*
> **JOS:** *Tell me the effect of that on you.*
> **Client:** *It goes just like the sea into a blueness that becomes dark where there is nothing; that's how far my mother is—it just hurts if I think of my mother in this context. It feels as if I'm longing for her and she does not understand. It is one-sided. It feels as if I'm burying something in the sand, hiding something from my mother, and if I look what it is, then it is the fact that I love my mother and that I care for her, and that I'm important (cries). It's a golden coin that I'm burying.*

The client was allowed to experience their feelings until they disappeared (Steenkamp 2010:250–252). The coin was discovered again and again until the client was able to experience it in a positive light (Steenkamp 2010:250–252).

2.7.4.5. Phase 5: Integration

During phase 5, phases 1 to 4 are integrated (Steenkamp 2010:253). This means that images selected to be imagined by the client in this phase are chosen with the goal of tying all the remaining traumatic experiences with the incomplete emotions and responses (Steenkamp 2010:253). In this phase, there are three **primary images** (PI ×3) and six **secondary images** (SI ×6) that the client and psychotherapist deals with in the regular frame order of SHIP® (Steenkamp 2010:253). While imagining each of the images, the client must experience everything, feel everything, and describe everything (Steenkamp 2010:253). Once the image has been imagined, any and all feelings evoked by the environment must be experienced in full, and only once the feelings have subsided can the client progress throughout the rest of the imagined environment (Steenkamp 2010:254).

1st Primary image

This is an imagined door with the words "The Road of My Life" written on it. Once the initial feelings have subsided, the client is tasked with focusing on their history and their journey that has brought them to this moment (Steenkamp 2010:253). This is done to experience any feelings that might have been missed during the other phases that might still be keeping the client from being their spontaneous selves (Steenkamp 2010:253). After these feelings have subsided, the client must shift their focus to the future, and they are tasked with the same task as when they were focusing on the past (Steenkamp 2010:253).

If there is still substantial disconnected information after the 1st Primary image, the following Secondary images can be used to assess if it is necessary to re-evaluate all the information gained up to this point in the SHIP® process, or to return to phase 1 of the SHIP® Frame (Steenkamp 2010:254).

The following Secondary images all deal with concept of relinquishing control (Steenkamp 2010:254):

- **1st Secondary image:** The client is asked to imagine themselves at the edge of a cliff (Steenkamp 2010:254). Clients who still have a lot of disconnected emotions will have trouble relinquishing control while imagining this scenario and may feel uncomfortable (Steenkamp 2010:254). Once the imagined environment is fully formed, the client is asked to look down towards the bottom of the cliff and to describe everything that they are experiencing (Steenkamp 2010:254). When the experiences and feelings reach a neutral state, the client is asked to fall forward over the edge of the cliff (Steenkamp 2010:254).

- **2nd Secondary image**: Clients are asked to imagine themselves in the middle of the sea**,** descending towards the seabed, and instructed to describe their experience as they descend (Steenkamp 2010:255). When they have descended to the bottom of the sea, they must sit and experience, with their eyes closed, all the feelings evoked by relinquishing all their control to the sea (Steenkamp 2010:256).
- **3rd Secondary image**: After being instructed that they can breathe under water, the client must imagine and describe all the feelings experienced, as they imagine themselves traveling down a river to a waterfall (Steenkamp 2010:256). The psychotherapist must ensure that the client remains passive and does not take control of the imagined environment (Steenkamp 2010:256). All forms of control need to be relinquished by the time they reach the waterfall, so that they can pass it easily (Steenkamp 2010:256).

2nd Primary image

The client is instructed to imagine a bridge and describe it in detail (Steenkamp 2010:256). When the client has successfully constructed the imagined environment, they are instructed to proceed to the middle of the bridge, look over the edge and explain everything that they are experiencing (Steenkamp 2010:256). Similar to the 1st Primary image**,** they are tasked with sitting in the middle with their eyes closed, and relinquishing control to allow all the feelings and experiences evoked by the imagined environment to wash over them (Steenkamp 2010:256). Once these feelings have subsided, they must first look to the side of the bridge from which they came and think of their past, and then to the side of the bridge to where they are going and think of their future (Steenkamp 2010:257). All focus should be on the feelings experienced while looking at either sides of the bridge (Steenkamp 2010:257). After all the feelings have subsided, they can proceed to the other side of the bridge (Steenkamp 2010:257).

3rd Primary image

The client is asked to imagine a door with the word "Freedom" written on it (Steenkamp 2010:260). Once again, if the psychotherapist deems that there is still substantial disconnected information, they can introduce the following Secondary images to assess the status of the client's SHIP® journey and whether it is necessary to go back to previous phases (Steenkamp 2010:261):

- **4th Secondary image:** The client is asked to imagine stairs that lead downward with the words "My Disconnected Self" written at the top (Steenkamp 2010:261). The psychotherapist asks the client to go down the stairs in order to connect any remaining disconnected feelings (Steenkamp 2010:261).

- **5th Secondary image:** The client is asked to imagine themselves inside a cocoon—the archetypal silkworm projection, where metamorphosis has taken place (Steenkamp 2010:263). The client has themselves gone through a kind of metamorphosis while doing SHIP® and here they must experience all the feelings that are evoked by imagining themselves inside the cocoon as well as emerging from it (Steenkamp 2010:263).
- **6th Secondary image:** When the client reaches this stage, they are expected to be open to the world and to begin exploring the world as their spontaneous self (Steenkamp 2010:263). The client is asked to imagine themselves on a raft in the middle of the ocean (Steenkamp 2010:263). They should describe the journey that they are experiencing when imagining themselves in this situation without taking control of the imagined environment (Steenkamp 2010:264). All physical and emotional responses need to be described (Steenkamp 2010:264).

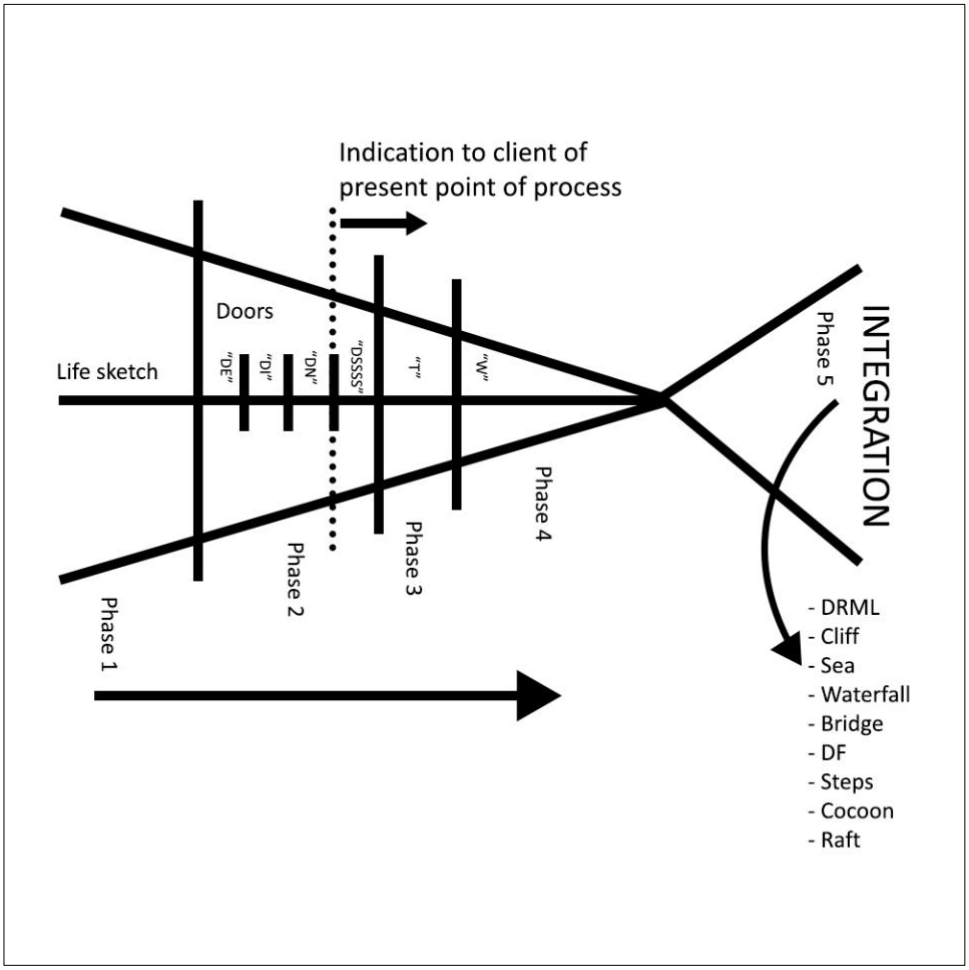

Figure 2.3: The Frame of SHIP® (Steenkamp 2010:205)

2.7.5. The difficulties of SHIP®

SHIP® is not without obstacles, and there are certain factors that could make treatment less effective or even unsuccessful. For example, there are cases where the client is unable to visualise the images requested during the phases. In this event, the psychotherapist has two options (Steenkamp 2010:233):

1. Move on to the next phase: The images that need to be imagined in these phases are more commonly identifiable and might be easier to visualise.
2. Test the limits: Ask the client to imagine hypotheticals of what they suppose a door might look like if they were to picture it.

The other difficulties of SHIP® arise from the manner in which individuals deal with their respective traumas through either the use of coping styles or distractors.

2.7.5.1. Coping styles

Coping styles are meant to regulate an individual's perceived external environment through a particular interpersonal behaviour strategy to protect their psychobiological integrity (J. O. Steenkamp 2018:105). It is the manner in which the individual responds to external trauma-activating associations, adopted as compromised responses, because of the trauma experienced (J. O. Steenkamp 2018:105). For example, a woman with serious trauma stemming from her childhood adopted the Survivor coping style, where she found herself attracting vengeful partners that would end up abusing her and making her feel like her life had no value (J. O. Steenkamp 2018:119–120). She did this because it was the only life that she had ever known (J. O. Steenkamp 2018:119–120).

During SHIP®, it is the psychotherapist's job to facilitate a space in which the client's coping style is neutralised, in order to fully experience their exposed trauma (J. O. Steenkamp 2018:248–250).

2.7.5.2. Distractors

Once coping styles are endangered by information that was disconnected during a traumatic event, distractors come to the fore (Steenkamp 2010:11). The main goal of distractors is to create a safe space for the individual and to preserve their perceived reality in an attempt to protect them (Steenkamp 2010:11). Distractors aim to validate one's perceived reality to allow them to keep responding to the external trauma-activating associations the way they always have and not have to face the corrective information presented to them (Steenkamp 2010:11).

For example, the first distractor that most humans generally fall back on when their perceived realities are threatened by corrective information is anger, since this is the first line of defence when attempting to survive (Steenkamp 2010:11). This keeps the individual from any form of personal growth as their inaccurate perceived reality is preserved through distractors (Steenkamp 2010:11). Individuals choose to activate these distractors even though they might not be aware that they are doing it, because it has become so routine (Steenkamp 2010:11).

Thus, when an individual's coping style is threatened, the distractor steps up; it appears to be impulsive, but this is not the case, as the individual has been conditioned to activate it (Steenkamp 2010:11). If a system is not given the chance to evolve and if it continues to distract the individual from facing the fear within themselves, it will progress into systemic rebellion or chronic systemic stress reactions, causing a situation where a distractor could manifest itself as a heart attack (Steenkamp 2010:12).

The feelings that were denied expression by the trauma-activating event are kept from completion if the client struggles to imagine memories and images freely (J. O. Steenkamp 2018:263). A simulated environment would potentially allow the psychotherapist and the client further access to the client's SHRs that need to be opened as a requisite for further healing. Once the client has experienced relief through such activation, it might lead to an easier internal image activation, since the internal spontaneous healing portal has been opened. A simulated environment could also be used as an additional tool for igniting subsequent layers of spontaneous healing when clients keep struggling to visualise the requested associative images.

2.8. Guidelines for designing a VR system to assist in the SHIP® process

Sections 2.4.2 and 2.6.4 discuss the shortcomings of ET that were rectified by VR to bring about VRET, and through that discussion, the following four adherence criteria have been identified to test whether VR technology could assist in the visual activation of potential clients.

2.8.1. Integration: Hardware

SHIP® clients are asked to imagine images based on the SHIP® Frame, similar to prolonged ET (Kieser-Muller 2016). SHIP® is similar to an immersion technique where they have to immerse themselves into their emotions and symptoms (Kieser-Muller 2016). VRET systems such as the *Bravemind* system mentioned in Section 2.6.1 immerses patients into a controlled, simulated environment using an HMD to expose them to their trauma, forcing them to re-experience it and

breaking down their fear structures, replacing them with what the psychotherapist deems correct perceptions of reality (Hodges et al. 1995; Friedrich 2016).

SHIP® psychotherapy allows the client to immerse themselves within their created fear structures to complete the experience of feelings that were disconnected during the trauma-activating event (J. O. Steenkamp 2018:224). During a SHIP® session, the psychotherapist guides a client through their own uniquely imagined images/environments (J. O. Steenkamp 2018:248–249). The similarities between ET and SHIP® lends credence to the idea that existing VRET systems could be adopted and adjusted for persons who struggle to imagine the required stimuli to assist or substitute for the client's imagination. The following systems are discussed to illustrate how the hardware used in VRET systems can be adopted to design a VR system that assists in the SHIP® process.

2.8.1.1. The virtual Iraq/Afghanistan VRE system

To treat PTSD in combat veterans, a full virtual Iraq/Afghanistan system was developed, with various simulated scenarios such as (Rizzo et al. 2015):

- scenarios where the user would drive a HUMVEE through environments modelled after Iraq, Afghanistan, and the USA
- a middle eastern city that could be explored by walking through the city.

These scenarios were presented to the patient using an HMD and directional 3D audio, with the option of adding stimuli relating to the patient's sense of smell as well as vibrations through touch (Rizzo et al. 2015). All the stimuli could be altered, intensified, or reduced by the clinician using a control panel in real-time (Rizzo et al. 2015). This was an important feature of the system as it allowed the clinician to modify the virtual scenario to suit any specific patient's needs (Rizzo et al. 2015). Drawing from the patient's descriptions, the clinician could change the sound, lighting, gunfire, and explosions to be identical to those descriptions (Rizzo et al. 2015). The clinician would control this through a control panel system that was both flexible and usable (Rizzo et al. 2010).

Figure 2.4: Virtual Iraq city (left), Desert road checkpoint (right) (Rizzo et al. 2015)

2.8.1.2. Sandbox-type public speaking anxiety (PSA) treatment system

This system used a mobile VR platform on the Oculus Go, an affordable HMD that is easy to use by both therapists and users (Lindner et al. 2021). The core environment was that of a person with **public speaking anxiety** (PSA) giving a speech in a room in front of an audience, with the audience consisting of a few avatars (Lindner et al. 2021). The users were able to create their own unique scenario to administer treatment for their PSA (Lindner et al. 2021). Through a user-friendly interface, the users would have control over settings such as the duration of the speech, the mood of the avatars, and the environment, i.e. a boardroom, conference room, or classroom (Lindner et al. 2021). The system would record their speech and head movements so that the user could watch their speech as an objective observer along with the other avatars afterwards (Lindner et al. 2021).

Figure 2.5: Delivering speech in simulated board room in front of avatars (Lindner et al. 2021)

2.8.1.3. VR as therapy tool for paediatric neurorehabilitation

This system was developed to assist in rehabilitating children with a neuromotor impairment (Ammann-Reiffer, Kläy & Keller 2022). The VE that served as the rehabilitation setting was developed using the Unity game engine and took the form of a magical forest (as illustrated in Figure 2.6) (Ammann-Reiffer, Kläy & Keller 2022). This magical forest created a peaceful environment for the children that enabled them to focus on their tasks and represented a scenario that is not necessarily accessible to many patients because of their physical condition (Ammann-Reiffer, Kläy & Keller 2022). This VE was experienced through an HMD that could track a user's hands as well as their position within a room (Ammann-Reiffer, Kläy & Keller 2022). The children would have to complete tasks within the VE to assist their rehabilitation (Ammann-Reiffer, Kläy & Keller 2022). These tasks included stepping over different obstacles, such as rocks and roots of trees; opening and closing a door of a hut; and gathering pieces of candy from a magic tree to feed to a badger (Ammann-Reiffer, Kläy & Keller 2022). The environment was designed so that the objects that the user had to interact with would grab their attention, while other features of the environment, such as the hills and trees, did not necessarily grab any attention (Ammann-Reiffer, Kläy & Keller 2022).

Figure 2.6: A virtual environment with (A) a magic forest, (B) the orientation game, (C) the apple game, and (D) the scoring game. (Ammann-Reiffer, Kläy & Keller 2022)

The systems described above used HMDs to immerse the users in the VE to treat them for various mental and physical disorders. A SHIP® VR system would also be able to use an HMD to immerse the client in a VE where the required stimuli could be simulated effectively. A SHIP® system would also have to be controlled by a simple, user-friendly interface similar to the one discussed above.

However, the client would not be the one interacting with the system, and they would have to be guided through the VE through a similar user interface to the one used in the Iraq/Afghanistan system. This interface would have to be user-friendly, with basic controls such as starting and ending the simulation to ensure that therapists with little to no experience with VR could successfully control the VE with minimal training (Lindner et al. 2021). The various phases mentioned in the SHIP® frame (as discussed in Section 2.7.4) can be pre-defined scenarios, such as those designed for the Iraq/Afghanistan system, so that the therapist can switch between them as they deem necessary. As discussed above in Section 2.8.1.3 (about using VR as a therapy tool for neurorehabilitation), an Oculus Quest 1 was used to make an otherwise inaccessible environment accessible to patients with physical impairments (Ammann-Reiffer, Kläy & Keller 2022). The various SHIP® phases are in the same sense inaccessible to clients who find it difficult to imagine certain stimuli, and therefore an HMD would make it possible for clients to experience these phases effectively.

2.8.2. Induction

Both SHIP® and VRET use visual associative triggers as disrupting activators within a simulated/imagined environment to induce the trauma state of dissociation in the client (J. O. Steenkamp 2018:248–249). There are various VRET systems that use a simulated environment to trigger these activators. The following discussions of VRET systems show how VR characteristics and features can be used to introduce the required activators in a simulated environment to assist in the SHIP® process.

2.8.2.1. Virtual environments and disrupting activators for the treatment of acrophobia

Created by Nabukenya et al. (2021), the system consisted of four bridges built between two towers. This environment was accessible to the user through an HMD, and aimed to expose the user to various height scenarios that could cause anxiety (Nabukenya et al. 2021). The task given to the user was to enter the elevator at the base level of the tower, go up to a bridge height of their choosing, and then cross the bridge to the other tower, as shown in Figure 2.7 below (Nabukenya et al. 2021). The users were also able to select the material of the bridge to either increase or decrease their level of discomfort (Nabukenya et al. 2021). The texture of the bridge could be felt by special shoes designed to provide haptic feedback to the user.

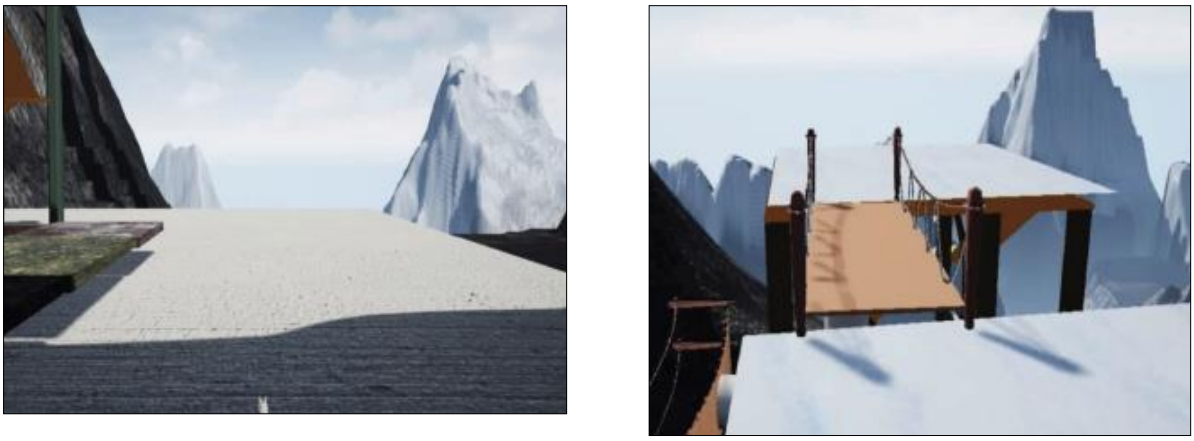

Figure 2.7: Base of elevator (left), bridge connecting two towers (right) (Nabukenya et al. 2021)

2.8.2.2. VRE for general social skills

Zainal et al. (2021) worked alongside a VR company to develop a self-guided VRET system for people suffering from social anxiety disorders. The system consisted of two exposure therapy scenarios that were viewable through a Pico Goblin VR headset (Zainal et al. 2021). Participants were allowed to choose between a scenario of a formal job interview or an informal dinner party (Zainal et al. 2021). Each scenario consisted of various scenes, each of which was designed to induce more anxiety within the user as they progressed through the VRE (Zainal et al. 2021). For example, the formal interview scenario consisted of seven scenes. During the third scene, the user had to undergo a one-on-one interview with a friendly interviewer, but during the seventh scene the user had to deliver an impromptu speech of about 90 seconds to two unfriendly interviewers who did not seem interested in what the user had to say (Zainal et al. 2021).

These systems use these simulated scenarios to serve as the disrupting activators or trauma-activating associations (J. O. Steenkamp 2018:177–185) to trigger responses from the patient with the goal of reshaping the fear-created structures (Hodges et al., 1995). For a VR system to successfully induce activation of the trauma state of dissociation during a SHIP® client's session, images that fall under the client's current phase in the SHIP® Frame need to be simulated. For example, in phase 2 of the SHIP® Frame (as discussed in Section 2.7.4.2), where the psychotherapist would normally ask the client to imagine a door with a particular word on it (e.g. 'Identity'), the door would need to be simulated with the word 'Identity' on it in real-time.

2.8.3. Disruption

Disruption takes place the moment the fear structure is changed or replaced (Rizzo et al. 2015). This is different from SHIP®, as SHIP® 'unfreezes' the trauma, not taking anything away from the past

or replacing it, but rather completing its sequence through the client's connection with the trauma (J. O. Steenkamp 2018:251–253).

Notably, there are VRET systems that are able to trigger these fear structures effectively and even change or replace them (Costa et al. 2018; Gromer et al. 2018). The following VRET systems are discussed briefly to illustrate how induction (the triggering of the fear structure) takes place and leads to the disruption (changing or replacing) of the fear structure. The discussion illustrates how certain carefully chosen elements of these systems can be used in combination with a VE to assist the SHIP® process to complete the sequence, instead of replacing or changing it.

2.8.3.1. VRET for fear of driving

Using virtual driving software, a study was conducted to research how participants with a phobia of driving would respond to a therapeutic program (Costa et al. 2018). The software provided rudimentary training for driving in a small town, where elements such as the weather and physical setting were controllable through a user interface (Costa et al. 2018). Unlike the previous systems, no HMD was used; rather, an LCD TV/monitor with two speakers was placed on either side of the user's head (Costa et al. 2018). During the exposure sessions, heart rates as well as self-reported levels of discomfort were recorded while being exposed to simulated scenarios, such as driving on a residential road with no cars, and driving on a highway with a lot of cars (Costa et al. 2018). The changing heart rates and self-described discomfort during exposure indicated that the existing fear structures of the participants were effectively triggered. As the participants progressed through more sessions, these symptoms became less severe (Costa et al. 2018), indicating that not only were the fear structures triggered, but they were disrupted and changed in such a manner that the anxiety experienced became less severe.

*2.8.3.2. VRET **cave automatic virtual environment** (CAVE) system for treatment of acrophobia*

A 3D multisensory CAVE system with five sides (four walls and the floor) was used in a study to determine the fear reactions of participants in a VE designed for height simulation (Gromer et al. 2018). The VE was designed with a landscape consisting of hills surrounding a lookout structure that had four platforms at different levels, connected by stairs (Gromer et al. 2018). The participants were asked to walk to the stairs of the structure and complete various tasks, such as climbing the structure as high as they preferred to, and being teleported to each level (Gromer et al. 2018). They were then tasked with walking to the outer rail on the highest platform of the structure as a final task (Gromer et al. 2018). With each task, the participants gave a fear-level rating based on their own perceived sense of danger, dizziness, and any other subjective fear responses (Gromer et al. 2018). The VE was

also built to introduce tactile feedback in the form of wind, which was simulated for half of the participants (Gromer et al. 2018). Participants reported that they experienced physiological and psychological responses such as fear and dizziness (Gromer et al. 2018). The participants who experienced the wind simulation showed higher fear responses and also avoided more intense fear-triggering scenarios in the VE (Gromer et al. 2018). This study shows how the VE simulated in the CAVE system was able to trigger fear structures as defined by EPT (as discussed in Section 2.2). In SHIP® terminology, the VE was able to disrupt the fear structures enough to evoke SHRs, but not enough to replace or change them, or to assist in alleviating the anxiety symptoms.

These systems were capable of disrupting existing fear structures, leading to responses such as increased heart rate, dizziness, and self-described discomfort, which are defined by SHIP® as SHRs (as discussed in Section 2.7.3 above).

Both systems added non-visual stimuli to increase the level of immersion, which lead to more effective disruption of the fear structures. To design a VE for SHIP®, one would have to go beyond the visual and incorporate other forms of stimuli to ensure that the VE activates the fear structure but also disrupts it. This indicates that a similar system might be able to assist SHIP® clients who struggle with imagining the required stimuli by triggering the trauma event through simulated stimuli to induce SHRs.

2.8.4. Integration: Achieving a state of flow

After (i) hardware integration, (ii) induction, and then finally (iii) disruption, there are signs that indicate whether successful integration has occurred, in other words whether the VRS (Virtual Reality SHIP®) system was able to induce an inter-systemic disrupting activator within a client and assist in the healing dialogue of TSM (J. O. Steenkamp 2018:277–280):

1. **From dis-ease to ease:** This means that SHIP® has assisted in connecting all the dissociated trauma memories and has allowed the client to experience them fully, resulting in the client being able to effectively regulate their ANS when confronted with trauma-activating stimuli and thus achieving a state of flow (as discussed in Section 2.7.1).
2. **Distributing the energy:** Due to the unfreezing of trauma through SHRs, clients' trauma-induced coping styles are incorporated with other coping styles that become available, i.e. there is a release of stuck potential. The implication is that clients become more flexible and are able to create and select more configurations of coping styles that are appropriate to the particular needs of the situation at hand.

3. **From trauma to the history of autobiography:** When frozen trauma has been experienced completely, activators that lead to anger, depression, or other emotional responses are dealt with more effectively by the client. The effect of spontaneous healing creates a resilience to future associative activators; clients who have evolved through the previous trauma have all their configurations or potentialities available to them to successfully interact with the external world and live freely.

2.9. SHIP® versus ET

While SHIP® can be considered a counterpart of CBT as whole because of its holistic approach to therapy (as stated in Section 2.7.1) for the scope of this study SHIP® is considered to be more of a behavioural intervention to make it more comparable to ET (as discussed in Section 2.4). The discussions on previous therapeutic approaches focussed on ET because of the similarities it shares with SHIP®, both positive and negative, as well as its well documented use in conjunction with VR as VRET. As discussed in this literature review, the efficacy and success of VRET is evident, and there are numerous examples of VRET systems that have helped to treat various mental disorders over the last couple of decades (as discussed in Sections 0–2.6.3). The literature on the subject is abundant and therefore begs the question as to why one would attempt to build similar systems for a different psychotherapeutic method such as SHIP®. Both SHIP® and ET administer treatment in similar fashions (J. O. Steenkamp 2018:252) and both treatments task the patient or client with imagining the feared stimuli or the traumatic events numerous times over one session (J. O. Steenkamp 2018:252). However, VR systems for ET already exist and are successful in many cases. To understand why this study focuses on SHIP® instead of ET, one must understand the key difference between the two methods.

2.9.1. SHIP® is not desensitisation

During the process of SHIP®, the main goal is not to habituate the client to the trauma-associative triggers. Rather, it is to allow the trauma, which has become stuck because of the client's fight or flight responses not engaging when the trauma event was first experienced, to become unstuck and thus complete its natural process (J. O. Steenkamp 2018:253) (as discussed in Section 2.7.1). SHIP® focuses on facilitating completion of frozen, underlying traumatic experiences and not on treating specific symptoms (J. O. Steenkamp 2018:253).

ET is based on systematic desensitisation therapy, which in turn is based on the classical conditioning principle (Markowitz & Fanselow 2020; McLeod 2021b). During this treatment, attempts are made to replace a reaction to feared stimuli with a more relaxed reaction by slowly

exposing the patient to higher degrees of the feared stimuli while they are taught to respond with relaxation techniques (McLeod 2021b). The success of ET is evident; however, there are many PTSD patients that do not benefit from it (Foa & Mclean 2015; Markowitz & Fanselow 2020).

2.9.2. The limitations of ET

ET only treats the symptoms exhibited by a patient, and not the fundamental cause of their disorder (McLeod 2021b). The treatment targets the elements of the trauma that are directly connected to the trauma (Markowitz & Fanselow 2020); for example, to treat a patient who suffers from arachnophobia, they would be asked to imagine a spider while lying down on a bed in the therapist's office. The efficacy of ET thus falters because of the context within which the exposure takes place—the therapist's office, and could lead to fear reactions returning when facing the feared stimuli in a different setting (Markowitz & Fanselow 2020). Other phobias, such as social phobias, also do not respond well to ET, because ET assumes in most cases that the only cause of phobias is classical conditioning, or learning through association (McLeod 2021b; McLeod 2021a). For example, a fear of public speaking might be treated more effectively through teaching social skills rather than using exposure therapy (McLeod 2021b).

2.10. Conclusion

The literature reviewed in this study has shown that ET and SHIP® are both effective as psychotherapeutic methods for treating individuals with various psychological disorders and/or TSMs. Both these treatments rely heavily on the ability of the individual to be able to visualise the requested stimuli effectively and, if they are unable to, the treatment may not be as effective or successful. However, when ET is used in tandem with VR as VRET, it is not only successful in overcoming such limitations, but it is also as effective, if not more so, than imaginal or *in vivo* exposure therapy. The similarities between ET and SHIP® are a basis for this study and its goal to investigate whether virtual reality can be used alongside SHIP® to induce the unique memories and unique responses required. Through the discussions above, guidelines have been identified that can be followed to design and implement a VRE that can assist in the process of SHIP®. These guidelines are as follows:

- Hardware integration: Use a stand-alone HMD to immerse the client in the VE.
- Induction: Use visual objects to grab the attention of the user. These objects need to stand out from the rest of the environment and keep the user's concentration.
- Disruption: Have the visual objects (the door) interact with the user in such a manner that they serve as associative triggers to help induce unique memories.

- Integration: The VE should integrate with the overall process of SHIP®, meaning that the facilitator should still be able to guide the user through the process through asking questions, making statements and generally guiding the participant through their experience through verbal communication.

The full system design and implementation is discussed in more detail in Chapter 4. Combining VR and SHIP® could lead to overcoming the limitations of ET. SHIP® is used in this study instead of ET, because of its more holistic approach to treating mental disorders by focusing on the underlying causes that lead to more effective, long-term symptom reductions.

2.11. Summary

This chapter has looked at EPT and how the theory is used to describe mental disorders, such as PTSD, and their treatment. The importance of mental imagery in the psychotherapeutic process was discussed to expand on how the fear structures defined by EPT can be modified to treat such mental disorders. Propositional images were defined as neural events that are capable of triggering emotional responses when imagined, similar to how external stimuli would trigger the same responses. This discussion was needed to explain why exposure therapy is successful as both an *in vivo* and as an imaginal treatment for mental disorders. Knowing that mental imagery can assist in the treatment of mental disorders, various problems and inefficiencies with regards to *in vivo* and imaginal exposure therapy were highlighted. VR systems were then defined and discussed, focusing on which aspects of VR are important to have a successful experience, i.e. what is needed objectively and subjectively to simulate an environment that completely immerses a user and makes them experience a sense of presence or 'being there'.

It was suggested that the problems with *in vivo* and imaginal exposure therapy can be addressed by using VR alongside ET to produce VRET. Citing past systems, their successes, advantages and disadvantages, VRET was discussed as an alternative to traditional exposure-based therapeutic methods. This was done to establish the success of VR for *in vivo* or imaginal exposure therapy for treating mental disorders.

SHIP® was then discussed in detail and described as a medium to allow clients to experience their past trauma through imaginal exposure. The differences between SHIP® and ET were discussed—for example, SHIP® is purely imaginal and does not desensitise a client to their traumatic experience, but rather helps them to experience it fully to come to terms with it. The similarities between SHIP® and ET were highlighted as well, focusing on both of their shortfalls. Some shortfalls of ET have

been overcome by VR, which suggests that similar shortfalls in SHIP® can be overcome by VR. This chapter concluded by looking at seven examples of VRET systems and how they could be used to design a system for assisting in SHIP® therapy.

The next chapter will discuss the methodology of how a theoretical SHIP® VR system, the PENSIEVE system, can be tested and investigated thoroughly to determine whether VR can help overcome the shortfalls of SHIP®.

3. Chapter 3: Methodology

In this chapter, the post-positivism paradigm used for the current study is introduced and discussed in detail with regards to the ontological, epistemological, and methodological stances that were taken at the start of the study.

After the paradigm is explained, there is a detailed discussion regarding the research design that introduces the main experimental method, namely the **Random Clinical Trial** (RCT) design. The process of the overall research is clearly defined and explained. The section maps out the logistics surrounding the current RCT study and explains the role of the facilitator who was recruited. It discusses the procedure followed to obtain the necessary ethical clearance for the current study.

The next section introduces the data collection techniques that were used to gather the required data. This section also explains the **change interview** (CI) and HAT form that were used. The sample on which the chosen data collection techniques were applied is discussed. This section concludes with a discussion on how consent was obtained from the participants. Finally, this chapter concludes with a discussion around how the collected data was analysed and processed using **thematic analysis** (TA). TA is clearly defined and explained in the form of six phases that the researcher followed.

3.1. Research paradigm

To define the research paradigm of this study effectively, three key questions had to be answered regarding the phenomenon being researched (Pickard 2013:6):

- What is the nature of the reality of the phenomenon (i.e., the ontological question)?
- What is the nature of the relationship between the researcher of the phenomenon and the phenomenon itself (i.e., the epistemological question)?
- How can the researcher gain the necessary knowledge from the phenomenon (i.e., the methodological question)?

The phenomenon being researched was whether a simulated virtual environment could assist participants who find it difficult to visualise a requested image to do so by simulating the image virtually. This was first and foremost an HCI (**human-computer interaction**) study, but the psychological background gave credence to the paradigm chosen to answer the research questions.

3.1.1. Post-positivism

The standard model for psychological research is that of post-positivism (Stedman et al. 2016), which has become connected to quantitative data collection methods over the course of time (Syed & McLean 2022). However, according to Syed and McLean (2022), there is no scientific reasoning for steering away from qualitative methods when conducting psychological research, and they claim that well-formulated questions that can be empirically addressed should drive research. The practice of using quantitative methods and data in psychological research might enable individuals and groups outside of the parameters of the study to misinterpret the results and knowledge gained from the study (Syed & McLean 2022). This means that results gained from a quantitative psychological study could potentially be generalised to a wider population when this was not the intention. However, the goal of the current study was not to extrapolate the results to a larger population, but only to investigate and gain understanding about the phenomenon being researched and refine the results to add to the existing knowledge for future studies.

The goal of post-positivist research is to make assertions, and then to improve, reject, or clarify them to assist with more credible assertions in the future, and to support the use of qualitative methods (Kelly, Dowling & Millar 2018). To effectively gain understanding into a phenomenon, one must focus on formulating a holistic description of the phenomenon using various methodologies, including qualitative, instead of explaining it as an absolute truth with just quantitative data that can then be easily extrapolated to a wider population by individuals outside of the study (Syed & McLean 2022).

The post-positivist paradigm was chosen for this study with a focus on obtaining and analysing qualitative data, because attributes of the VR treatment and traditional SHIP® treatment that are deemed effective had to be identified by observing the participants. The study required the researcher to identify and evaluate the factors that bring about certain outcomes, and it is based on observing and assessing objective reality (Creswell & Cresswell 2018:26). Therefore, the paradigm of this study comprised:

- a critical realism ontological stance
- a modified dualist or objectivist epistemological stance
- a modified experimental or manipulative methodological stance.

The study was carried out with the purpose of adding to existing knowledge to assist with future research in this field (Pickard 2013:7–11; Kelly, Dowling & Millar 2018).

3.1.2. Ontological stance

Adopting a post-positivism paradigm for this study meant that researching the phenomenon would not lead to an absolute truth but rather an approximate truth (Denzin & Lincoln 2011:106; Welford, Murphy & Dympna 2011; Kelly, Dowling & Millar 2018). This stance was taken for the following reasons (Pickard 2013:10):

- Given the subjectivity of an individual's imagination and how differently each of us interpret reality (see, for example, 2.3.1 and 2.5.4), gaining an absolute truth about which of the two methods is more effective would be improbable. In other words, just because Factor X leads to a more effective session for Subject A, does not necessarily mean Factor X would lead to a more effective session for Subject B.
- The possibility of human error during the data collection phase made it less likely or possible to find an absolute truth regarding the phenomenon being researched.

For these two reasons, the ontological stance taken for this study was that of critical realism (Pickard 2013:8). Critical realism suggests that reality is arranged in the following sequence: empirical, actual, and real (Fletcher 2017), or, to simplify: experiences, events, and causal mechanisms (Koopmans & Schiller 2022). For the current study, these three areas connected well with the realm of SHIP®:

3.1.2.1. Experiences (the empirical layer)

This layer includes the things we feel, see, sense, and experience (Koopmans & Schiller 2022). However, within the empirical layer, the manner in which humans experience and interpret reality serves as a filter by which these events and objects are assessed (Fletcher 2017). The social ideas, meanings, and actions that occur within this layer can also be causal (Fletcher 2017).

3.1.2.2. Events (the actual layer)

Within the actual layer, there is no filter that mediates objects and events (Fletcher 2017). This layer includes events and objects that happen or exist whether we observe them or not (Fletcher 2017; Koopmans & Schiller 2022). They are different from the perceived events experienced and interpreted within the empirical layer, and are seen as true occurrences (Danermark et al. 2001:20).

3.1.2.3. Causal mechanisms (the real layer)

The causal mechanisms are considered real, but are often unnoticed, and lead to or create certain events (Koopmans & Schiller 2022). Causal mechanisms refer to the innate characteristics of an object that create events (Fletcher 2017). Critical realism aims to explain social events through

investigating the effects these causal mechanisms have or can have on this three-layered depiction of reality (Fletcher 2017).

SHIP® posits that an individual who suffers from TSM has had traumatic experiences that were put on hold, and that certain triggers in everyday life can lead to adverse emotional or physical responses that are associated with the trauma (as discussed in Section 2.7.2). The new experiences that trigger discomfort are incorrectly processed; they are filtered and mitigated through an individual's past experiences, or the individual's coping styles and/or distractors (as discussed in Section 2.7.5), before they can reach and reside within the empirical layer of reality.

The original traumatic event that caused the trauma remains unprocessed and unresolved and is therefore frozen within the actual layer of reality (as discussed in Section 2.7.2). It was never fully experienced. Only through the causal mechanisms (the real layer) or trauma-activating associations (as discussed in Section 2.7.2) can this original traumatic event be triggered within the actual layer, leading it to be fully experienced and observed, which allows it to move into the empirical layer.

SHIP® aims to treat the root of the trauma, not the effects that the unobserved causes have on an individual's perceived reality, i.e. the symptoms exhibited on the surface (as discussed in Section 2.9.1). Experiences and people's perceptions of reality are acknowledged within critical realism, but its goal is to explore the underlying meanings behind the phenomenon being researched and what implications it might have (Joffe 2011; Terry et al. 2017). This approach of critical realism can assist us in understanding underlying causes, and investigating further than the observable symptoms (Koopmans & Schiller 2022).

3.1.3. Epistemological stance

The relationship that developed between the phenomenon and the researcher was that of cause and effect (Pickard 2013:9), as each participant was guided through imagined or simulated images and was tasked with describing all their experiences in as much detail as possible (J. O. Steenkamp 2018:248–249). This causality was seen as complex in nature, meaning that the responses observed and the triggers that lead to them would differ between participants, and depended on context (Bergene 2007; Clark, Lissel & Davis 2008; Lipscomb 2010; Angus & Clark 2012; Koopmans & Schiller 2022). The observations made were susceptible to interpretation, meaning that this study took a modified dualist or objectivist epistemological stance (Pickard 2013:9).

Realism in the post-positivist paradigm contemplates a reality that can be objectively observed if researchers have the advanced tools necessary to do so, but admits that the tools at their disposal depend on the context in which they are used, and that the tools include a certain set of values (Fox 2008). Thus, analysis within the social sciences is inevitably an attempt to understand a phenomenon as well as one can, given the specific context, and is an attempt to practise objectivity as well as possible during the research (Fox 2008; Pickard 2013:11).

3.2. Methodological stance

For the current study, the participants were observed in a controlled environment to identify certain factors that bring about certain outcomes. The same stimulus was introduced to the participants in this controlled environment using one of two methods, and then the relationship between the participant's subjective experience of the stimulus and the method used was investigated. These investigations rendered observations that were prone to subjectivity and open to interpretation, which meant that the data gathered were mostly qualitative. However, quantitative data were also obtained, with the purpose of integrating it—along with the qualitative data—in a joint display, to provide additional knowledge into the phenomenon being researched that could prove useful for the following (Richards et al. 2019):

- understanding which factors had the most effect
- understanding why there were different results for different participants
- finding ways to improve the intervention for future research.

The variable being manipulated was the method in which stimuli were introduced to the participants during the sessions, whereas the constant was the scenario being simulated or imagined. The relationship that developed between these two variables and the participant was observed, analysed and measured, giving this study a methodological stance that is experimental or manipulative (Pickard 2013:11).

3.3. Research design

For this study, the researcher decided to follow a random clinical trial (RCT) design, with qualitative data as well as quantitative data being gathered through observation. This section explains the steps that were taken to implement the RCT design and all its components:

- the aim of the RCT study
- sampling for the RCT study
- the sessions procedure
- RCT study logistics

- the role of the facilitator.

3.3.1. Randomised clinical trial (RCT)

The standard design for determining the efficacy of psychotherapeutic treatments is the RCT design (Hoffman & Steyn 2010; Thiese 2014; Hariton & Locascio 2018; C. J. H. Steenkamp 2018). It has been used in various studies to determine the efficacy of treatments to treat disorders such as acrophobia (Donker et al. 2019), combat-related PTSD (Beidel et al. 2019), and nightmares (Kunze et al. 2017). Within this design, participants are randomly divided up into two groups. One group receives a 'Test' intervention to treat a condition and the other ('Control') group receives either no intervention or a 'Standard' intervention that is traditionally or currently used to treat the condition (Machin, Fayers & Tai 2021:27).

When developing a new or alternative therapeutic method, it is important to compare it to the existing standard or typical method of treatment, if possible (Machin, Fayers & Tai 2021:34). This approach enhances objectivity and is effective in examining causal relationships between an intervention and its outcomes (Hariton & Locascio 2018). This effectiveness comes from randomly assigning participants to the two groups and ensuring their characteristics are balanced. This ensures that any differences observed between the groups are due to the specific intervention being studied (Thiese 2014; Hariton & Locascio 2018). It is crucial to ensure that there are no known differences between the groups for the randomisation to be considered successful, making the intervention the only differing factor (Thiese 2014).

The data gathered were that of the subjective experiences of the participants in each of the two groups, giving this study a qualitative method approach (Welman et al. 2005:6–7; Pickard 2013:16). RCT is usually carried out with quantitative data; however, for this study the focus was placed on gathering and analysing qualitative data with RCT for the following reasons (O'Cathain 2018:5–10):

- To allow the study to address a larger variety of questions: qualitative data can assist in gaining more knowledge on how results are affected by context, how methods of measuring how effective an intervention is can be improved, how the interventions actually work, and more.
- To investigate what changes need to be made to interventions to improve them for future research or for implementation in practice: data gathered through focus groups and interviews are rich in information and give a better understanding of how an intervention works and why it works.

- To assist in performing the RCT, such as with gathering participants: for example, observing participants who decide to drop out of the study helps to identify misunderstandings in communication to limit future dropouts.
- To help with explaining the RCT results in the case of an unsuccessful intervention: qualitative data can inform why a specific intervention was unsuccessful, which can assist with other similar studies in the future.
- To assist with transferring knowledge gained into the real world.
- To help understand how complex a specific intervention is.

3.3.2. Sampling for the RCT study

The method and size of the sampling all depends on the study type as well as the chosen research method (Sevenster 2007). The sufficiency of a sample depends on the size of the sample, its participants and how well they fit the paradigm of the current study (Vasileiou et al. 2018). There are two broad kinds of sampling techniques, namely, probability sampling and purposive sampling (Pickard 2013:59). Purposive sampling is often considered more appropriate for qualitative research, whereas probability sampling is more often used for quantitative research (Pickard 2013:59; Vasileiou et al. 2018). These two broad techniques are also known as probability sampling and non-probability sampling, the former being random whereas the latter is not (Sevenster 2007; Kaliyadan & Kulkarni 2019). In probability sampling, the probability that a member of a population will become a participant in the chosen sample can be calculated, whereas in non-probability sampling it cannot (Welman et al. 2005:56; Kaliyadan & Kulkarni 2019).

As discussed in Section 3, the current study placed more focus on gathering and analysing qualitative data. Within qualitative research, the samples tend to be small, to assist with analysis that is in depth and case-focused (Sandelowski 1996; Vasileiou et al. 2018). The current study aimed to understand the phenomenon in question and not to generalise; therefore, non-probability sampling was used to select the participants. This section describes the process by which the intended sample was selected in the following steps:

- the population
- purposive sampling: the initial group
- purposive sampling: the low LIP group
- randomised groups
- inform and consent.

3.3.2.1. The population

The population from which the sample was selected purposively was obtained by posting notices on the University of Pretoria's Multimedia sub-department's social media channels. These posts inviting people to respond were repeated until an initial group size of 28 participants was reached.

3.3.2.2. Purposive sampling: The initial group

Although convenience sampling was used to gather participants from the University of Pretoria, these participants still had to adhere to certain criteria to be considered for the initial group. The following criteria were chosen to reduce the differences between the participants to ensure that the data were more significant (Thiese 2014; Hariton & Locascio 2018) and to exclude any potential participants who might experience adverse reactions during the sessions (Andrade 2021):

- no prior knowledge of SHIP®
- no history of SHIP®
- no prior trauma or diagnosed mental disorders.

In order to gain the most objective data possible, the initial group was refined into a group that best fit the scope of the phenomenon being researched, i.e., individuals who struggle to imagine images and requested stimuli.

3.3.2.3. Purposive sampling: The low-LIP group

A small sample selected with specific intent may be used for a qualitative study with the goal of gaining a more in-depth understanding of the phenomenon being researched, as long as the sample aligns with the specific study's research paradigm (Miles & Huberman 1994:27; Patton 2002:227; Palinkas et al. 2015; Campbell et al. 2020). The researcher and facilitator came up with a method to identify and recruit participants who exhibited a low imaginative potential, meaning individuals who struggle to imagine requested stimuli, to enrich the data gathered. If participants were chosen at random and no consideration was given to their levels of imagination, the data gathered would be less credible (Andrade 2021). Therefore, purposive sampling was exercised on the initial group gathered in Section 3.3.2.2 for the following reasons:

- to investigate only the individuals who fit the phenomenon being researched (Pickard 2013:64; Andrade 2021)
- to reduce the differences between participants to increase the credibility of the findings (Pickard 2013:64; Thiese 2014; Hariton & Locascio 2018; Andrade 2021).

To achieve this, all the participants of the initial group underwent an imagination exercise in the form of a structured interview designed by the researcher and facilitator (as discussed in Section 3.4.13.3.1) where they were given a score evaluating their **Level of Imaginative Potential** (LIP). The LIP score was a method proposed by the facilitator specifically for use in the current study. With their in-depth knowledge of SHIP® in practise they were effectively able to develop this method to identify participants who struggle to imagine requested stimuli effectively. The specific criteria and process of this method are outlined in more detail in Section 5.1.3. In the initial proposal for this study it was stated that the participants of the initial group would undergo a traditional SHIP® session. Before the data collection for the study commenced, the researcher and facilitator agreed that an imagination/relaxation exercise would be sufficient to establish the LIP ratings of the participants. This change was made to reduce the risk of participants having adverse reactions to the requested stimuli, and it allowed the facilitator to leave the participants in a neutral state at the end of each session. Participants who received the lowest LIP ratings were included in the remainder of the study. The test was given to all 28 participants of the initial group to select a total of 20 participants with the lowest LIP ratings for the remainder of the study, with 10 participants per group (VR and standard). The small group was well suited for the current study's time-consuming analysis approach (as discussed in Section 3.5.5).

3.3.2.4. Randomised groups

After determining the 20 participants with the lowest LIP scores from the initial group, they were divided up into two groups, a 'standard' group and a 'VR' group:

- **Standard**: This group's participants partook in a traditional SHIP® session facilitated by a trained SHIP® facilitator.
- **VR**: This group's participants partook in a session where a virtual environment was introduced as a stimulus instead of the participant's imagination. These sessions were also facilitated by the trained SHIP® facilitator.

For this study, the two groups of participants needed to have similar average levels of LIP ratings. Assigning participants completely at random to either group might leave one of the groups with a higher average level of imaginative potential than the other group. This variation between groups would make the results of the study less reliable (Thiese 2014; Hariton & Locascio 2018; Andrade 2021), as one treatment would have the advantage of participants who find it easy to imagine required stimuli, which would lead to better induction for that group. Thus, randomisation of the groups was repeated until the mean level of the LIP ratings of the groups were within an acceptable threshold of each other.

3.3.2.5. Inform and consent

The population from which the study sample was drawn consisted of any individual with no prior experience or knowledge of SHIP® who was willing and available to partake in the study. It was also important that these individuals should not have any history of mental illness and should not have any past traumatic experiences (as discussed in Section 3.3.2.2). The initial group of participants were verbally informed about the context and process of the research prior to the LIP rating tests. This pre-research briefing was conducted in person and in the presence of the facilitator. After the participants were briefed on the nature of the study, a physical letter detailing the research in writing was provided to each participant to peruse. The participants were informed verbally and in writing of their right to exit the study at any point without any consequences; all of their data would remain confidential and would be destroyed, and therefore not used for final publication.

Consent forms were given to each participant of the initial group at the end of the briefing to agree to participate in the LIP rating sessions. Consent forms were also given to each participant of the low-LIP group after selection, to agree to participate in the study and to agree to the findings being written up and presented. These consent forms were explained, with any questions being answered, and then they were signed by participants.

3.3.3. The sessions' procedure

The research method used for this study was that of experimental research, which attempts to determine causality (Pickard 2013:120; Creswell & Cresswell 2018:31). Various VR environment studies have used this method to investigate phenomena where results from an experiment with two groups were compared with one another (Slater et al. 2006; Freeman et al. 2016; Van Kerrebroeck, Brengman & Willems 2017; Donker et al. 2019). The results of the two groups determine the causal link between the outcomes and treatments (Creswell & Cresswell 2018:31).

As mentioned above, two groups of participants were introduced to two different methods during their sessions in a controlled research environment, which made this study experimental in nature (Pickard 2013:120). However, the fact that the participants for this study could not be purely randomly assigned, for reasons explained above, meant that this study would be a quasi-experiment (Welman et al. 2005:88). The variables observed during the sessions within this controlled environment were as follows (Pickard 2013:120):

- **Independent variable (IV):** the introduction method of visual stimuli (imagined or simulated)

- **Dependent variable (DV):** the level of induction or opening of memories observed by the facilitator
- **Moderator variable (MV):** the autonomic responses observed or described during induction
- **Control variable (CV):** the stimuli being imagined or simulated.

The controlled variable (CV) of this study was that of the 'door' image from the SHIP® Frame. Only a single image out of the SHIP® Frame was chosen because this study was focused on determining the viability of VR as a method for SHIP® (as discussed in Section 3.1.2). Other images in the SHIP® Frame were considered to be too ambiguous for the purposes of this study; for example, simulating or imagining a cave might not trigger unique experiences within every participant. It was also not practical to select and create specific simulated environments from the SHIP® Frame for each participant because of time constraints.

The 'door' image with the participant's name on it was chosen because it would allow the activation of unique experiences within each participant. The participant's name on the door is what made every simulation or imagining of the door unique.

Each participant in the sample took part in one session, which made this a between-groups design, similar to designs used in studies conducted by Freeman et al. (2016) and Van Kerrebroeck et al. (2017); this allowed each participant to be exposed to either one method, scenario, or situation (Budiu 2018). During their session, the participant either was asked to imagine their name on the door or was introduced to a simulation of a door with their name written on it. The participants that took part in the VR sessions wore HMDs to immerse them into the virtual environment (as discussed in Chapter 4). The facilitator guided the participants in the imaginal sessions in the same manner as the participants in the VR sessions. The audio of each session was recorded via a smartphone and transcribed by the researcher.

3.3.4. RCT trial logistics

For the current study, the controlled environment where the sessions took place was that of the University of Pretoria's Virtual Reality and Interaction (VRI) Lab. The VRI Lab was chosen for the following reasons:

- The VRI lab offered enough space to comfortably fit multiple people, although only the facilitator and one participant would use the space at any given time.

- The VRI lab was mostly noiseless, which would help the participants focus on the imagined or simulated environment without notable disturbances.

The main logistical issue faced was acquiring a comfortable bed or chair for the participants to sit or lie on while undergoing their sessions. The researcher decided to provide a large blow-up mattress with comfortable pillows (as seen in Figure 3.2). This mattress was foldable and compact, which made it a convenient choice for the current study. The office chairs inside the VRI lab were also made available for participants to sit in during their session if they preferred (as seen in Figure 3.1).

Figure 3.1: HMD setup with cable to desktop computer (left) and HMD resting on office chair for participants who preferred to sit

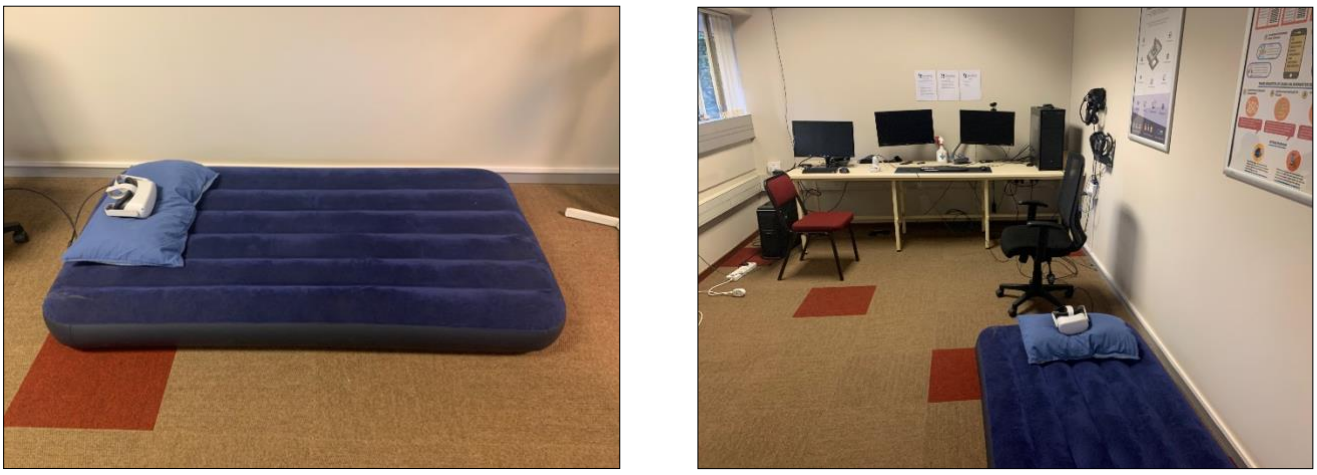

Figure 3.2: HMD resting on the blow up air mattress (left) and the complete setup for the current study (right)

3.3.5. The role of the facilitator

This study asked a trained SHIP® psychotherapist to come in as a facilitator to run the sessions and gather data during these sessions. A SHIP® psychotherapist was selected for this because of their in-depth training in the field of image activation and because they actively work with image activation in

clients in practice. The choice to involve a facilitator was motivated by ethical and logistical considerations.

3.3.5.1. Ethical considerations

The facilitator was mainly responsible for guiding the participants through their sessions and using their in-depth knowledge of SHIP® to gather data such as observable psychological and physiological responses. Only the facilitator was present during the sessions, as it would have been unethical for the researcher, as an untrained individual, to run such a session. The facilitator was also focused on the goal of the study, which was to test the efficacy of the VR system as a medium, and not to administer actual therapy. A neutral image of a door with the participant's name on it was simulated and imagined so as to avoid triggering traumatic memories. In the unlikely event that this neutral image did trigger a response that the participant found uncomfortable in any way, the facilitator was more than capable of guiding the participant away from the neutral image, and could assist the participant by referring them to another trained SHIP® therapist that could assist the participant outside of the study if necessary.

3.3.5.2. Logistical considerations

As discussed in Section 2.5.4, investigating the unique experience of a participant within a virtual environment remains difficult to objectively measure, which means that subjective methods of measurement remain the primary method of investigation. As stated in Section 3.1.3, it is of the upmost importance to practise objectivity as well as possible when observing the participants during their sessions. Therefore, the best way to enhance the objectivity of this study was to incorporate a trained psychotherapist who practises such objectivity on a day-to-day basis with their clients.

3.3.5.3. The process of facilitating

After each session, the facilitator filled in a questionnaire developed to measure assistive events that occurred during therapeutic sessions—known as a "Helpful Aspects of Therapy" (HAT) form (as discussed in Section 3.4.3)—to be viewed and analysed by the researcher. This form did not disclose any personal or intimate information related to a participant, or any information that the researcher was not privy to. Each form for each session only described the overall effectiveness as experienced by the facilitator of the specific method used in that session.

Lastly, after all the participant sessions were completed, the facilitator took part in a semi-structured interview with the researcher (as discussed in Section 3.4.2). The purpose of this interview was to

gather the necessary data regarding how the induction level of the standard group compared to the induction level of the VR group.

3.3.6. Ethical clearance

To obtain clearance for the current study to gather the necessary data, the researcher submitted the following documents to the Ethics Committee of the Faculty of Engineering, Built Environment and IT (EBIT) at the University of Pretoria:

- a complete research proposal for the Master's study
- a University of Pretoria Ethics Application form for the Master's study
- a Registrar Checklist for the Master's study
- the consent forms to be completed by participants
- the data collection forms to be completed by the facilitator as well as the head researcher
- a letter to the Dean of the EBIT faculty for approval to recruit students for the data collection
- a data management plan
- approval letters from the SHIP® foundation to conduct the current study.

Because of the psychotherapeutic aspect of the current study, the abovementioned documents were sent to the Health Sciences Ethics Committee of the University of Pretoria as well. The researcher was only allowed to commence with the study after approval was received from both the EBIT Faculty and the Health Sciences Ethics Committee.

3.4. Data collection techniques

For the purposes of this study, the autonomic responses from introduced stimuli of each of the participants needed to be observed, in other words, data pertaining to the experience lived by the participants in both groups (Sevenster 2007). As discussed in Section 2.5.4, the primary tool for measurement of participant experiences remains largely subjective. Various VR studies collected self-reported data as their core data, in forms such as visual analogue rating scales and questionnaires (Hodges et al. 1995; Difede & Hoffman 2002; Slater et al. 2006; Freeman et al. 2016; Van Kerrebroeck, Brengman & Willems 2017). While qualitative data are often used in studies investigating VR environments (Hodges et al. 1995; Difede & Hoffman 2002), several studies of VR systems and their psychological application have attempted to enhance their research through the use of both qualitative data as well as quantitative data (Slater et al. 2009; Rizzo et al. 2010). An example of data collection that could be beneficial to this study is that of the visual analogue rating scales used by Freeman et al. (2016), where, at the start and end of the testing day, participants were asked to

grade the level of belief they had for their persecutory belief—with 0% being "Do not believe it at all" and 100% being "Absolutely certain" (Freeman et al. 2016). Prior to entering either a virtual-reality or real-life scenario, participants would rate the following questions on a scale of 0 to 10 (Freeman et al. 2016):

- "At this moment, how convinced are you that your worries are true?"—with 0 being "Not convinced at all" and 10 being "Absolutely certain".
- "How distressed do you feel about your worries?"—with 0 being "Not distressed at all" and 10 being "Extremely distressed".
- "How distressed did you feel going outside?" or "How distressed did you feel in the virtual reality scenario?"—with 0 being "Not distressed" and 10 being "Extremely distressed".

A scale such as this alone was not sufficient to gain the necessary insights in the current study, but served as a basis from which the researcher could expand to more open-ended questions during the CI (as discussed in Section 3.4.2), such as in previous research investigating pain experienced by clients during SHIP® therapy (Sevenster 2007). The aforementioned study asked certain questions regarding how the clients experienced their pain, which were asked in the form of a personal interview, taking special care to hold an objective stance throughout (Sevenster 2007). The current study used various techniques, which are discussed in detail below.

3.4.1. Imagination exercise: A structured interview

The LIP scores of the initial group of 28 participants (as discussed in Section 3.3.2.2) relied on the individual's capacity to imagine a requested image. This kind of scoring is complex, subjective and qualitative in nature, seeing as it is an in-depth description of how the individual perceives a requested stimuli or image. Typically, such data are gathered through conducting an interview with the individual (Pickard 2013:196). The facilitator has to guide the participant through the process of visualisation, requiring a high level of interaction, which interviews can provide (Pickard 2013:196). The stimulus that needed to be imagined was pre-determined and the data sought were complex in nature, requiring the participant to be able to go back and forth in their minds (Pickard 2013:196). Therefore, the most suitable technique for collecting data was a structured interview (Pickard 2013:199). Before the study began, each participant took part in an imagination/relaxation exercise that took the form of a structured interview, where they were asked to imagine a specific image or scenario. They were asked to describe what they experienced in as much detail as possible, taking all their senses into account. The facilitator concluded each session by giving each participant a LIP rating between 0 and 10. This rating was not made known to the participants and remained strictly confidential, for use by the facilitator and the researcher only.

3.4.2. The change interview (CI)

The CI is a semi-structured interview that lasts 30 to 45 minutes (Elliott 2002). This semi-structured interview aimed to gather (Elliott 2002):

- the facilitator's insights regarding the changes that they experienced during all the sessions
- what they think contributed to these changes
- the characteristics that they consider to be helpful or hindering.

For the current study, the researcher had to conduct a similar semi-structured, or guided, interview after both groups have completed their sessions. The researcher interviewed the facilitator rather than the participants, like Hoffman and Steyn (2010), where the coaches of tennis players were interviewed to verify the changes experienced by the players. The interview gathered qualitative data regarding how the facilitator perceived the levels of induction in the standard and VR groups, and which factors the facilitator believed influenced this perception. The researcher used the format prescribed by Elliot (2002), although the questions were modified to be asked in such a manner that they covered a single group and not an individual. The format of the CI can be seen under Appendix B. Similarly, Slater et al. (2006) conducted debriefing sessions where the researcher used a modified standard questionnaire to interview participants of an experiment who had just experienced a VE used as an intervention method for their fear of public speaking. This was done to determine the degree of anxiety they experienced during specific sessions, thus expanding on the data gathered from the unmodified questionnaires completed by the participants during recruitment (Slater et al. 2006). The current study's interview had the similar goal of expounding upon the facilitator's HAT findings (as discussed in Sections 3.4.2–3.4.3). The audio of this interview was recorded and later transcribed.

3.4.3. Helpful aspects of therapy (HAT)

The HAT questionnaire is a qualitative measure that is often used to measure therapeutic events that the client perceived as being important (Llewelyn 1988; Elliott 2002; C. J. H. Steenkamp 2018). The questionnaire consists of seven open-ended questions given to the client after a therapy session (Elliott 2002). In their own words, the client would describe what events in the therapy they deemed to be helpful (Llewelyn 1988). C. J. H. Steenkamp's research (2018) attempted to find specific, important psychotherapeutic change processes during SHIP® sessions, using a modified HAT questionnaire that included SHIP® terminology, which was answered by the SHIP® practitioner once a session was completed.

The current study used a questionnaire developed by Elliot (2008), slightly adjusted to incorporate VR terminology, to locate important events that occurred during therapy sessions with both the VR group and the standard group. The researcher compiled this questionnaire on a computer and printed out a copy for each participant. This questionnaire was completed by the facilitator with a pen after each session. The questionnaire was preceded with a single Likert-scale question: "To what extent was the session useful to the process of SHIP®?"

Quantitative data gathered in other studies investigating VR environments have included the use of physiological data, such as measuring the participant's heart rate, galvanic skin response, and respiration measurements (Slater et al. 2009; Rizzo et al. 2010). However, as discussed in Section 3.1.1, the current study's goal was to understand the effectiveness of VR as a tool in SHIP® and not to corroborate if quantitative metrics match precisely across different methods. Therefore, quantitative data such as those mentioned above were not included. The only quantitative data gathered for this study took the form of a Likert scale question at the start of the HAT questionnaire and the LIP ratings gathered (as discussed in Section 3.4.3) to determine the test groups. Data obtained from the HAT form fell into the realm of descriptive qualitative and quantitative data (C. J. H. Steenkamp 2018), with a focus on the qualitative data that could be used to corroborate the experiences of the facilitator noted during the CI (Elliott 2002).

The two most important data collection instruments of this study were the facilitator-as-instrument and the researcher-as-instrument. They administered all of the data collection techniques (as discussed in Section 3.4) (Creswell & Cresswell 2018:205). They had to be accurate and thorough throughout the data collection process to gather reliable and credible data.

3.5. Data processing and analysis

As discussed in Section 3, the current study was primarily focused on understanding the phenomenon being researched. This was done by formulating a more holistic description of the observation of participants experiencing the intervention methods, as opposed to formulating an absolute truth that could be generalised to a wider population. The focus was thus on describing the data gathered and identifying themes as thoroughly as possible. A method that is appropriate to use to analyse qualitative data such as that gathered in this study, is thematic analysis (TA), which seeks to unearth, investigate, and outline themes that reoccur (Braun & Clarke 2006; Nowell et al. 2017). In the remainder of this section, the manner in which the gathered data were processed and analysed is explained as follows:

- Thematic analysis

- Post-positivism and TA
- Critical realism and TA
- Themes
- Six phases of TA
- TA in the current study

3.5.1. Thematic analysis

This method describes the data gathered, although it also includes explaining the methods of identifying themes (Kiger & Varpio 2020). TA has the flexibility to be used in various research frameworks, sample sizes, research questions, and research designs (King 2004; Terry et al. 2017:20–21; Kiger & Varpio 2020). This method is not bound to any specific research paradigm and can be used within the post-positivist paradigm (Braun & Clarke 2006; Joffe 2011; Terry et al. 2017:19).

3.5.2. Themes

Themes are constructed during TA to connect components of the data, to subject them to reinterpretation, and/or to re-examine these components (Kiger & Varpio 2020). Before the process of TA can be explained, one needs to define the term 'theme' and what it means within the realm of TA (Kiger & Varpio 2020). Braun and Clark (2006) describe a theme as a moulded response or meaning that encapsulates something significant from the data that enlightens the research question. Within TA, a theme is seen as latent content that represents the subjective meaning of the data as it exists within the context it was found (Vaismoradi & Snelgrove 2019). It does not matter how often a specific idea or component related to a particular theme occurs within the data set (Kiger & Varpio 2020), and the degree of significance of a particular theme is also not always reflected by how often it appears in the data set (Braun & Clarke 2006; Nowell et al. 2017). Themes can be grouped as follows (Braun & Clarke 2006; Kiger & Varpio 2020):

- Semantic: the apparent meanings of data components
- Latent: the underlying meanings of data components.

During the early phases of analysis, focus is usually placed on the semantic meanings of the data, and then as one investigates the data deeper, analysis can develop to the more latent direction (Terry et al. 2017:23). TA offers great flexibility in terms of identifying themes, but it is important to aim to include themes that address the research questions and give significant information (Braun & Clarke 2006). There are two approaches that can be taken when identifying themes:

- Inductive approach: This approach focuses on coding the data without any pre-existing concepts to draw from (Nowell et al. 2017). It is a data-driven, bottom-up approach to

analysis that is powered by what resides within the collected data (Braun & Clarke 2006; Braun & Clarke 2012:58; Terry et al. 2017:22; Nowell et al. 2017). This approach is notably used within grounded theory (Varpio et al. 2020).

- Deductive approach: This top-down approach focuses on a theory or idea that already exists and that is used to interpret the data collected (Braun & Clarke 2012:58; Varpio et al. 2020). The themes thus come more from the theoretical framework set out at the start of the researched that is brought to the data (Braun & Clarke 2012:58). This approach is useful when one has a specific research question one wants to focus on (Braun & Clarke 2006; Kiger & Varpio 2020) and is also less dependent on the data's semantic meaning (Terry et al. 2017:22).

The current study started analysis by identifying semantic themes within the data to provide a starting point to delve deeper to find latent themes as the researcher became more immersed in the data. Since strong theoretical guidelines have been put forth in Chapter 2, this theme identification was carried out by using the deductive approach to identify themes within the data.

3.5.3. Post-positivism and TA

The motivation for using TA for the current study was that it can be used to focus on the experiences and unique interpretations of individuals to comprehend the reality that they perceive (King 2004; Terry et al. 2017:19; Kiger & Varpio 2020). It is a fitting and powerful method for any research that seeks to analyse data in an effort to understand participant experiences, mannerisms, and perceptions (King 2004; Braun & Clarke 2012; Terry et al. 2017:19). Theoretical knowledge regarding reality and the development of it is thus supported within this method (Kiger & Varpio 2020). The current study primarily focused on observing each participant's lived experience of the intervention methods and how they perceived it on a physiological and emotional level (as discussed in Section 3.2) and it was these observations that needed to be understood, making TA the best suited method for analysing the gathered data.

3.5.4. Critical realism and TA

As discussed in Section 3.1.2, the ontological stance taken for this study was that of critical realism. Within this stance, the current research did not seek to merely acknowledge experiences but attempted to understand the underlying causes and meanings of these experiences (Joffe 2011). TA can thus make it possible for researchers to explain why specific groups in a population do not experience reality the same way as others do (Kiger & Varpio 2020). For the current study, focus was placed on individuals who struggle to imagine requested stimuli—i.e., individuals who experience the

reality of imagining different from others and therefore experience the reality of psychotherapy differently. TA provided the current study with the necessary descriptions and insight to understand this phenomenon.

3.5.5. Six phases of thematic analysis

The current study used the six-step process set out by Braun and Clark (2006), which has become the most common method used for TA (Clarke & Braun 2017). This form of analysis is recursive in nature, meaning that the researcher might return to previous phases if new themes or significant information is identified that requires further analysis (Kiger & Varpio 2020). The phases of this process are as follows (Terry et al. 2017:23–33; Nowell et al. 2017; Kiger & Varpio 2020):

- familiarising oneself with the data
- generating initial codes
- searching for themes
- reviewing themes
- defining and naming themes
- producing a report or manuscript.

3.5.5.1. Familiarisation with the data

The first phase in the TA process is that of actively reading and re-reading through the entire data set repeatedly (Braun & Clarke 2006). It gives the researcher a starting point to engage with the data gathered (Terry et al. 2017:23). Even if the data are collected through interactive means—such as through interviews—which allow the researcher to start the analysis with some prior knowledge and ideas (Nowell et al. 2017), it is still important for the researcher to immerse themselves in the data by repeatedly reading through the data actively to identify patterns (Braun & Clarke 2006; Nowell et al. 2017; Terry et al. 2017:23). The researcher has to know the breadth and depth of the data collected (Braun & Clarke 2006). This first phase can be very time consuming if the data were gathered through a wide variety of data collection techniques, such as interviews, focus groups, and more (Kiger & Varpio 2020). This is especially true for studies that include audio data that needs to be transcribed (Kiger & Varpio 2020), which is one of the reasons why studies such as the current study opt for a smaller sample size (Braun & Clarke 2006).

3.5.5.2. Generating initial codes

During the second phase, or the initial phase of generating codes, the researcher can start to identify potential data components that might be significant and that might connect to other data items or the research questions (Terry et al. 2017:26; Kiger & Varpio 2020). It is important to note that this

phase does not create themes yet; it gathers potential codes from the data, and requires the researcher to keep going back to the data repeatedly (Nowell et al. 2017; Kiger & Varpio 2020). A code is the most elementary component to which meaning can be attached regarding the phenomenon being researched (Kiger & Varpio 2020). Codes allow the researcher to concentrate on certain aspects of the data and to make it easier to understand (Nowell et al. 2017). They can be generated in the same manner as themes—by identifying semantic or latent codes through inductive or deductive analysis (Braun & Clarke 2006; Braun & Clarke 2012:61–63). These codes should be as unique as possible, so as not to be confused with other codes that fit into the coding framework or to be left redundant (Attride-Stirling 2001; Nowell et al. 2017). After the researcher has defined a set of codes, they can start to apply the codes to the whole data set (Kiger & Varpio 2020). In the current study, codes were generated in the same manner as themes were identified (as discussed in Section 3.5.2).

3.5.5.3. Searching for themes

Once the researcher has identified all the potential codes in the data set, the initial coding and collating of the data can start (Braun & Clarke 2006). Themes are generated by comparing, analysing, and combining codes that connect to each other (Terry et al. 2017:27; Kiger & Varpio 2020). Using thematic maps can help the researcher to organise and illustrate the connections between themes and sub-themes (Braun & Clarke 2006; Terry et al. 2017:28).

Thematic maps entail generating a detailed report of the generated codes and themes as well as their relationships with one another (Braun & Clarke 2006). This report includes detailed descriptions of each of the codes and themes, their frequency of occurrence and criteria, as well as examples (Braun & Clarke 2006). It is important to take note of all themes that might link to the research question and carry importance regardless of how much data falls under it (Kiger & Varpio 2020). Themes should connect to one another but not have overlapping codes between themes (Terry et al. 2017:28). These themes should also be unique and distinguishable from one another (Terry et al. 2017:28).

3.5.5.4. Reviewing themes

Once a set of potential themes have been identified, phase four commences with refining those themes (Braun & Clarke 2006; Nowell et al. 2017). This phase ensures that the generated themes work well alongside the data set and research question (Terry et al. 2017:29; Nowell et al. 2017). This phase consists of two levels of analysis, as follows:

- First level: Review the coded data placed within a specific theme and confirm that it belongs under said theme (Braun & Clarke 2006; Terry et al. 2017:29; Kiger & Varpio 2020). The

researcher has to determine whether each theme has enough data to support it, whether a specific theme is too vast, and whether the data included in a theme actually supports the theme (Terry et al. 2017:29–30; Kiger & Varpio 2020).

- Second level: The same questions asked in the first level apply to the themes at this level; however, they are asked in relation to the entire set of data (Terry et al. 2017:30; Kiger & Varpio 2020). Within this level, the researcher determines whether the entire data set is accurately represented by the themes and whether they fit into the thematic map (Braun & Clarke 2006; Terry et al. 2017:30).

Once the thematic map shows how the themes interconnect with one another and that they relate to the research question or phenomenon being researched as a whole, the researcher can move on the next phase (Braun & Clarke 2006; Kiger & Varpio 2020).

3.5.5.5. Defining and naming themes

During this phase of the analysis, the specific aspects of the phenomenon being researched, which is captured within each theme, needs to be clearly defined (Braun & Clarke 2006; Terry et al. 2017:31). Each theme's name should be refined to ensure that it is concise but still explains the theme adequately for use within the final report (Braun & Clarke 2006; Nowell et al. 2017). The most important components of each theme then need to be focused on, including which aspects of the data set it represents (Braun & Clarke 2006). A coherent narrative of each theme needs to be generated, explaining exactly how and why the theme is relevant and how it contributes to the phenomenon being researched (Braun & Clarke 2006; Terry et al. 2017:30–31).

3.5.5.6. Producing the report/manuscript

The last phase is to write up the complex narrative of the data (Braun & Clarke 2006; Terry et al. 2017:32) by compiling the final report with the elements gained through the previous phases (Terry et al. 2017:32; Kiger & Varpio 2020). The manner in which the researcher interprets the data should be described in this report in a clear and concise way (Braun & Clarke 2006; Braun & Clarke 2012:69).

3.5.6. Thematic analysis in the current study

As discussed above, TA is recursive in nature. For the current study, a recursive approach was also taken, meaning that the process was repeated for the data from the HAT forms (as discussed in Section 3.4.3) and the data from the CI (as discussed in Section 3.4.2). The phases of TA for the current study are outlined as follows:

- Phase 1: Familiarisation of HAT form data
- Phase 2: Generating codes from HAT form data
- Phase 3: Searching for themes in the HAT form data
- Phase 4: Reviewing themes and codes in the HAT map
- Phase 5: Familiarisation of CI data
- Phase 6: Generating codes from CI data
- Phase 7: Searching for themes in the CI data
- Phase 8: Reviewing themes and codes in the CI map
- Phase 9: Defining and naming themes and generating the **phenomenon map** (PM)
- Phase 10: Producing the report/manuscript.

3.5.6.1. Phase 1: Familiarisation of HAT form data

The facilitator made observations during the sessions, which were noted with pen on the printed-out HAT form after each session (as discussed in Section 3.4.3). After all the sessions were completed, the HAT forms of all the participants were repeatedly and actively read by the researcher to become familiar with the breadth and depth of the data collected. These data were more relevant to the individual sessions and not to the two groups as a whole.

3.5.6.2. Phase 2: Generating codes from the HAT form data

Potential codes were generated by the researcher during the reading and re-reading of the HAT forms. These codes were relevant to each individual session and not the specific group as a whole. The codes generated were used to start generating a thematic map—henceforth referred to as the HAT map—for the HAT forms, to explain in detail the relationships and hierarchies of themes and codes of the individual sessions.

3.5.6.3. Phase 3: Searching for themes in the HAT form data

The researcher read through the HAT forms completed by the facilitator, and attempted to identify the local themes (Welman et al. 2005:212) that might have had an impact on the overall effectiveness of the two treatments. Themes were identified for the individual sessions by re-reading the HAT forms and comparing and refining the various generated codes with one another to establish relationships and a hierarchy of themes, and to identify overarching themes between the individual sessions. The identified themes were integrated into the HAT map, which put forth the relationship between the themes and codes, described the themes in detail, and also provided examples of the

themes within the HAT forms. These themes were identified deductively (as discussed in Section 3.5.2) using the theoretical guidelines established in Sections 2.6–2.8.

3.5.6.4. Phase 4: Reviewing themes and codes in the HAT map

The HAT map was repeatedly re-read along with the HAT data to ensure that the themes and codes identified were aptly described and appropriately categorised, had ample support within the raw data, and connected well with the phenomenon being researched. Thus, the HAT map was refined and finalised as much as possible.

3.5.6.5. Phase 5: Familiarisation of the CI data

The researcher repeatedly and actively read the data gathered from the CI with the facilitator to become familiar with the breadth and depth of the data collected. These data were more relevant to the two groups as a whole and not the individual sessions.

3.5.6.6. Phase 6: Generating codes from the CI data

Becoming familiar with the data enabled the researcher to generate codes regarding the groups as a whole. These codes were used to start generating a thematic map, henceforth referred to as the CI map, to explain in detail the relationships and hierarchies of themes and codes of the two groups.

3.5.6.7. Phase 7: Searching for themes in the CI data

The researcher compared and refined the codes generated from the CI data to identify local themes. These themes were incorporated into the CI map to expound upon the relationships that exist between the themes and codes; described in detail; and also supported with examples from the CI data. The themes were identified deductively (as discussed in Section 3.5.2) using the theoretical guidelines established in Section 2.8.

3.5.6.8. Phase 8: Reviewing themes and codes in the CI map

The researcher re-read the CI data along with the CI map generated in phases 6 and 7 to ensure that there were enough data to support each generated code and identified theme; that each theme and code were described effectively; and that each theme and code were placed in the correct category. This was also done to ensure that the CI map connected well to the phenomenon being researched and was subsequently finalised.

3.5.6.9. Phase 9: Defining and naming themes and generating the phenomenon map (PM)

During phase 9, the researcher actively and repeatedly analysed the HAT map and CI map to identify overarching and connecting themes and codes. These themes were then clearly defined, refined, and named through constant comparative analysis as described by Pickard (2013:269–273). The HAT map generated in phases 3 and 4 was repeatedly compared with the CI map generated in phases 6 and 7 to define the nature of the relationship that exists between the independent variable (IV) and the dependent variable (DV) of the current study (Pickard 2013:269–273).

The two maps were integrated with one another to generate a thematic map for the overall phenomenon being researched. This map is henceforth referred to as the PM, and it describes in detail the thematic connections and hierarchies that exist between the two treatments and the individuals that experienced them.

In the PM, the themes were given definitive names and detailed descriptions. The relationships between the themes were finalised along with the hierarchies. The most credible data were chosen and incorporated as support for the themes and connections to the phenomenon being researched.

3.5.6.10. Phase 10: Producing the report/manuscript

In the final phase of the current study, the researcher used the complex PM, generated in phase 9, to write up a clear and concise narrative report. The researcher's interpretation was evident within this report and explained all the elements gathered during phases 1 to 9 in detail, along with supporting evidence.

3.6. Summary

This chapter started by defining the paradigm of the research clearly within the scope of the post-positivist paradigm, placing special focus on the ontological, epistemological, and methodological stance of this study. This was done to justify why the study used the various research methods, data collection techniques, and analysis methods. The research design of the study was thoroughly mapped out, clearly describing what an RCT study is and how the collection of qualitative data would work alongside a research method that is typically executed with quantitative data.

The various steps of the overall research were clearly outlined, defining the various groups of participants clearly to avoid confusion between the initial group and low-LIP group. The procedures for the standard and VR groups' sessions were discussed, as well as the role of the facilitator and the RCT logistics.

The chapter described data collection techniques such as the structured interview, CI, and HAT form, as well as the various tools and instruments used to implement these techniques. It explained the reasons for using different sampling techniques, along with the need for rigorous sifting through participants to acquire a sample that fit the scope of the research. It also explained why the participants of the low-LIP group could not be randomly divided, but needed to be randomised repeatedly until the mean LIP ratings were at an acceptable threshold to ensure data credibility. The method of informing the participants about the research as well as obtaining consent was discussed.

Lastly, this chapter focused on the method of analysis, explaining in detail the six steps of TA that were followed to analyse, code, and structure the data into a final narrative report. The chosen method of TA was justified by referring back to the paradigm established at the start of the chapter.

In the following chapter, the system design will be discussed in detail. The chapter focuses on the software and hardware used to develop the system that was used as intervention method for the VR group.

4. Chapter 4: System design

4.1. Introduction

This chapter discusses the overall design, technical details, and implementation of the VR system used to induce unique memories within participants in the VR group of the current study. This system, which was used to simulate a pre-defined image (as discussed in Section 3.3.3) for the participants in the VR group, remained consistent throughout the entire study, and is referred to from this point as the PENSIEVE. The PENSIEVE consists of a server side and a client side. Both these components' hardware and software details are discussed in detail in this chapter.

4.2. Server side

The server side of the PENSIEVE consisted of a user-friendly control panel system (as described in Section 4.2.3.1), accessible through a desktop monitor. It was used to control and facilitate the client side—the simulation being rendered in the HMD. This was similar to the control panels used in some of the systems examined in Chapter 2 (in Section 2.8). The following aspects of the simulation were controlled via the server side:

- specifying the name of the participant to be rendered on the door simulation
- fading the door simulation into view on the HMD
- rendering the specific participant's name onto the door through a slow fade
- ending the simulation by fading out the simulated door.

The server side was operated by the facilitator during each of the participants in the VR group's sessions (as discussed in Section 3.3.3). It was the facilitator's role to select the specific participant's name from a list and then guide them through the two phases of the system, namely: (1) a slow fade in of the simulated door with no name, and (2) a slow fade in of the participant's name on the simulated door. Thus, it was imperative that the interface was easy to use and the program logic easy to traverse, such as the control panel system used in the virtual Iraq/Afghanistan VRE system discussed in Section 2.8.1.1 (Rizzo et al. 2010), to avoid introducing a certain phase too early or to avoid the wrong name being rendered for the wrong participant. In Figure 4.1 below, the server side's program flow is laid out in detail with the aid of a flow diagram.

4.2.1. Program flow

The diagram below illustrates the functionality of the server side, which consists of eight steps. These eight steps are summarised below and are discussed in more detail in Section 4.2.3:

- To initiate the PENSIEVE, a local server was established on a desktop for the facilitator to be able to communicate with the HMD in real-time. During this step, the researcher assisted

the facilitator in setting up the local server on a desktop connected to the local network, initiating the control panel system, and activating the HMD.

- During the second step, the connection between the desktop and the HMD was established.

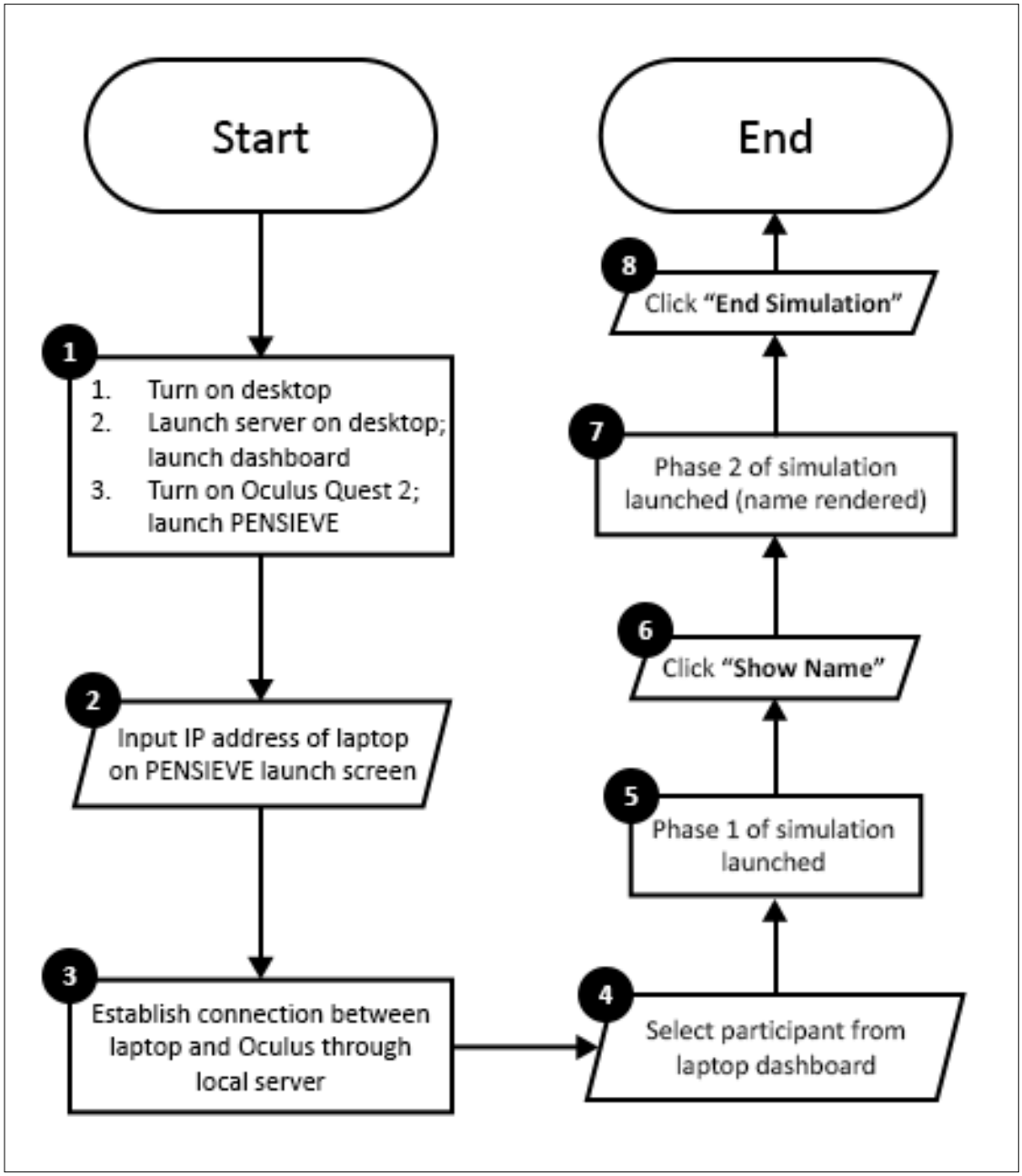

Figure 4.1: The server side basic flow chart

- The current participant from the VR group was then selected from a simple control panel on the desktop.
- After the correct participant was selected, a prompt would appear notifying the facilitator that the simulation had started. Section 2.7.4.2 discussed the basic process of using the door image during a SHIP® therapy session, and the steps listed there motivated the addition of a

step-by-step guide to assist the facilitator through the process of the session. During this step, only a door would fade in and be visible, with no name on it yet.

- A button labelled "Show Name" appeared to the facilitator to allow them to proceed with the session when ready.
- After the button was pressed, the name of the participant was successfully rendered and visible to the participant on the client side, i.e. within the VE rendered on the HMD. The facilitator was also able to see the rendered name on the door on the desktop monitor (as explained in Section 4.2.2).
- A button to end the simulation also appeared, allowing the facilitator to end the simulation when ready.

To achieve the program flow set out above, various hardware technologies and software technologies were used. Below follows a detailed discussion on which technologies were used, why they were used, and the broader implications of the technologies used.

4.2.2. Hardware details

The basis for the hardware used for the current study was determined by the various systems researched and described in Section 2.8. The current study required a facilitator to be able to control, launch, and terminate the VE remotely without the need to interact with the VE through the use of controllers. Rizzo et al.'s (2010) virtual Iraq/Afghanistan system used a user-friendly interface for clinicians to change the immediate environment in real-time. A similar interface was built for the current study using a desktop computer to run a local server and a user-friendly interface with which the facilitator could easily control the VE simulated on the HMD. The desktop computer was connected to the HMD using a cable. To establish a connection between the server and the HMD, the current study required a local area network, so the Wi-Fi available to students in the University of Pretoria's VRI Lab was used.

The PSA treatment system—as described in Section 2.8.1.2 (Lindner et al. 2021)—recorded users' sessions to enable users to review their experience at a later stage. For the current study, however, the facilitator was the objective observer, and needed to be able to view the participant experiencing the VE in real time. Therefore, recording each session as a video to watch later would not suffice; instead, the participant's experience of the VE was visible on the facilitator's desktop monitor in real-time. This was essential so that the facilitator would know when to proceed to the next phase, or end the simulation. The Meta Quest 2 (*www.meta.com*) was the chosen HMD for this study.

Figure 4.2: The client side HMD position on the mattress (left) and the server side setup on a desktop computer (right)

4.2.3. Software details

This section reports on the software used to implement the server side for controlling the VE rendered for the VR group. The software used is discussed in detail, as well as the motivations and the broader implementation concerns.

4.2.3.1. User friendly interface environment

In the virtual Iraq/Afghanistan VRE system (Rizzo et al. 2010), a clinician was able to alter the VE to suit a specific patient's need in real time through a control panel. This inspired the use of a similar control panel for this study. The trained SHIP® facilitator would use it to facilitate all the participant sessions, initiate and terminate the VE remotely, and adjust various settings of the VE. Its interface was designed to be as simple and user-friendly as possible, such as the interface used in the PSA treatment system discussed in Section 2.8.1.2 (Lindner et al. 2021). The control panel took the form of a pre-defined, click-based web application, created using the following scripting and styling languages:

- Hypertext Preprocessor (PHP)
- HTML
- JQuery

- Bootstrap.

All participants enlisted for the VR group of the current study were pre-defined using aliases on a system database (the backend), to allow the facilitator to click on the next participant according to the session schedule. This removed the need to type a participant's name into a text input and risk misspellings or other human errors, and provided the participants with anonymity. A screenshot of the server-side program home screen can be seen below in Figure 4.3.

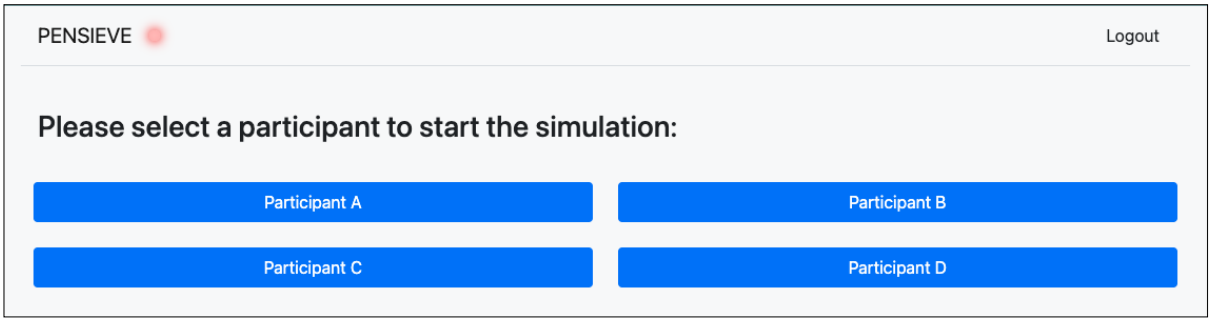

Figure 4.3: The server side home screen

The program flow was achieved using PHP, a free server-side scripting language that is used to make web pages interactive (*www.php.net*). The program was instructed to fetch the participant details from a database hosted on MAMP, a local server environment that is free to download (*www.mamp.info*). The red light next to "PENSIEVE" indicated whether the local server was running. Without the server running, communication between the server side and the client side would not be possible.

Once the facilitator selected a participant by clicking on one of the buttons with the mouse cursor, a pop-up window would appear to indicate that the simulation on the HMD had begun (as seen in Figure 4.4). This pop-up window was created using Bootstrap, a free-to-use frontend toolkit made to design user-friendly web applications (*getbootstrap.com*) and was used as the core component to facilitate the program flow for the server side. A screenshot of the initial pop-up window can be seen below.

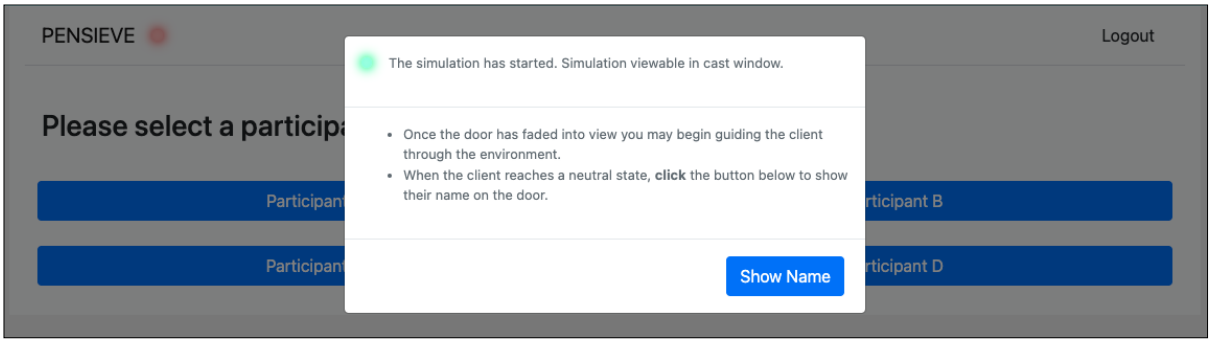

Figure 4.4: Phase 1 pop-up window

The pop-up window showed an alert at the top, informing the facilitator that the simulation had started and that it was visible on the monitor. Steps to be taken before proceeding to the next phase were also provided on-screen in bullet point form, to make it easy for the facilitator to know when and how to proceed to the phase 2 modal. The 'Neutral' state is referred to in the SHIP® Frame process, as explained in Section 2.7.4.2. Once the facilitator determined that the participant reached this state, using their professional opinion (as discussed in Section 3.3.5), they clicked on the "Show Name" button to proceed to the next phase. A screenshot of the phase 2 pop-up window can be seen below in Figure 4.5.

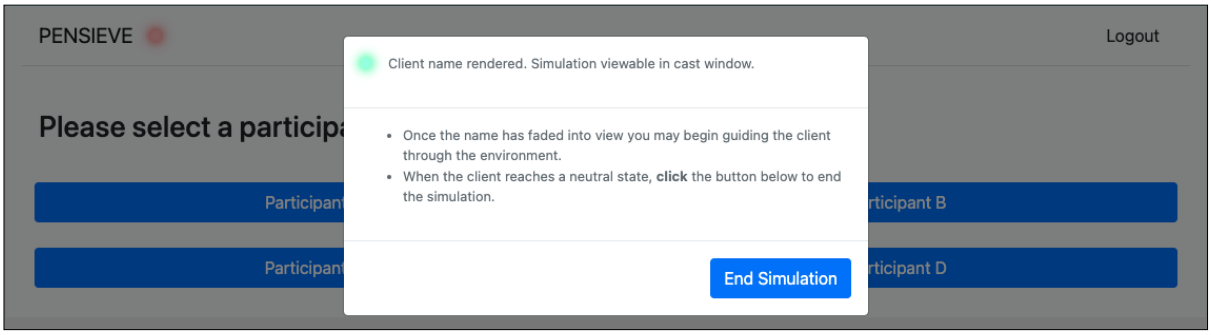

Figure 4.5: Phase 2 pop-up window

The phase 2 pop-up window notified the facilitator that the participant's name was rendered on the initial simulation of the door (as seen in Figure 4.20), thereby establishing the unique connection with the participant (as discussed in Section 3.3.3). Similar to the initial pop-up window, it notified the facilitator that the simulation was visible on their control panel monitor screen and reminded them about the steps to be taken before ending the simulation. Once again, the facilitator relied on their professional opinion to decide when the participant reached a neutral state. When the facilitator clicked on the "End Simulation" button, the simulation would fade out from view on the HMD and the phase 2 pop-up window would fade out from view on the desktop monitor to the home screen. Additionally, to prevent the facilitator from clicking on a participant who had already had their session, the applicable button was deactivated. A screenshot with a deactivated button can be seen in Figure 4.6 below.

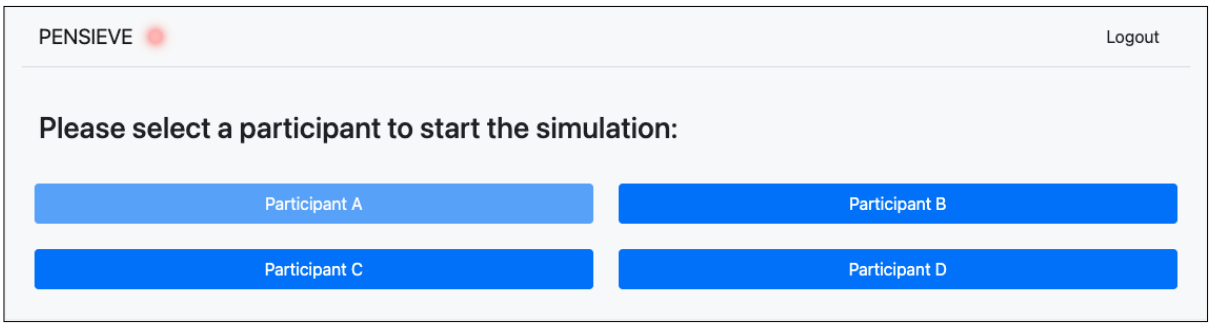

Figure 4.6: The server side control panel home screen with deactivated button

The server side was designed to keep the flow of the program as simple and user-friendly as possible. By allowing for only mouse click inputs and providing step-by-step prompts, the facilitator would be able to effectively navigate the VR sessions for each of the participants in the VR group. The following section discusses how the researcher set up a local server to allow for the server side to effectively communicate with the client side.

4.2.3.2. The local server

The current study required a virtual environment to be simulated—while being controlled by a facilitator via a separate interface—for a participant wearing an HMD. To accomplish this, a local server would be started on the desktop on which the control panel was being run, and the HMD would be connected to it via a local network, similar to how the virtual Iraq/Afghanistan system worked (Rizzo et al. 2010). To establish the connection between the server side and the client side the following steps were taken:

- The server was started via the desktop Terminal (as seen in Figure 4.7).
- Once the server was up and running, the server side interface was launched and the active server was indicated by a green light in the top left corner (as seen in Figure 4.8) and on the Terminal window (as seen in Figure 4.9).
- The VE was then launched on the client side and an IP address of the desktop used in step one on the local network was entered into the input field (as seen in Figure 4.10) to establish the connection.
- After proceeding, the connection between the server side and the client side could be confirmed in the Terminal window of the desktop used in step one (as seen in Figure 4.11).

Once the connection was successfully established, the screen on the HMD would fade to black and wait for instructions from the server side. With the connection established and the server side up and running, the system was ready to launch the VE that would assist in the SHIP® therapy process (as discussed in Section 2.7.4.2). Its design is explained in detail in the following section.

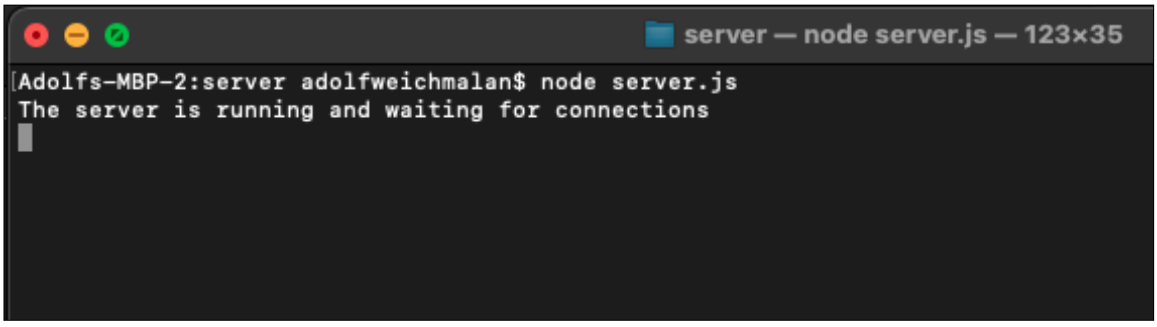

Figure 4.7: Server started up via desktop Terminal

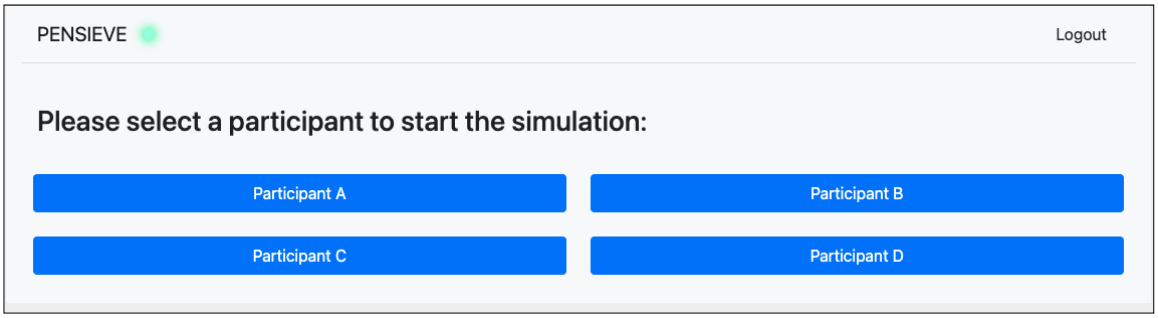

Figure 4.8: Active server indicated via green light in top left corner of server interface

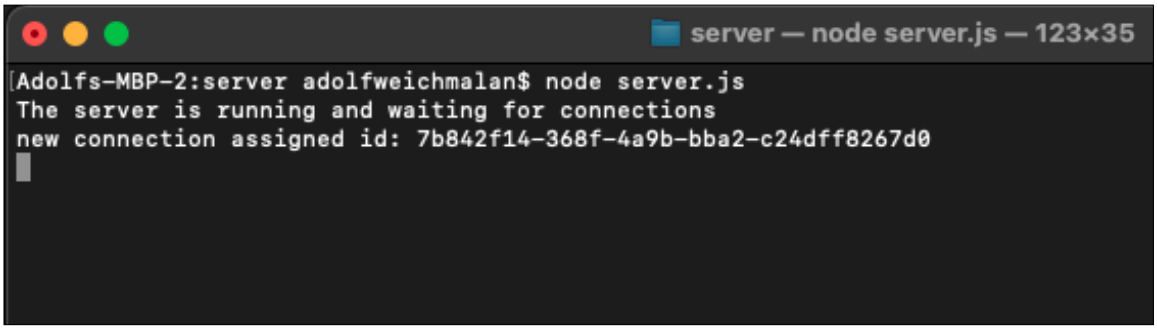

Figure 4.9: The client side connection to the server can be seen on the Terminal once the interface is launched

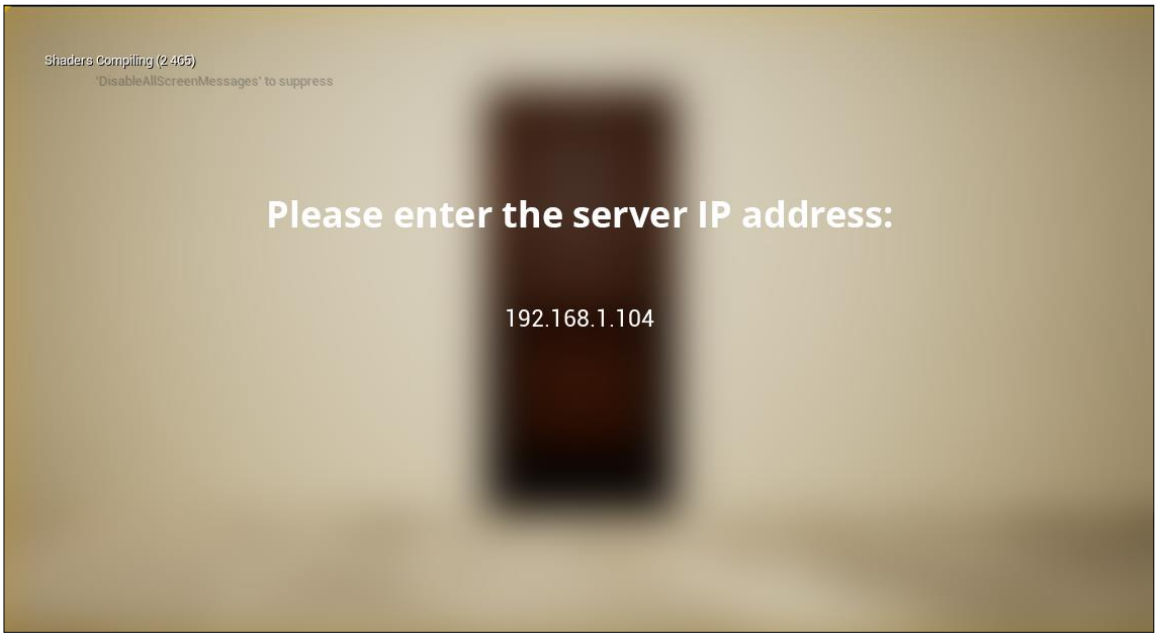

Figure 4.10: The client side home screen visible on the HMD prompting for IP address of desktop as input

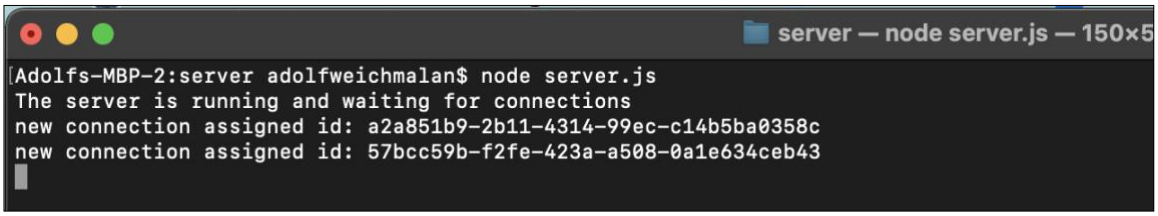

Figure 4.11: Terminal screen after the connection between the server side and the client side has been established indicating successful connection

For the current study, it was decided to use a local server setup, mainly for the sake of simplicity. All the technologies to achieve this were readily available at no extra cost and had the capacity to carry out the lightweight nature of the commands issued by the facilitator.

4.3. Client side

The client side for the PENSIEVE system—referred to simply as the client side—consisted of the VE and the HMD. Section 2.5.1 discussed the five pillars of a VR experience. The design of the VE for the client side in the PENSIEVE system had to adhere to those pillars to be considered a true VR experience.

One of the pillars addressed in Section 2.5.3 is 'immersion'. The researcher decided to use an HMD to immerse the user within the VE (Vergara, Rubio & Lorenzo 2017). Each participant in the VR group would wear the HMD during their session (as stated in Section 3.3.3). It is important to note that the only interactions that occurred between the participant and the VE was the head movement tracking, which updated their view in the VE in real-time. Other than that, the VE was not interactive in any way. It was designed only to introduce a visual associative trigger to attempt to induce activation of the unique memory or experience within the participant (as discussed in Section 2.7.4). Similar to the systems outlined in Section 2.8.2, the main purpose of the VE was induction; therefore, the VE only rendered a virtual door in an environment that placed the focus on the door with as little distractions as possible (as explained in Section 4.3.4) to carry out a SHIP® psychotherapy session, as described in Section 2.7.4.2.

As stated above, the client side was controlled by the facilitator. The basic program flow of the VE is outlined below, and is illustrated in the flow chart shown in Figure 4.12.

4.3.1. Program flow

The standard process of a SHIP® session using the door image served as the basis for the program flow design of the VE (as stated in Section 2.7.4.2). Figure 4.12 shows the events that occur from the moment the participant put on the HMD to when the facilitator terminated the session.

1. Once the participant was in a neutral state, the facilitator would ask the participant to imagine a door. After a couple of seconds, the facilitator would activate the door through the server side control panel, causing the door simulation to slowly fade into view on the HMD.
2. Once the facilitator determined that the participant had entered their neutral state again, they would instruct the participant to imagine their name on the simulated door. After a couple of

seconds, the facilitator would activate the second phase of the door simulation, causing the participant's name to slowly fade onto the door.

3. Once the facilitator determined that the participant had entered their neutral state again, they would instruct the participant to slowly pull their focus away from their name on the door and come back to reality. After a couple of seconds of allowing the participant to pull away from the VE, the facilitator would terminate the simulation, causing the entire environment to fade out.
4. Once the environment faded out, the participant would be instructed to remove the HMD.

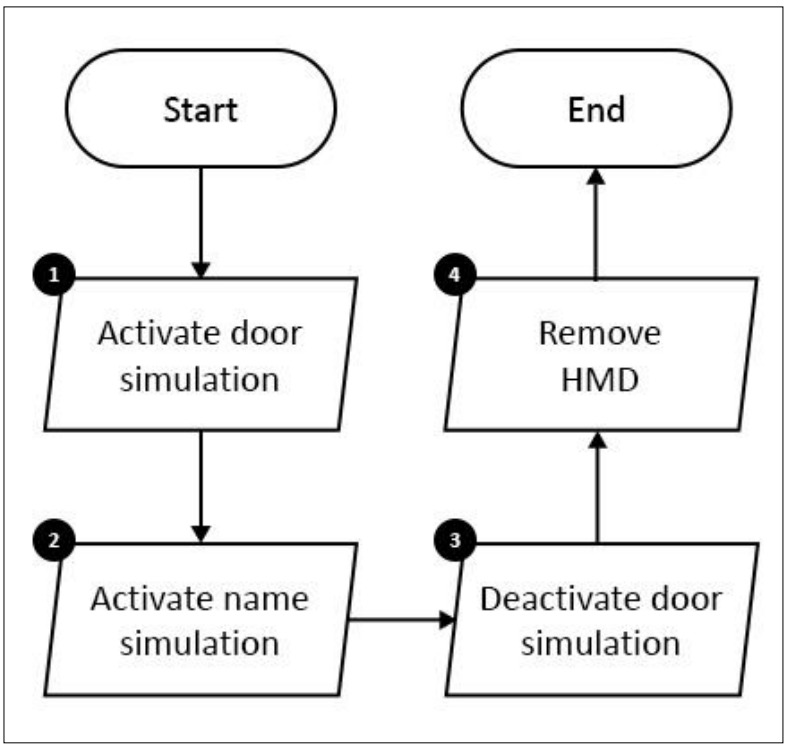

Figure 4.12: The client side (VE and HMD) basic flow chart

As outlined in Section 2.8.1.3, VE systems should design objects of importance in such a manner that they stand out from the rest of the VE and grab the attention of the user. Thus, the VE experienced by each participant had to be designed to keep the participant's focus on the most important object in the VE, the door. Section 3.3.4 explained that the main logistical issue faced was to ensure that each participant was comfortable throughout their session, and this included ensuring the comfortable fit of the headset. The HMD used in the current study had to be light and comfortable enough to enable the participant to remain in a relaxed state. The following sections describe both the hardware, software, and design heuristics that were used to achieve this.

4.3.2. Hardware details

This section explores the hardware that was used to implement the VR system used with the VR group. For the purposes of the current study, only the HMD will be described in its entirety, as the system did not require other forms of input, such as hand-held controllers.

4.3.2.1. Head-mounted display (HMD)

Various VRE systems examined in Section 2.8 used HMDs to immerse the user within a VE. The current study also opted for an HMD, specifically the Meta Quest 2, from this point on referred to as the Quest. The Quest had all of the specifications necessary to successfully immerse the participant into the VE, such as 360-degree immersion, and was mainly chosen for this reason. The Quest was also readily available, as the researcher owned one that could be used for the VR sessions. Other characteristics that motivated this choice included the type of HMD, its physical design, and its performance. Each is explained briefly below:

- **Type:** The Quest is a standalone HMD, which means that it does not require an external computer to run its virtual environments (Greenwald 2022). With no wires to move around or position in such a manner that could be distracting for the participant, a standalone HMD was best suited for the current study to create a completely immersive experience.
- **Physical design:** The lightweight design of the Quest and its three-point elastic strap headband were important factors to warrant its use in the current study (Greenwald 2022). Other HMDs such as the HTC Vive (*www.vive.com*) and the Valve Index (*www.valvesoftware.com*) have much heavier and bulkier fasteners to keep the HMDs in place on the user's head (as seen in Figure 4.13). For the current study, the participant had to be able to lie comfortably on their back, which made bulkier and heavier fasteners (such as the HTC Vive and Valve Index) unsuitable. It was imperative that the HMD was as comfortable as possible and created as little distraction as possible; therefore, the Quest was selected because of its comfortable and lightweight elastic strap (as seen in Figure 4.14).

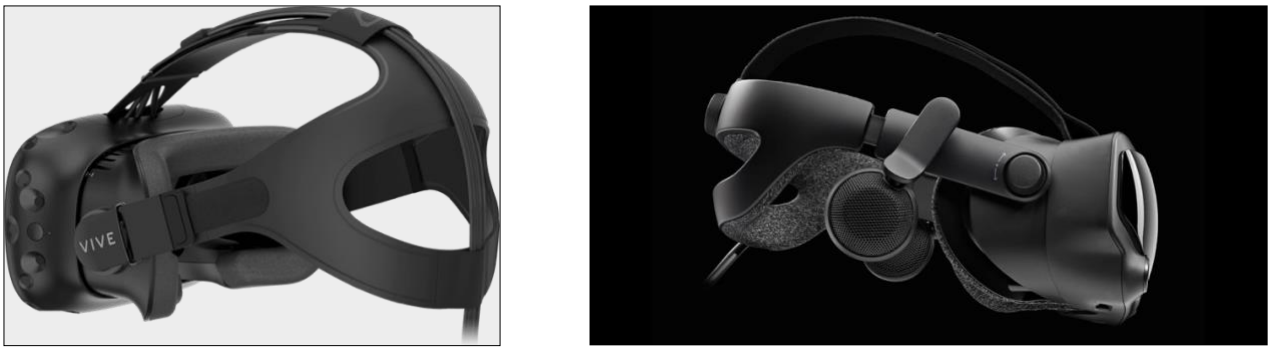

Figure 4.13: The HTC Vive (left) and Valve Index (right) have bulky head fasteners

Another prerequisite for the current study was for the facilitator to be able to see what was happening with the user's experience in real-time (as stated in Section 4.2.2). This was accomplished by running the VE via Unreal Engine to allow the facilitator to be able to see what the user was seeing.

Table 4.1: Meta Quest 2 hardware and software specifications

Type	Standalone
Resolution	1832x1920 (per eye)
Refresh rate	120 Hz
Weight	502g
Dimensions	102mm x 191mm x 142mm

Figure 4.14: Front view of Meta Quest 2 (left) and top view of Meta Quest 2 (right)

4.3.3. Software details

For the current study, Unreal Engine 4.27.2 (UE4) was used to design the VE. The following section details the process of designing the VE and the reasons why UE4 was chosen.

4.3.3.1. Unreal Engine 4.27.2

Unreal Engine (UE) is a game engine technology launched in the middle of the 1990s and is very popular for developing and designing software that is meant to entertain users (Gestwicki 2019). The engine provides functionality that is commonly used to develop entertainment software, such as input management, a 3D graphics rendering system, networking infrastructure etc. (Gestwicki 2019). Not only does the engine have support for different platforms such as mobile and gaming consoles, but it also supports development for software used on VR devices (Gestwicki 2019). UE4 is a free

engine that one can download to use all the functionalities listed above and more, but it also comes with free starter content such as 3D models of doors and windows (Satheesh 2016:1). One advantage of the starter content for designers is being able to test gameplay faster than normal (Epic Games 2023c). What is unique to UE is the method in which the software is programmed. Instead of using a programming language, such as C++ or C#, UE uses the Blueprint Visual Scripting system (discussed in the next section).

4.3.3.2. The Blueprint Visual Scripting system

As the current study had time constraints, it was appropriate to use development tools that would save time, such as UE's Blueprint Visual Scripting (BVS) system—a comprehensive system to assist in the development and scripting of gameplay mechanics that uses a node-based user interface (Epic Games 2023b). It is both powerful and versatile and is used to create gameplay elements through reusable code and elements, and/or classes (Epic Games 2023b). Its user-friendly interface gives designers access to a whole spectrum of tools and concepts for programming (Epic Games 2023b). The researcher had extensive knowledge of the software, reducing the time it would take to master entirely different software. An example of the node-based interface of the UE editor can be seen below in Figure 4.15 (Epic Games 2023a):

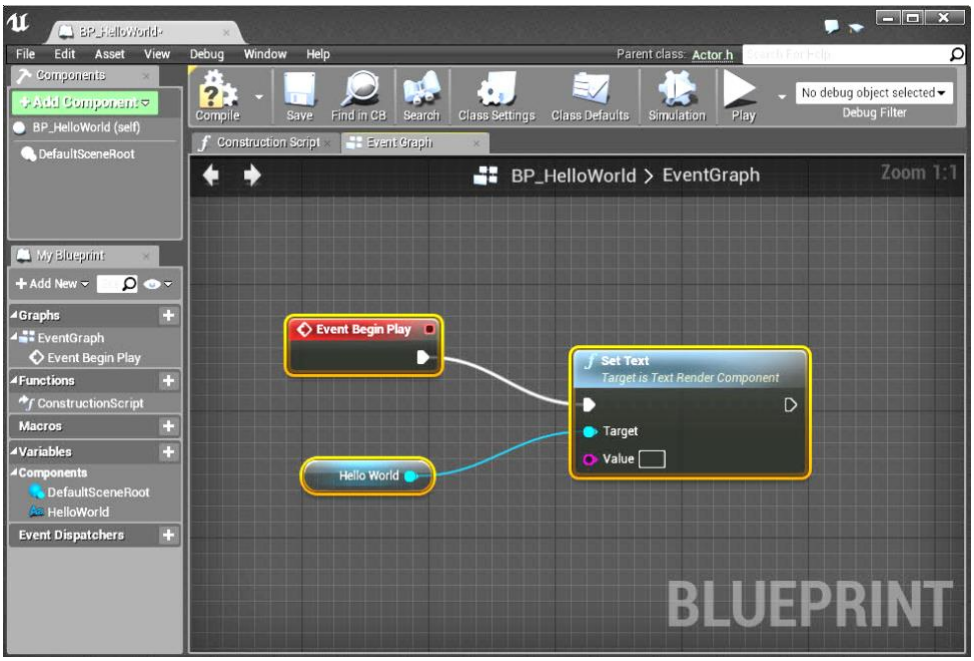

Figure 4.15: Node-based interface of Blueprint Visual Scripting system in UE4

4.3.3.3. UE starter content

As mentioned above, UE provides a designer with a large variety of free starter content. This starter content includes various elements that any designer might need, such as 3D models of shapes,

materials, and everyday objects used in real life (Epic Games 2023c). This partly motivated the use of UE, as it would save time when designing the VE. Among the objects available is a door, as well as the primitive box shape, both of which were used for the design of the VE for the current study; these are discussed in detail below.

UE also provides a designer with other starter content, such as various templates from which to start their project (Epic Games 2023d). Different templates provide rudimentary starting points, depending on the type of game the designer is developing (Epic Games 2023d). One of these is a VR template that was used for the current study as a starting point, as seen in Figure 4.16 below (Epic Games 2023e).

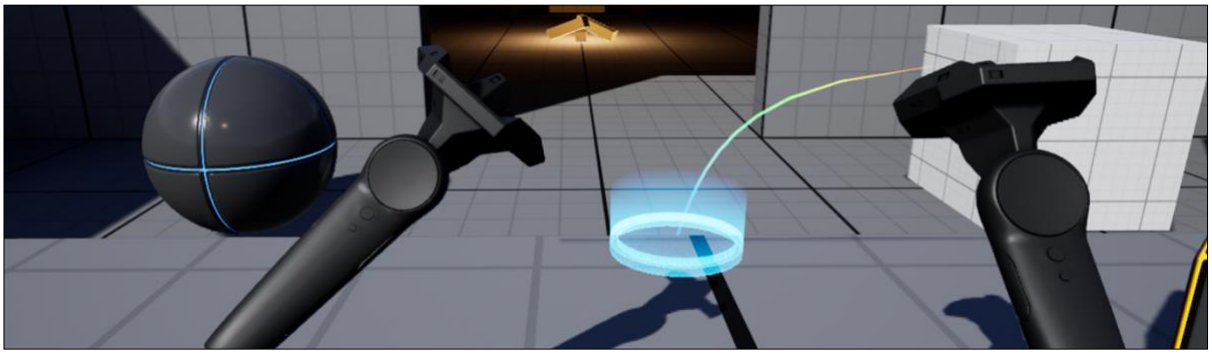

Figure 4.16: Example of VR template provided by UE4

4.3.4. Designing the VE

In Section 2.5.1, the five pillars of a VR experience were defined. These pillars, namely 'virtual world', 'sensory feedback', 'interactivity', 'immersion', and 'participants', had to be adhered to for the system to be considered a virtual experience. As stated at the start of Section 4.3, the VE for the current study did not allow for any interaction with the simulated world, apart from the participant being able to look around. The VE was mostly a visual experience and the participant had no control over the VE, but had the freedom to look around, making the VE application a passive one (Vergara, Rubio & Lorenzo 2017).

As indicated in Section 3.3.3, each participant of the VR group would be guided through the VE by the facilitator. Therefore, the participant would need to be able to hear the facilitator when instructions were passed on verbally. Thus, the VE did not include any audio input. This was also done to lessen distractions and keep the participant's concentration on the door and their name rendered on the door.

The fact that the VE was only visual in nature did not exempt it from having to adhere to specific design heuristics to make the experience for the user comfortable and effective. The design heuristics identified are discussed in detail in the following section.

The act of looking around the VE is in itself a way in which the user interacts with the environment; therefore, the two pillars of 'interactivity' and 'participants' were accounted for through this interaction. The design heuristics identified were considered and used to account for the other three pillars that make up a virtual experience.

4.3.4.1. Design to increase the user's sense of presence

The difference between immersion and presence was explored in Sections 2.5.3 and 2.5.4. Even though the level of immersion of the VE is important, more focus was placed on increasing the level of presence felt by the participants in the current study. As stated in Section 2.5.4, a user should feel as if they are actually 'there' when immersed in a VE to have them respond as naturally as possible. For SHIP® therapy to succeed, a client's physiological and psychological reactions, or SHRs (as discussed in Section 2.7.3), must occur naturally and as a response to the imagined stimuli. This is exemplified in the VRET system for fear of driving (Costa et al. 2018) and the VRET CAVE system for treatment of acrophobia (Gromer et al. 2018) as discussed in Section 2.8.3, which were able to evoke such responses within the participants. Therefore, the VE for the current study was designed so that its appearance, the objects it contains, and the way it behaves mimic the expectations that a user has of reality (Sutcliffe & Gault 2004; Moore et al. 2020). The only interaction with the VE was that of the freedom to look around the environment. The environment allows the user to explore, and therefore the interaction was designed to give the participant the feeling of standing in the room.

4.3.4.2. Maximise efficiency in the spatial environment

VR is fundamentally spatial, so it is very important to create a VE that does not make it complicated for the user to achieve their goals and is also comfortable for them (Vi, da Silva & Maurer 2019). The VE should be carefully designed to use the additional space and to its advantage while minimising the need for physical movement on the part of the user (Vi, da Silva & Maurer 2019; Kamińska, Zwoliński & Laska-Leśniewicz 2022). Factors that were considered when designing the VE for the current study were as follows:

- Determine the visual and physical limitations of the technology, such as the user's **field-of-view** (FOV)—i.e., the dimensions of the display (Shi et al. 2021), as well as their **point-of-view** (POV)—i.e., whether they are sitting, standing, etc., and keep them in mind when

placing content (Vi, da Silva & Maurer 2019; Kamińska, Zwoliński & Laska-Leśniewicz 2022).

- Investigate thoroughly how a space can be used to avoid positioning too many objects together (Vi, da Silva & Maurer 2019). In a room-scale VE, for example, the aim should be to have objects with the highest chance of being interacted with, or with the most information, placed closer to the user, while other, less important objects be outside of their immediate space (Schjerlund, Hansen & Jensen 2018).
- Objects that are related or the same should be positioned together to assist users in locating information and finding more objects (Schjerlund, Hansen & Jensen 2018; Vi, da Silva & Maurer 2019).

For the VE of the current study, a single door was placed in an empty room in front of the starting location of the user. The space around it was left empty to maximise efficiency when the user entered the VE, meaning they would not get distracted or need to search for whatever they were supposed to be looking at. Moreover, the user was lying down and thus unable to physically move to another location. The only other object in the room would be the eventual introduction of the participant's name on the door. This name was faded onto the door in front of the user to minimise the need for the participant to look around the VE and search for their name. The final door rendering—before and after the name was rendered onto it—can be seen in Figure 4.19 and Figure 4.20. The 'sensory feedback' pillar for a VR experience (as described in Section 2.5.1.2) was accounted for through the user being able to look around and receive sensory input because of their head position, and also through fading in of the participant's name on the door. This provided them with visual feedback with regards to the progression of the VR experience. Auditory feedback was only provided in the form of the facilitator guiding the participant through the VE with their verbal instructions and none via the VE itself.

4.3.4.3. Make the user's comfort the main priority

The user's safety is a priority when designing a VE, and steps should be taken to protect the user physically (Vi, da Silva & Maurer 2019). As discussed in Section 2.6.4, motion sickness is sometimes experienced by users and could increase their discomfort. Since one is immersing a user into a 360-degree environment, multiple factors that affect the user's level of comfort could be introduced (Vi, da Silva & Maurer 2019). For the purposes of this study, the level of comfort experienced by the user was paramount, because if they could not relax and let their emotions and imaginations run freely, no SHRs would take place (as discussed in Section 2.7.3). Therefore, the following factors were considered when designing the VE.

- The personal space of the user must be respected, meaning that objects introduced to the user in the VE should not be placed right in front of their faces as these could give them a fright or bewilder them (Vi, da Silva & Maurer 2019; Kamińska, Zwoliński & Laska-Leśniewicz 2022). Objects of importance should be placed a comfortable distance from them from the start of the experience (Schjerlund, Hansen & Jensen 2018; Vi, da Silva & Maurer 2019).
- Due to the fact the user is being immersed in a 360-degree environment, the user might feel uncomfortable because of the discrepancies between what they expect to experience and what they actually experience physically and visually (Vi, da Silva & Maurer 2019; Moore et al. 2020). The VE must be designed to avoid causing motion sickness for the user (Vi, da Silva & Maurer 2019). Notably, the current study's VE did not allow for any movement around the VE. Motion sickness is generally a product of perceived motion (as discussed in Section 2.6.4), so participants were not expected to experience motion sickness.
- Different forms of discomfort associated with the environment, such as height and lighting, can be experienced by users in a VE, and methods should be put in place to adjust certain aspects of the VE to lessen such discomfort (Vi, da Silva & Maurer 2019).

The methods discussed in Section 2.6.4 were considered along with the above-mentioned factors to design a VE that is as comfortable as possible for the user, such as by limiting the span of the environment to only one room. The VE of the current study had the user begin in an empty room with minimal lighting to illuminate only the door. The door was placed a comfortable distance away from the user to not intrude on their personal space (as shown in Figure 4.20). No interaction with the VE was required from the user; however, since the participant would still expect to be able to look around them, the VE did allow for them to do this. The acrophobia treatment system discussed in Section 2.8.2.1 (Nabukenya et al. 2021) allowed the user to increase or decrease their level of discomfort by changing their environment. Because the VE of the current study only had lighting to illuminate the door, and when looked around the user would only see trailing darkness and no other objects (as seen below in Figure 4.17), it could prove to be uncomfortable for some users. Similar to the acrophobia treatment system (Nabukenya et al. 2021) and the general social skills VRE discussed in Section 2.8.2.2 (Zainal et al. 2021), where the users had control over the level of discomfort they were experiencing, a mechanism was built into the PENSIEVE to adjust the lighting. If a particular user felt uncomfortable due to the darkness, the facilitator could simply make the room brighter to illuminate all the walls around them. The 'virtual world' pillar (as discussed in Section 2.5.1.1) was satisfied by designing the VE with the above-mentioned heuristics in mind.

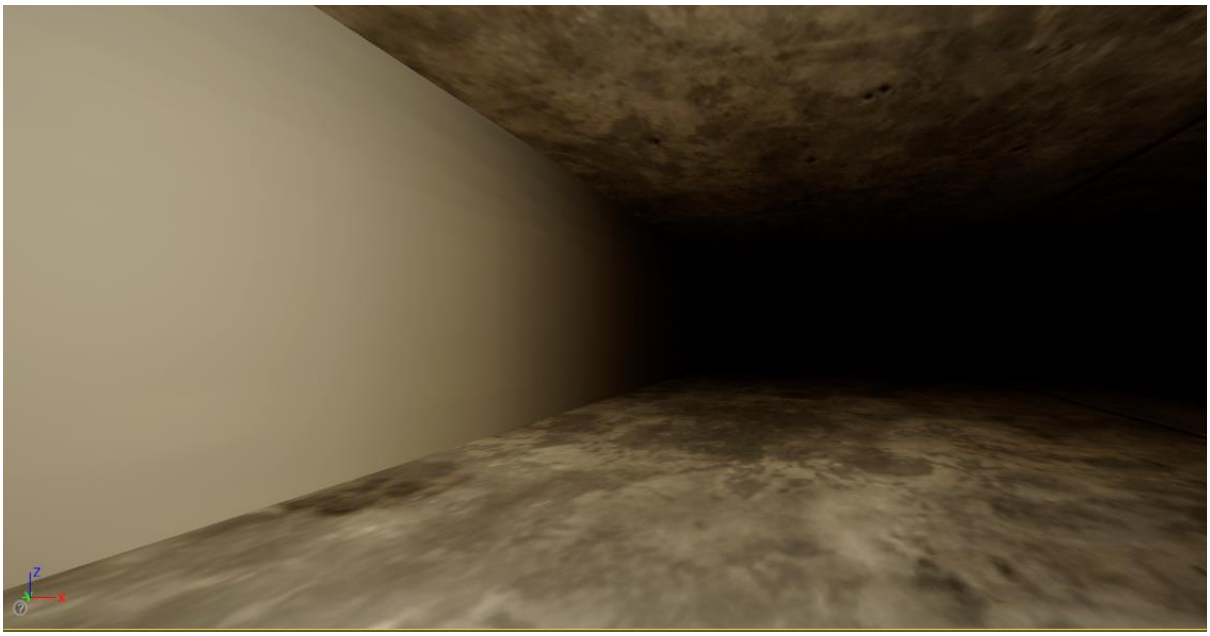

Figure 4.17: Dimly lit room with no other objects—view of right side

4.3.4.4. Avoid overwhelming the user

In the paediatric neurorehabilitation VR systems discussed in Section 2.8.1.3, objects of importance were designed to grab the user's attention. It was also noted in the study of a VR Advanced Life Support (ALS) training system that the objects that can and should be interacted with must be clearly visible (Moore et al. 2020). Thus, it is important not to distract the user from what is important within the VE, and the aim should be to keep the environment as simple as possible with as few redundant elements as possible. The VE should be focused on relaying relevant information in a way that does not overwhelm the user. To keep the current study's environment as simple as possible, the following factors were considered (Vi, da Silva & Maurer 2019):

- Objects of importance should be available to the user when needed, but should not distract them from the immediate or more important tasks.
- The user's vision should be unimpeded by virtual elements.

The current study's VE did not require any form of additional information, such as through a heads-up display; therefore, there were no virtual elements that could impede participants' vision. Furthermore, the only objects of importance were the door and the name on the door, both of which were only faded into view when needed. No other elements were rendered in the VE that could distract the user.

4.3.4.5. Consider hardware limitations and capabilities

The system used dictates how users are able to explore and experience the VE (Vi, da Silva & Maurer 2019). It is thus important that the VE is designed in such a manner that tasks can be completed with the hardware available to them (Vi, da Silva & Maurer 2019) and that the user's positioning while wearing the HMD is taken into account when designing the VE and placing objects (Kamińska, Zwoliński & Laska-Leśniewicz 2022). The standard process of a SHIP® session, as outlined in Section 2.7.4, has the client lying down and thus unable to reposition themselves. For the current study, this standard process was also adopted for running the VR group's SHIP® sessions (as discussed in Section 3.3.3), which would not allow them to reposition themselves within the VE. Thus, no controllers or position tracking were used, meaning that the user was unable to interact with the environment using their hands, or move around the VE. This meant that the objects of importance had to be placed in the vicinity of the user to avoid them having to walk to it to read their names on the door. The system also had to be designed in such a manner that the facilitator could interact with the environment such as with the virtual Iraq/Afghanistan (Rizzo et al. 2010) system and the PSA treatment system (Lindner et al. 2021). This was discussed in detail in Section 4.2, where the facilitator interacts with the environment through a user interface. Focus was also placed on using the visual possibilities provided by the hardware to ensure that the environment looks realistic enough to draw the user's attention to the important object, i.e., the door.

4.3.4.6. Guide users through cues

The VE should assist the user through their experience by means of cues to help them start the experience, make their choices easier, or whatever else is required to take them through the entirety of the experience (Sutcliffe & Gault 2004; Vi, da Silva & Maurer 2019). The following factors were considered when designing the current study's VE to assist the users through their experiences (Vi, da Silva & Maurer 2019):

- Grab the user's attention through the means of visual, haptic, or auditory cues to show them what is important to achieve their goals or where to move.
- Design the choices that have to be made by the user to be as simple as possible.
- Do not bombard the user's senses through too many notifications or indicators.

As discussed at the start of Section 4.3.4, the most prevalent cues for progression through the PENSIEVE was that of auditory instructions from the facilitator guiding the VR group's sessions. However, the current study's VE also cued the start of each phase (as described in Section 2.7.4.2 and 4.2.1) by first fading in the VE from black, with the door directly in the user's line of sight, and secondly, fading in the participant's name on the door. From the start, the user's attention is on the

only object within the VE, i.e. the door. Lastly, the VE did not incorporate any type of heads-up display, so there were no other visual elements that could overwhelm the user's senses. The only sense of the participant that was engaged by the VE during the experience was their visual senses, and no auditory, tactile, or haptic feedback was introduced by the VE.

4.3.4.7. Avoid SHIP® distractors

As stated in Section 2.7.5.2, there are some distractors that can occur during a SHIP® session that a psychotherapist must look out for and avoid, because they could hinder the progress of the therapy. Some of these distractors influenced the design of the VE for the current study:

- **Image jumping:** This occurs when the client imagines images that are different from the requested stimuli in succession, and does not connect with the sensorimotor content of each image (J. O. Steenkamp 2018:227).
- **Image colouring:** The client creates what they perceive to be ideal images to manipulate the psychotherapist into believing that a specific problem has been dealt with and that they can move on (J. O. Steenkamp 2018:227).

To reduce the possibility of the participant experiencing one of these distractors, the researcher decided that the VE should take the form of an empty room with only two main objects, the door and the name of the participant rendered on the door.

To summarise the above section, the following criteria were put forth for the design of the VE:

- Design an efficient spatial environment.
- Make the participant comfortable both inside and outside of the VE.
- Do not overwhelm the participant's senses.
- Design a VE that complies with the hardware used.
- Use visual cues to keep the participant's attention.
- Avoid SHIP® distractors by using minimal objects within the VE.

4.3.5. The final VE

Taking all the above-mentioned design heuristics into consideration, the final VE took the form of an empty room with only two main objects introduced at different stages of the simulation. A VR template provided by UE4 was used as a starting point, and was emptied of all other objects and elements, so that only the user's starting location and basic environment lighting were left. The rest of this section explains how the VE was designed using the elements provided by UE4's starter content.

4.3.5.1. The empty room

The main structure of the VE consisted of four walls, a ceiling and a floor. To create some sense of depth within the VE to prevent motion sickness (as stated in Section 2.6.4), different materials were used to distinguish the ceiling and floor from the surrounding walls. Having all the walls appear to be of the same material as the floor and ceiling might make the user feel uncomfortable inside of the VE, due to a discrepancy between what is expected and what is experienced. Making the walls out of the same material as the ceiling and floor might also disorientate the user and might lead to motion sickness.

4.3.5.2. The door

The main goal of the current study's VE was to instil a high level of presence within the VE so as to have the participant respond to the interaction afforded with the core object of the entire VE—the door—as naturally as possible (as discussed in Section 2.5.4). It was also noted in Section 2.5.4 that the two dimensions fidelity and interactivity can add to the sense of presence. As the current study's VE was devoid of interaction, except for natural head movement and tracking, the VE would need to be very realistic to instil the required levels of presence. Fortunately, the starter content provided with UE4 includes a realistic 3D model of a door (as seen in Figure 4.18). This door was used as the core object in the VE, because of its realism, to assist with the participant's sense of presence.

It was noted in the study of the VR Advanced Life Support (ALS) training system that participants requested for more discernible design elements—such as text within the VR simulation to be more readable (Moore et al. 2020). If a participant in the current study's VE was tasked with looking at their name rendered on a door, but was unable to see the name clearly, it would violate the heuristic of what was expected versus what was experienced (as stated above in Section 4.3.4.3). Therefore, the participant's name had to be rendered in text large enough to be clearly visible from the position where the participant was standing (as seen in Figure 4.20).

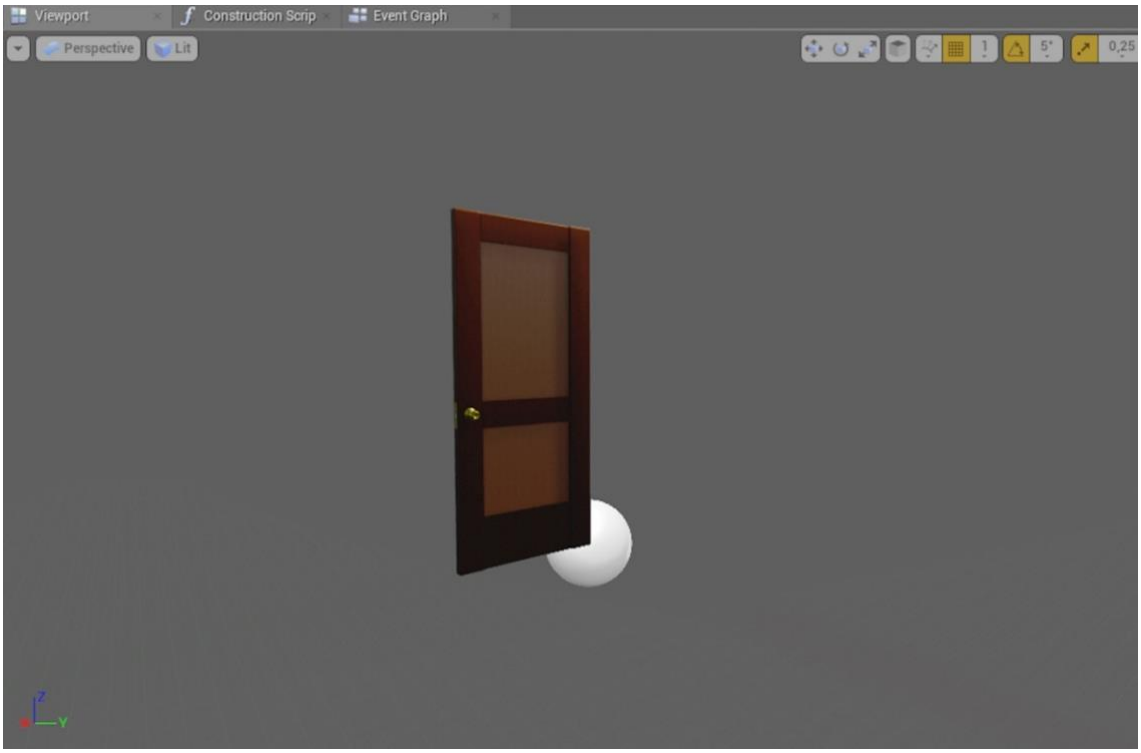

Figure 4.18: 3D door used in VE

Figure 4.19: The door in the VE before the participant's name fades in

Figure 4.20: The door in the VE after the participant's name fades in

For the purposes of the current study, the researcher designed a VE to mimic the perceived human imagination, with a non-interactive, minimalistic, realistic, immersive environment. The minimalistic design helped to grab the attention of the participants and fix their concentration firmly on the objective, which was the door and what it might symbolise within their subconscious. The walls and floor were visually distinguishable from each other using materials that would lessen the discomfort of participants and help prevent potential motion sickness. Head movements were allowed for the same reasons. The last pillar needed for a virtual experience, i.e. 'immersion' (as discussed in Section 2.5.3), was achieved through the design of a VE that was realistic.

4.4. Summary

This chapter presented and motivated all the relevant details regarding the design and implementation of the PENSIEVE system. The two main components of the system were introduced at the start of the chapter, namely the server side and the client side.

The server side of the system was examined first, starting with the basic program flow of the component. The hardware details, including the main desktop and monitor, were introduced and discussed. This was followed by an in-depth report on the software details relevant to the design and implementation of the server side control panel. The local server and the software used to connect the server side and the client side were also explored.

The chapter then looked at the client side component consisting of the VE and the HMD. After discussing the overall program flow, it explained the hardware details surrounding the client side,

including how an HMD was chosen to immerse the participants in the VE. The chapter continued by looking at the software details of the client side, explaining BVS, starter content, and starter templates that motivated the use of UE4 for the VE. The chapter also described the spatial design of the VE and the heuristics that motivated the final design. The chapter concluded by reviewing the final design of the VE; how it was achieved; what objects, elements and starter content were used; and the reasoning behind the design.

The following chapter examines the results obtained from the participant sessions with the VE and without the VE.

5. Chapter 5: Data analysis and results

This chapter discusses the results obtained from the primary research method in detail. This includes the first phase quantitative data obtained from the initial group recruited through purposive sampling (as described in Section 3.3.2.2), which helped determine which participants would carry on with the remainder of the study.

This chapter then specifies the data collected during the RCT (as explained in Section 3.3.1), and the results obtained from analysing said data using TA, as explained in Section 3.5. The quantitative data collected in the HAT forms are also addressed, to provide a broad overview of both groups and how their sessions were perceived by the facilitator.

The majority of the data collected came from the facilitator (their observations, their answers given on the HAT forms, and their answers during the CI) and the audio recordings of the participants' sessions. Throughout this chapter, inverted commas and italics (e.g. *"I can see the door simulation"*) indicate quotes of the participants. The quotes are kept as close to the originals as possible, including where the researcher translated Afrikaans quotations or remarks to English. For the sake of brevity, phrases such as "um", "like", etc. are included only where removing them would negatively affect readability or alter the meaning of the sentence. Each participant is referred to by a unique number. Participants in the first phase of data collection were labelled with the letter 'P' and a number (for example, 'P01' refers to participant 1 in the first phase). For the RCT, the Control group participants were denoted with a 'C', and the virtual reality group with a 'V' and their numbers.

Notably, the facilitator referred to throughout the chapter is not the researcher. The facilitator assisted in the data collection process, as it would have been unethical for the researcher to collect personal data from participants within the context of this study. (The primary researcher of this study is the author, who analysed the gathered data to obtain the results discussed.)

This chapter starts off by looking at the data gathered during the relaxation/imagination exercise held with the initial group of 28 participants. Initially, 33 participants agreed to partake in the study and were given designations P1–P33 when the phase 1 data collection began. After five of those participants withdrew from the study due to scheduling conflicts, the researcher decided to keep the original designations assigned, to avoid confusion with tracking scores and other logistics.

The procedure followed during the imagination exercise is described first, followed by the results obtained. The selection of the final participant group is then addressed. The section also explains why some participants were not considered for the remainder of the study or dropped out.

After the first phase's data collection and analysis discussion, the second phase of the data collection is presented, along with the data obtained and its analysis. The relevant section starts by introducing the RCT, the data collected from the sessions, and the TA that was used to analyse the data. The general procedure of each SHIP® session is described. The last section focuses on the overall intent of the sessions, unexpected occurrences in the sessions, and what actions were taken by the researcher and the facilitator to deal with these. Emphasis is made that the intent of these sessions was not to provide any psychotherapeutic treatment. In certain sessions, the facilitator assisted participants who experienced adverse reactions to process the reactions effectively, by creating a supportive and safe space for them to do so. This was done to protect the participants from potential psychological after-effects, and to allow them to leave their sessions in a neutral state.

This chapter then delves into the data collected from the Control group and the VR group. The Control group had traditional SHIP® sessions—the facilitator asked them to imagine the requested stimuli and engage with SHIP® activities, while the VR group had VR SHIP® sessions—being immersed within a simulated environment that provided them with visuals for the requested stimuli, and then also engaging in SHIP® activities after being immersed. For both groups, the audio recordings taken of each session were transcribed and analysed by means of TA, to identify the various clusters of emotional, physical, and mental responses induced in the participants.

Following this, the chapter discusses the various aspects of VR that either assisted the overall process of SHIP® or hindered it. The data explored in this section come primarily from the HAT forms that the facilitator filled in during the sessions, and the CI that the researcher conducted with the facilitator. The researcher analysed both the HAT forms and CI transcript using TA, to identify various themes and similarities and draw comparisons between the two groups. The section continues by looking at the hindering aspects of VR that were identified during the analysis. Finally, the chapter concludes with a summary of the entire data collection and analysis process.

5.1. Phase 1: The imagination exercise

This section reports on the process of narrowing down the initial group of participants obtained (as outlined in Section 3.3.2) into the final group that would be divided into a Control group and a VR group to take part in the RCT.

5.1.1. Process

The purpose of this first phase of data collection was to gauge each participant's individual LIP rating (as explained in Section 3.3.2.3), a numerical value based on the richness, authenticity, and consistency of their descriptions. This was necessary to find the participants with the lowest LIP ratings, to create two homogenous groups for the RCT. The overall process was as follows:

- The facilitator asked the participant to relax their bodies and to try and become aware of themselves within the space.
- Once the participant was relaxed, the facilitator asked them to imagine a door.
- After a couple of minutes, the facilitator asked the participant to describe the door in as much detail as possible.
- Once the participant had finished with their description, they were asked to just relax and keep imagining their door.
- After about 10 minutes the facilitator asked the participant to describe the door again.

Some of the participants were uncomfortable with lying down flat on the air mattress. The facilitator and the researcher agreed that the most important aspect of the data collection process was that each participant felt as comfortable as possible. Therefore, they gave participants the option to either lie down flat on the air mattress, sit on the air mattress with their backs against the wall, or sit in the office chair opposite from the facilitator.

5.1.2. Results of phase 1 (imagination exercise)

This section presents the results of the initial group's imagination/relaxation exercise with the facilitator. In total, 28 individuals took part. From this group, six participants were excluded from the rest of the study. Four of these were excluded for the following reasons:

- previous exposure to SHIP®
- unavailability during the designated time frame for the RCT.

The other two participants presented signs of past or present trauma, as explained below.

5.1.2.1. The presence of past trauma and phobias

Besides finding participants with the lowest LIP ratings, the imagination exercise helped identify participants at risk of having adverse reactions to the requested stimuli during their SHIP® session. As explained in Section 2.7.4, the images requested to be visualised during a SHIP® session contain a wealth of associative information capable of inducing a trauma memory unintentionally. These participants presented signs of past or present trauma or phobias:

- **P10:** This participant exhibited signs of *"holding onto old fear"*. The participant didn't automatically close their eyes and was only asked to do so once the door visualisation was

already underway. The facilitator described the participant's demeanour as *"a very cautious, fearful individual"*. This participant's session ran much longer than the other sessions, because the facilitator needed to provide the participant with a safe space to effectively process their adverse reactions, and refer them to the psychologists at hand on campus.

- **P25:** During the briefing before the session, the participant told the researcher that they had a phobia of certain animals, and that they were concerned with the possibility having to imagining these. The researcher assured them that the imagination exercise would not include this. However, when the session started, the participant said: *"Lots of [these animals] around. I am scared of [these animals]."* The facilitator decided to end the session immediately, noting they were not a good candidate for the study.

5.1.3. The Low-LIP group

As explained above, 22 participants were considered for the remainder of the study. The 20 participants with the lowest LIP ratings obtained during phase 1 were selected, and are shown in Table 5.1 below. As discussed in Section 3.3.2.3, the LIP method was proposed and developed by the facilitator using their in-depth knowledge of SHIP® in practise to effectively determine to what degree participants can effectively imagine requested stimuli. Because this method was designed specifically for this study, no benchmark existed for what was to be considered a low LIP score. Therefore the facilitator and researcher decided to recruit the 20 participants from the entire population with the lowest LIP scores for the remainder of the study. During the imagination/relaxation exercise, each participant was given a score out of 10 for three different criteria that the facilitator deemed necessary to qualify viable SHIP® candidates. The facilitator recommended these criteria based on their professional experience with SHIP®:

- level of engagement (score out of 10)
- level of authenticity (score out of 10)
- level of consistency (score out of 10).

These scores were averaged out to determine the overall LIP rating of a participant. As per Section 3.3.2.3, the 20 participants with the lowest LIP rating were selected to partake in the remainder of this study. The imagination exercise rendered very high LIP ratings for all the participants, with most of the participants scoring above 8 out of 10. However, the 20 participants selected had the lowest LIP ratings of the entire initial group. As stated before in Section 3.3.2.4, to ensure that the only significant difference between the two groups in the RCT was the method of running the SHIP® sessions (VR or traditional), the researcher divided the final group randomly into two homogenous groups of 10 with similar average LIP ratings. This was done using a JQuery script designed for this purpose. The individual scores were entered into the software and were randomised until two groups

of 10 were formed with average LIP ratings (7.84 and 7.66) that differed by less than one. Table 5.1 below shows the results—the two groups with their respective participants and scores. The code in brackets denotes each participant for the remainder of this study.

Table 5.1: The final group divided into two randomised groups

Control Group		**VR Group**	
Participant	**LIP Rating**	**Participant**	**LIP Rating**
P31 (C01)	8.6	P29 (V01)	7.6
P21 (C02)	4.6	P02 (V02)	9.3
P33 (C03)	8.0	P24 (V03)	8.3
P04 (C04)	9.3	P18 (V04)	8.6
P28 (C05)	8.0	P32 (V05)	8.6
P08 (C06)	9.3	P06 (V06)	6.3
P05 (C07)	8.3	P09 (V07)	9.7
P30 (C08)	9.3	P13 (V08)	2.3
P22 (C09)	5.0	P20 (V09)	9.3
P19 (C10)	8.0	P11 (V10)	6.6
Average	7.84	Average	7.66

This section has looked at the process followed to obtain the final group that was recruited for the RCT, and it explained how the final group was randomised. The following section introduces the RCT of the current study and discusses the data obtained from the two randomised groups and its analysis.

5.2. Phase 2: The RCT

This section outlines what data were obtained through the audio recordings of the sessions with both groups, and the subsequent analysis of this data, leading to a thorough exploration of the themes that emerged.

The facilitator administered a SHIP® session with each participant, using a different method for the session depending on the participant's group. Each session started off with the facilitator giving an introduction, an example of which can be seen below.

"I want you to start out by making sure you're comfortable, and just relax your body. Basically, what we're doing today is very similar to the last time. We may go a little bit deeper, but it's not intrusively deeper. Become aware of your body. Feel the sensation of lying on the air mattress, the temperature of the aircon in the room, your feet inside your shoes. Your hands touching the fabric of your clothing or the mattress. And as you go into that relaxed state, shut out all the noise around you. It's just my voice and the visuals that you see in front of you. Then I want you to start out by

visualising a door and with the door you can visualise all the details of the door. What colour it is, what size it is, what space it's in. Just allow your mind to create a picture of a door in front of you."

Notably, the facilitator asked both the Control and the VR participants to imagine a door at the start of their sessions: the Control group with their eyes closed, and the VR group while the simulated door was still out of view.

As stated in Section 4.3.1, the simulated door was not visible when the participant put on the headset. Before the facilitator faded the simulation into view, each participant would stare into the black screen of the HMD. The facilitator then asked the participants to start imagining a door. A couple of seconds after this instruction, the facilitator would activate the simulation and it would fade into view. Therefore, participants were not left for long without the door simulation. This was done to keep the SHIP® process consistent across both groups, to ensure that the only differentiating factor between the two groups was the VE. The facilitator took special care to keep the introduction and overall structure of the sessions as consistent as possible. There were small variations between the introductions and structures of some of the sessions, mainly due to alterations that the facilitator made to ensure that each participant felt comfortable and safe. After the introduction, the SHIP® session officially commenced and the process of each one varied from participant to participant.

For each group, the facilitator asked participants if there were any emotions that came up for them, either when imagining their name on a door or when presented with a simulation of a door with their name on it. Once a participant identified an emotion they were experiencing during their session, the facilitator would typically ask them where in their body they felt that sensation physically. If the participant was able to identify a physical sensation, they were asked to stay with that feeling and experience it fully. The emotions, physical sensations, and mental responses were experienced and noted by participants within the VE or within their own imaginations. Some responses were a result of subsequent questions asked by the facilitator as the session progressed. The main purpose of SHIP® is not only to identify physiological and psychological feelings, but to process them effectively. Therefore, throughout the sessions the facilitator would periodically ask what sensations and/or emotions the participant was experiencing.

TA was applied to the data gathered from the audio recordings according to the process described in Section 3.5.6. Data that were gathered from the audio recordings revealed the various induced reactions and sensations exhibited or experienced by the participants during their sessions. The following sections describe the codes that emerged from the audio recordings gathered. First, the

changes made to the RCT setup are discussed, and the influence of a power outage is addressed. The rest of the chapter goes into the analysis of the data obtained.

5.2.1. The procedure of a session

As explained in Section 5.1.1, the most important aspect of the data collection process was to have each participant feel as comfortable as possible. Therefore, the participants were given the option to either lie down flat on the air mattress, sit on the air mattress with their backs against the wall, or sit in the office chair opposite from the facilitator. This allowed participants to feel more comfortable and in control of the session, and encouraged them to be more engaged.

All the responses and sensations were induced as the facilitator offered guidance and asked questions during the sessions. After the participant had seen or imagined the door with their name on it, the facilitator would ask the participant what emotions came up for them. If the participant was able to identify an emotion, the facilitator would ask where in their body they felt that emotion. If the participant was able to identify a physical sensation within their bodies, the facilitator would ask them to stay focused on that sensation for a while. Then, the facilitator would intermittently ask the participant what thoughts, memories, or sensations came up for them while imagining the requested stimuli.

If participants were unable to identify any emotions or sensations, the facilitator would ask the participant to keep focusing on the requested stimuli. The more emotions and/or sensations were identified, the longer a session tended to be. This was because emotional processing was taking place (as outlined in Section 2.7.3), and the facilitator did not want to rush this process to avoid the risk of causing any psychological harm to the participant.

5.2.2. Psychological space

During the course of the SHIP® sessions of both the Control as well as the VR group, there were some participants who had very deep, and sometimes intense, adverse reactions to seeing or imagining the requested stimuli. These participants are discussed in this section. They tended to have very meaningful and effective sessions, and some of their responses to the stimuli required the facilitator to debrief the participant after an intense or adverse response. This was necessary to prevent the adverse reactions from turning into or manifesting as trauma. The intent of these sessions was to observe the potential, personal connection formed between the participant and the chosen stimuli—i.e., the door with their name on it. It was critical to ensure that participants did not

leave their sessions with any TSMs, so the facilitator created a safe space and guided them through these adverse reactions to process their emotions effectively.

It is important to note that no psychotherapeutic treatment was administered to any of the participants. Moreover, although the intent of the sessions was mainly to observe personal connections between the stimuli and participant, these adverse reactions were not inherently a negative result in the context of the study. Some of these reactions were considered SHRs, a critical component in the process of SHIP® to ensure a successful therapeutic session.

The following participants had intense adverse reactions to the stimuli:

- **C09:** When visualising the door, the participant grew *"unsure and scared to open the door"*. The facilitator asked what would happen if they opened the door. Eventually the participant opened the door and started to imagine stimuli beyond it. This visualisation allowed the participant to experience induced memories of their childhood, which brought up strong emotions of sadness, regret, and fear. The facilitator created the space for them to process these emotions effectively, and the participant concluded their session feeling a sense of purpose and excitement.
- **V05:** Upon seeing the simulation of their name on the door, the participant experienced complete relaxation. The facilitator asked them to stay with that feeling of relaxation and experience it throughout their body for a while. After a couple of minutes the facilitator asked the participant to *"picture a very mini, tiny, shrunken version of you going into those muscles in your neck and in your body"*. The participant then experienced physical sensations relating to a past injury they sustained while participating in sport. (The facilitator had no prior knowledge of these injuries.) The physical sensations manifested in and around the area where the injury occurred and brought up emotions such as fear and uncertainty. The facilitator created a space for the participant to experience these emotions fully, and towards the end of the session the sensations were much weaker and most of the emotions had subsided.
- **V07:** This participant was starting to imagine the door of a house that they had lived in. Once the simulation was introduced with the participant's name on it, they experienced induced memories of a deceased family member. This led more to emotions of nostalgia and the induction of happy memories. This initial mental response was considered adverse and intense because of how personal it was. The facilitator created a safe space for the participant to effectively process all the emotions experienced. The participant's session concluded with them feeling more relaxed and with a sense of relief. Notably, the door that

the participant was tasked to start imagining (right before the simulation was introduced) contributed to the overall experience.

- **V09:** This participant experienced memories and thoughts of their children and their family when the simulated door first appeared. They experienced a sense of pride and humility during their session. These emotions were intense for the participant so the facilitator considered them to be an adverse response. Thus, the facilitator created a safe space to guide the participant through to ensure that they effectively process the emotions. This session concluded with the participant looking to the future and feeling grateful and blessed for their lives.

These participants' experiences were seen as adverse because most of the other participants in both groups experienced less intense and personal responses. These more intense experiences are revisited later in this chapter, with a keener focus on the specific physiological and psychological responses, and whether these responses were considered to assist or hinder the overall SHIP® process.

5.2.3. The Control group

The Control group consisted of 10 participants who underwent their SHIP® sessions without the use of VR. This section looks at the events that transpired during the Control group's SHIP® sessions as well as the themes that emerged from them.

5.2.3.1. Emotional responses

The results of the TA revealed that the participants experienced and noted various induced responses whenever the facilitator asked them what emotions they were feeling at any given stage of their session. These emotional responses consisted of both positive and negative emotions.

Positive emotions

The positive emotions experienced revealed themes such as euphoria, tranquillity, comfort, and curiosity.

- **Euphoria:** Participant C02 initially had a euphoric experience during their session. After the initial imaging of the door with their name on it, the participant noted that they were feeling *"happy"* or *"excited"*. When asked by the facilitator what emotion or emotions came up for them when imagining the door, participant C02 responded with: *"I guess happy or excited, this particular door's from when I was on holiday, so it was an exciting time."*

- **Tranquillity:** Feelings of tranquillity, such as feeling calm or relaxed, were experienced by multiple participants. For example, participant C05 explained that they felt *"overall, just calm"* after first being asked how the imagined stimuli made them feel.
- **Comfort:** Feelings such as comfort and familiarity within the Control group were categorised as feeling safe within the context of SHIP® therapy. The role of comfort and familiarity in feeling a sense of safety is explained further in Section 5.4. Two participants in the Control group expressed that they felt comfortable at the start of their sessions—C01 and C04. Participant C01 noted, when asked what emotions came up, that they felt *"Just sort of a feeling of comfort,"* while participant C04 said, *"I guess I'm just comfortable."*
- **Curiosity:** Two participants in the Control group experienced the feeling of curiosity. Participant C03 noted that they *"feel confused, curious"*. The facilitator asked participant C07 which WhatsApp emoji they would associate with the emotion that they were feeling:
  C07: *"So I'm thinking of the 'thinking emoji'."*
  Facilitator: *"Okay, so it's curious almost?"*
  C07: *"Yeah, that's it, that's a good way of putting it."*

Negative emotions

These emotions experienced included emotions of fear, anxiety, discomfort, and dysphoria.

- **Fear:** Participant C09 had a very intense and deep SHIP® session and experienced a wide range of emotions, most notably fear. They said, *"I think one thought that comes to mind is, like, [being] unsure and scared to open the door"* and acknowledged that they felt *"the fear of regret."*
- **Anxiety:** Two participants experienced some form of anxiety during their sessions. Participant C04 experienced a feeling of anxiety when the thought of their mother was evoked. They said, *"I just can think about my mom […] I feel kind of anxious about it."*
  Participant C02, after initially feeling euphoric, later experienced anxiety in the form of apprehension. Below is an excerpt from the recording:
  C02: *"It kind of feels like, I don't know how to explain it, but they're very close to that sort of not-too-intense anxiety, but that sort of slight anxiety. Um, but that's very much..."*
  Facilitator: *"More apprehension than anxiety?"*
  C02: *"Yeah."*
- **Discomfort:** Participant C07 had the most discernible experience of feeling discomfort in the form of feeling vulnerable. As the session progressed, the participant noted a thought that came up as well as an accompanying feeling. They said, *"I think it also makes me feel […] I feel a bit vulnerable."*

- **Dysphoria:** Two participants in the control group had feelings associated with dysphoria. Participant C07 noted a feeling of inadequacy and said: *"I kind of feel like, because I feel a bit inadequate, I always feel like I have to do something about it."* Participant C09 experienced sadness when their session progressed to them opening the imagined door, noting, *"I feel kind of sad seeing old stuff. So, like, dusty. Like the things I used to love doing, but I didn't get time to do anymore or just don't do anymore."*

5.2.3.2. Physical responses

The physical responses or sensations described in this section occurred when the facilitator asked the participants where in their bodies they felt the emotions. The Control group experienced various physical responses and sensations; however, only the most prevalent are reported below.

Chest

Most participants experienced a physical response or sensation within their chest, for example:

- **C01:** This participant experienced the emotion of *"comfort"* in their chest, saying, *"You know, just sort of like in the chest area."*
- **C02:** The participant felt euphoric sensations of *"happy"* and *"excited"* in the chest.
- **C04:** This participant experienced anxiety within their chest when thinking of their mother. They noted, *"I still feel it in my chest. I want to say my heart, more."*

Hands and fingertips

Participant C08 experienced a physical sensation in their hands and fingertips.

- **C08:** This participant experienced the feeling of *"fear"* and *"exhilaration"* when the door visualisation led them to imagining themselves approaching a storm. They noted: *"It's subsided a bit. It's almost more in the hands now."*

Head

There were some participants that experienced physical sensations in various parts of their head, such as the back of their head, their foreheads, etc.

- **C03:** This participant located the feeling of being *"confused"* as a physical sensation in their head. They noted, *"The confusion is in my head"* and *"I feel a wave of it from my head until my chest."*

The participants in the Control group experienced various other physical sensations or responses in areas such as their legs, stomachs, ears, and all over the body.

5.2.3.3. Mental responses

The mental responses outlined below occurred when the facilitator asked the participants if any unique memories, thoughts, or sensory sensations arose when imagining the requested stimuli. Not all participants had unique mental responses. The most coherent mental responses are briefly reported below.

Unique memories

- **C02:** This participant used a memory of a door that they saw in their past to mould the imagined door in their mind. This door evoked more memories that were related to that initial memory.

  This was the thought process of the participant as the memory was evoked:

  C02: *"Well, this particular door was a church door, and I loved visiting churches when we were in Paris. Um, but this one was in Dusseldorf […] But it just reminded me of when we were in Paris, and it brought up this memory of me and my friend running into a different church […] Yeah, it was exciting, but also stressful because we were a little late."*

Unique thoughts

- **C05:** This participant had the unique thought of soaring through the clouds on a dragon similar to the movie 'The NeverEnding Story'. The participant noted that they were experiencing something that felt like a dream and noted that it was *"like 'The NeverEnding Story', the dragon from 'The NeverEnding Story', soaring through the clouds then disappears almost. And then it's basically just the clouds of the sky."*

Unique sensory sensations

- **C01:** Along with feeling *"comfort"* in their chest, this participant had a unique thought of a fireplace, and started to hear the fireplace crackling. They stated, *"It just feels like—there's some sort of a—just like a fire burning. Like a fireplace or a fire. [I'm] hearing crackling sounds of the wood."*

There were more unique memories, thoughts, and sensory sensations experienced by different participants, but these were the most noteworthy. These sessions clearly demonstrated the unique connections that were formed between the participants and their visualisations of the requested stimuli, as well as the unique responses that were induced. It is important to note that not all the responses reported above were spontaneous healing reactions (SHRs).

5.2.4. VR group

As explained at the start of Section 5.1.3, the VR group consisted of 10 participants with low LIP ratings. The following section discusses the events that occurred and that each participant reported to the facilitator that ran the VE.

5.2.4.1. Emotional responses

The emotions reported below were gathered from the TA process applied to the audio recordings of the VR group. As explained above, these emotions were induced by the VE and experienced by the participants, who reported them whenever the facilitator asked them what feelings or physical sensations they were experiencing.

Positive emotions

These positive emotions included sets of emotions such as empowerment, euphoria, safety, tranquillity, curiosity, and reflection.

- **Empowerment:** Participants V02 and V10 experienced what can be described as a sense of empowerment. Most notably, when asked by the facilitator what emotion was being brought up by the simulated door, participant V02 responded instantaneously, *"I feel empowered and proud."* Participant V10 noted that they felt *"challenged"* towards the end of their session and noted, *"I feel challenged, like the door is asking me to do more."*
- **Euphoria:** Five out of the 10 participants experienced euphoria at some point during their sessions, ranging from feeling happy or excited, to feeling the sense of acceptance. A notable case of this was participant V09, who had a profound experience during their session. The door simulation brought up unique memories of their children, as related in more detail in Section 5.2.4.3. The facilitator asked them to provide one word to explain what they were feeling, to which the participant replied *"joy"*.

  Participant V03 experienced the feelings of being *"happy"* and *"excited"* from seeing the simulated door with their name on it.
- **Safety:** Feelings such as comfort and security are emotions closely associated with the overall feelings of safety and are covered in more detail in Section 5.4. Participants V01 and V03 noted such feelings when immersed within the VE.

  For Participant V01, their session started off with a sense of calm and peace, and as the session progressed it evoked more thoughts and feelings. V01 noted towards the end, *"I get a similar feeling of, like, the comfort when I hug my partner."*
- **Tranquillity:** Five participants felt some sense of calm or relaxation at some point during their sessions. Two participants' experiences of this feeling of tranquillity were more

significant than the others. Participant V07 had a very deep SHIP® session (described in more detail in Section 5.2.4.3) with no negative emotions, but they did experience a lot of different emotions and physical sensations. The final feeling that they experienced during their session was a *"relaxed"* emotion.

Participant V08 also experienced tranquillity, noting towards the end of their session, *"I'm just getting more and more relaxed and thinking, thinking about less, you know?"* As explained later (in Section 5.3.1.1), this session was significant because this participant was unable to visualise any door during phase 1 of the study.

- **Curiosity:** The feeling of curiosity was experienced by three participants. Participant V02 noted at the start of their session, *"I really have a need to open this door in front of me"*, which illustrates the curiosity that they were experiencing.

  Participant V10 noted, *"I really want to know what's on the other side of the door."* They then opened the door figuratively and went on to imagine a room on the other side of the door. The participant noted that they were feeling curiosity and said, *"It seems like a mysterious place."* Participant V08 did not note their curiosity during their session, but after the recording had stopped, they mentioned to the researcher and facilitator that they started to grow curious about what was behind the door.
- **Reflection:** Feelings of reflection noted in the VR group were that of nostalgia and humility. Participant V07 experienced nostalgia when recollections from their past came up and noted, *"Nostalgia is the main feeling I'm feeling at the moment."* Participant V09 experienced the feeling of being humbled towards the end of their session. Their session is explained in more detail in Section 5.3.2.1.

Negative emotions

The range of negative emotions experienced by the VR group includes feelings of fear, anxiety, discomfort, and dysphoria.

- **Fear:** Participants V05 and V07 experienced fear during their sessions. In particular, a unique memory was unearthed for participant V05 (described further in Section 5.2.4.3 under Unique memories). When presented with the simulated door, they experienced *"fear [and] uncertainty"* and said, *"I'm too hesitant. Cautious, worried that it might make it worse."*
- **Anxiety:** Fear and anxiety often go hand-in-hand. Both V05 and V07 experienced anxiety outright or an associated feeling such as *"hesitant"* or *"uncertain"*. Participant V05 noted, *"I would say it brings up happiness because I've always wanted to be successful, but also a bit of fear and anxiety because I know it won't be easy."*
- **Discomfort:** Three participants of the VR group experienced some form of discomfort at the start or during their sessions. Participant V04 felt uneasy when they started their session,

saying, *"Initially I felt kind of anxious, but now it's more like —I don't know how to describe it, but not-anxious [sic]. But like 'Okay now what?', like an unease."*

Participant V10 also experienced this right at the start of their session and noted that they felt *"a little bit uneasy"*.

- **Dysphoria:** Feelings such as disappointment and emptiness were experienced by participants V05 and V10. During V05's session, a unique memory was evoked when looking at the simulated door with their name on it (as related further in Section 5.2.4.3 under Unique memories). When asked what feelings came up, the participant answered, *"I would say disappointment."*

  Participant V10 experienced emptiness, and this feeling was more closely associated with the VE than V05's dysphoria. Participant V10 noted, *"It's like a very empty feeling. Even before I look around, it's like I can feel the emptiness,"* as the simulation started.

The participants experienced many different emotions during the VR group sessions. To process these emotions effectively, participants would have to experience them as physical sensations within their bodies to 'unfreeze' the trauma. The participants in the VR group did experience some of these emotions as physical sensations that manifested in their bodies, and these physical sensations are explored next.

5.2.4.2. Physical responses

When asked to identify where in their bodies they experienced the emotions discussed above, the participants experienced various physical sensations. The most noteworthy ones are outlined below.

Chest

A physical sensation in the chest was the most common in the VR group with eight out of the 10 participants experiencing such a manifestation. The following participants were the most noteworthy because of the deep sessions that they experienced:

- **V07:** As described above under Tranquillity, this participant had a profoundly deep experience where the simulation of the door evoked a past memory, which evoked feelings of nostalgia at the start of the session. The participant noted, *"I feel that in my chest"* when asked where the feeling was coming from. The participant's unique memory is discussed in more detail later in this section under Unique memories.
- **V09:** This participant also experienced a very deep SHIP® session with the VE. Upon seeing the door, the participant was overwhelmed by thoughts and memories, which lead them to

experiencing pride. When asked by the facilitator where in their body they felt the emotion of pride, the participant answered, *"My chest."*

Shoulders

Two participants experienced emotions within their shoulders as physical sensations. Participants V05 and V10 experienced *"disappointment"* and *"unease"* respectively within their shoulders.

- **V05:** The simulated door evoked a unique memory of a past injury for this participant, as described in more detail in the Unique memories section below. The participant experienced the emotion of disappointment in an area close to where the injury occurred, saying, *"It's in my shoulder blade area."*
- **V10:** At the start of participant V10's session, the facilitator asked where they felt *"unease"* in their body. They answered, *"I think in my shoulders and in my chest."* Later in the session, once the feeling of *"unease"* was replaced by the feeling of *"emptiness"*, they indicated, *"I think it's around the throat or shoulders area here."*

Arms, hands, and feet

Some individuals had physical sensations in the arms, hands, and feet.

- **V02:** This participant noted the emotions of feeling *"empowered"* and *"proud"* when first seeing the simulated door with their name on it. When asked where they felt these emotions, they said, *"In my chest, and my upper arms."*
- **V04:** Towards the end of their session, this participant experienced being *"calm"* and *"happy"*. Initially these emotions were experienced as physical sensations in their chest, but after a short while they noted, *"It spread to my face and definitely to my hands."*
- **V08:** This participant had a difficult time becoming aware of specific emotions or sensations, but towards the end of their session they noted the following: *"Actually feels as if my hands and feet are getting numb. So relaxed it is [sic], you know?"* During the session, they became self-aware to the point where they could identify where an emotional feeling was manifesting itself within their body.

During the VR group sessions, various physical sensations were experienced by the participants. The participants identified the physical sensations reported above as manifested emotions. These emotions either disappeared later during the session or they intensified. For some participants, when asked to stay focused on the manifested physical sensation, they also experienced unique thoughts and/or memories, which assisted them in processing the emotions they were feeling more

effectively. These unique thoughts and/or memories are discussed in the next section and are categorised as Mental responses.

5.2.4.3. Mental responses

As explained in Section 5.2.2, one of the key focus points of the current study was whether or not individuals were able to make a personal connection with the stimulus simulated by the VE. The door simulation with the participant's name on it was chosen specifically to try and form that personal bond between the participant and VE. As stated before, it is important for SHIP® clients to personally connect with the imagined stimuli, to allow them to access traumatic memories and thoughts that might be 'frozen' in their psyche to experience them in the present and thereby 'unfreeze' them. Some participants, when seeing their name appear on the door, experienced unique thoughts or profound memories that helped them access past emotions or feelings in the present, similarly to the traditional SHIP® process.

Unique memories

There were two participants who experienced very deep memories during their sessions.

- **V05:** Upon seeing their name on the simulated door, this participant immediately felt relaxed and at ease. They noted where they experienced these emotions: *"I would say from my neck down into my legs."* The facilitator asked them to focus on those sensations and to give in to them. After a while, the facilitator asked the participant: *"I want you to picture a very mini, tiny, shrunken version of you going into those muscles in your neck and in your body and just experiencing that. Go there and feel what relaxation feels like for you."* After this instruction, the participant started to think back to an injury they sustained playing rugby in the past. The participant noted, *"With me imagining going down into my muscles, it went from relaxation to actually focusing on an injury I received when playing rugby, a couple years back in my shoulder."* When the facilitator asked what emotion came up for them, the participant replied: *"I would say disappointment."* They continued: *"When I started feeling or thinking about it now, it almost feels like the muscle is still not 100 percent."* As stated in the previous section (5.2.4.2 under Shoulders), while focusing on this feeling of disappointment, the participant started to feel physical sensations in their body around the area of where they had sustained their injury. Towards the end of the session, all the emotions they were feeling in their body became weaker, which indicates that emotional processing took place. This emotional processing is explained further in Section 5.3.2.1.
- **V07:** When the simulated door appeared with the participant's name, the facilitator asked what emotions they could identify while immersed in that space, to which the participant replied: *"My dad is there."* The facilitator asked the participant to elaborate, and they said: *"I*

mean, because the door I was imagining was [to] a house—that's when my parents were still together—[that] we lived in. My dad passed away, like, two years ago, and yeah, we missed him at my sister's graduation yesterday. So that feeling is still a bit raw. So, nostalgia is the main feeling I'm feeling at the moment." The simulated door had invoked a very personal memory for the participant, and they experienced the emotion of *"nostalgia"* in their chest. What makes their session noteworthy is the fact this emotion eventually turned into the feeling of being relaxed. The participant noted, *"Yeah, it's feeling better now. Everything feels nice, relaxed. And like I've gotten a bit of a burden off."* This processing of the emotion of *"nostalgia"* and its significance is explained in more detail later in Section 5.3.2.1.

Unique thoughts

Nine out 10 participants in the VR group experienced unique thoughts during their sessions. These were categorised as 'thoughts' because it was unclear whether they were directly linked to a memory. What can be deduced is that these thoughts are in some way personal to the specific participant. Not all the unique thoughts are discussed, only the ones that were considered most noteworthy.

- **V09:** As noted in the previous sections, this participant experienced a very deep SHIP® session. Upon seeing their name on the simulated door, the facilitator asked them how they feel when looking at their name on the door. The unique memory of the participant's children was invoked, and the participant noted that they felt the sense of pride manifesting as a physical sensation in their chest. They periodically would utter sentences that seemed to be unrelated to the session but were likely the result of a deep intense thought process that was going through the participant's mind. Some of the sentences the participant verbalised included: *"Just love them so much"* and *"Honesty...that I taught my boys."* The participant started to think about their future and legacy towards the end of the session, noting that they could *"see"* the future and mentioned *"the future with grandchildren."*
- **V10:** This participant felt intrigued by the simulated door early on in their session and even asked, unprompted, *"How do I open it?"*, assuming that the VE provided such interaction. After the facilitator explained to them that no functionality to physically interact with the VE was built into the system, the facilitator guided the participant to 'open' the door in their imagination to see what is on the other side. The participant obliged and 'opened' the door. What followed was a series of unique thoughts on what was on the other side of the door. The participant imagined a lab and described the lab: *"It seems to have a lot of stuff. There's a shelf that has buckets of, like, empty paint... And then also there's a lot of chemical stuff, but there might have also been plant life. When you go in, after walking a bit you can turn left and there's more rows of the tables [sic]*

and stuff. But then there's also, at the far end and there's more light and I think it's [a] door out? I'm not sure; there's a lot of light coming from there."

It is worth noting that the participant spoke very softly during their session, so transcribing the description was difficult. However, they were able to imagine an entire room with various objects inside it, and to connect these thoughts to something personal in their lives, saying, *"This door feels like it might represent great things in life. Like, all the stuff inside is really cool and creative things that people have made and it's—I feel like I should open the door and I should be going out there and doing great things."* This participant's experience and the hindering as well as assistive events of the session are discussed in more detail later in Section 5.3.

The system built for this study did not provide any functionality to interact with the VE physically, and the participant had to 'open the door' using their imagination. While this is similar to the Control group in the sense that participants still had to imagine opening the door, this participant's reaction is noteworthy because they asked *"How do I open it?"* unprompted. One of their first reactions towards the door was to interact with it, indicating the level of presence they felt.

Sensory experiences

Participants V04 and V07 were the only two participants in the VR group to note any type of sensory experience during their sessions. Both participants heard a specific sound that was connected to the VE and the subsequent thoughts and/or memories that were evoked. Participant V04 had a unique memory pertaining to a garden that they liked to visit in their past. The participant noted: *"I think of the garden, but, like, a specific spot where we usually sit and relax. Or when we did yoga there."* This unique memory led to them hearing the sounds of birds and mosquitoes, noting, *"I think of the sounds that you hear, like the birds, but also of the mosquitoes; I was thinking of the itching now."*

Participant V07 experienced a unique memory of their father (as related in the previous section), which in turn led to them hearing their father's voice. When asked what sensory sensations they experienced when focusing on that memory of their father, the participant replied, *"My dad's voice and a hug with him."*

This section has looked at the data collected during the RCT and the subsequent analysis of the data using TA. It started off by introducing the RCT and explaining the general procedure of administering SHIP® sessions to both groups, and what happened when a power outage impacted one of the VR sessions. It explained the main intent behind the sessions, and highlighted that these

sessions did not administer any psychotherapeutic treatment to the participants. It discussed the adverse reactions that occurred during certain participant sessions, as well as the actions taken by the facilitator to protect the participants and bring them back to a neutral state. Then it described the audio recordings obtained from the sessions and their analysis. The various psychological and physiological responses with both groups were discussed and clustered together into emotional, physical, and mental responses. Not all of these responses could be considered assistive or hindering to the process of SHIP®. The analysis of the audio recordings revealed many different responses, but this section only considered those most relevant in the context of this study. These connected more effectively to the assistive and hindering events that the facilitator noted during the sessions.

The next section looks at the aspects of VR that contributed to the induction of certain responses. Where the previous section focused on the perspective of the participants, the following section focuses on the facilitator's observations in the HAT forms and during the CI.

5.3. VR aspects

The previous section discussed the various responses experienced by the participants in the VR group. As stated before, even if a participant was able to identify specific emotions, physical sensations, or unique mental responses, it does not necessarily mean they had a successful or effective SHIP® session. To determine which responses were assistive to the overall process of SHIP® and which ones were hindering, TA was applied to the HAT forms filled in by the facilitator after each VR session as well as to the CI, as stated in Section 3.5.6. The CI was conducted with the facilitator a month after the sessions concluded.

The facilitator gave their observations of what transpired during the sessions in the HAT forms; this provided the data indicating which of the responses discussed above were assistive or hindering and what events or attributes of the VR group sessions contributed to that observation. The data resulting from the CI allowed the researcher to identify themes across both the Control and VR groups and to explain how the two groups compared with one another. All these data showed how important aspects of VR either contributed or counteracted the traditional SHIP® process. This is expanded on in the following section.

5.3.1. HAT session usefulness scores

At the start of each of the HAT forms, the facilitator rated the usefulness of the session towards the process of SHIP® on a scale of one to ten, referred to as HAT scores. The facilitator scored each session according to the following guidelines:

- 1–4 would not be considered a useful session at all.
- 5–7 was considered to be a neutral session that didn't advance or hinder the process of SHIP®.
- 8–10 was considered to be useful to the process of SHIP®.

The scores of each participant in each group can be seen in Table 5.2 below:

Table 5.2: HAT session usefulness ratings

Control group		**VR group**	
Participant	**Score**	**Participant**	**Score**
C01	7	V01	7
C02	6	V02	8
C03	6	V03	8
C04	8	V04	7
C05	5	V05	9
C06	7	V06	7
C07	8	V07	7
C08	9	V08	9
C09	9	V09	10
C10	7	V10	6
Average	7.2	Average	7.8

Various events during each session either assisted or hindered the SHIP® process. These events motivated the HAT scores.

Table 5.2 shows that the VR group had a slightly higher average HAT score than the Control group. However, there was only a small difference between the average HAT scores of the two groups, as illustrated in the chart in Figure 5.1 below. The box-and-whisker plot illustrates that most of the scores fall within the realm of 7/10 and 9/10, with only a few outliers. While the VR group shows a marginal improvement over the Control group, the small difference and sample size means this evidence can only be considered anecdotal. One can therefore conclude that the facilitator experienced both treatment methods as being assistive to the overall process of SHIP® and did not perceive one method as clearly superior. This phenomenon of both methods being similarly assistive to the overall process of SHIP® can be explained through the therapeutic alliance (described in more detail in Section 5.5) that was formed between the facilitator and each participant.

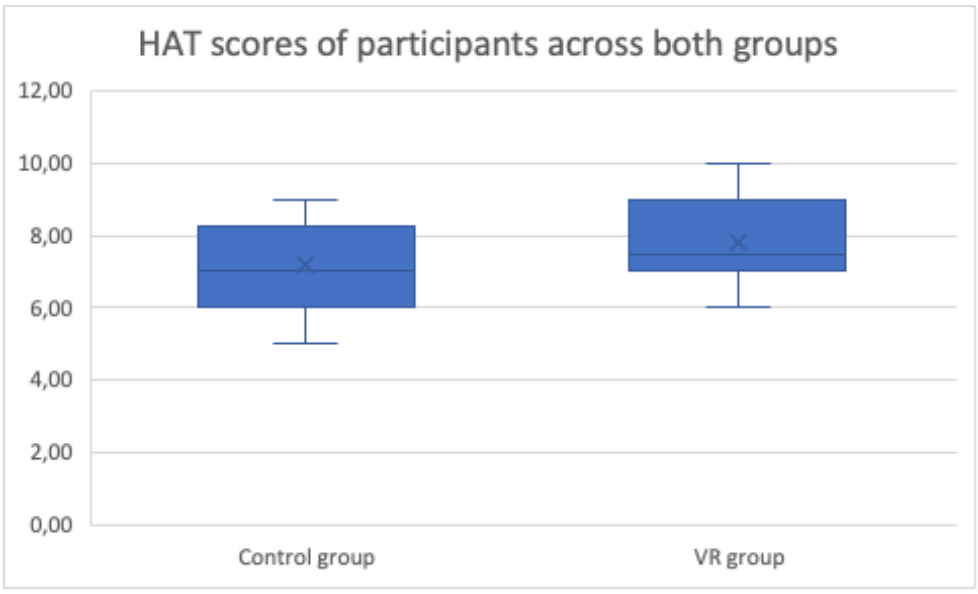

Figure 5.1: HAT scores of participants across both groups

The individual HAT scores are explored here where they provide insight into individual experiences of certain participants, what aspects of VR and the traditional SHIP® process led to these experiences, and why the facilitator perceived them to be assistive or not.

Notably, the LIP ratings discussed in Section 2 were used to select 20 out of the 22 eligible participants who had the most difficulties during the imagination exercise. The facilitator determined these ratings using simplified criteria that purely focused on whether or not a participant could visualise an image, describe that image, and retain details of the image for a certain period of time. In contrast, the HAT scores were based on far more complex criteria and were determined by the facilitator's in-depth SHIP® knowledge on what events, emotions, and various other aspects assisted and/or hindered the process of SHIP®. As such, no comparative analysis was performed between these two scores, because they were derived from completely different criteria.

Interestingly, one participant per group (V08 and C09) struggled to visualise the requested stimuli during the imagination exercise, but they performed well in their SHIP® sessions (which is discussed in more detail in Sections 5.3.1.1 and 5.3.2.2). These two cases are important to explore further, especially the case of V08.

The bar graphs below illustrate the LIP ratings and the HAT scores of each participant in the Control and VR groups, and the insights gleaned from each are then discussed below.

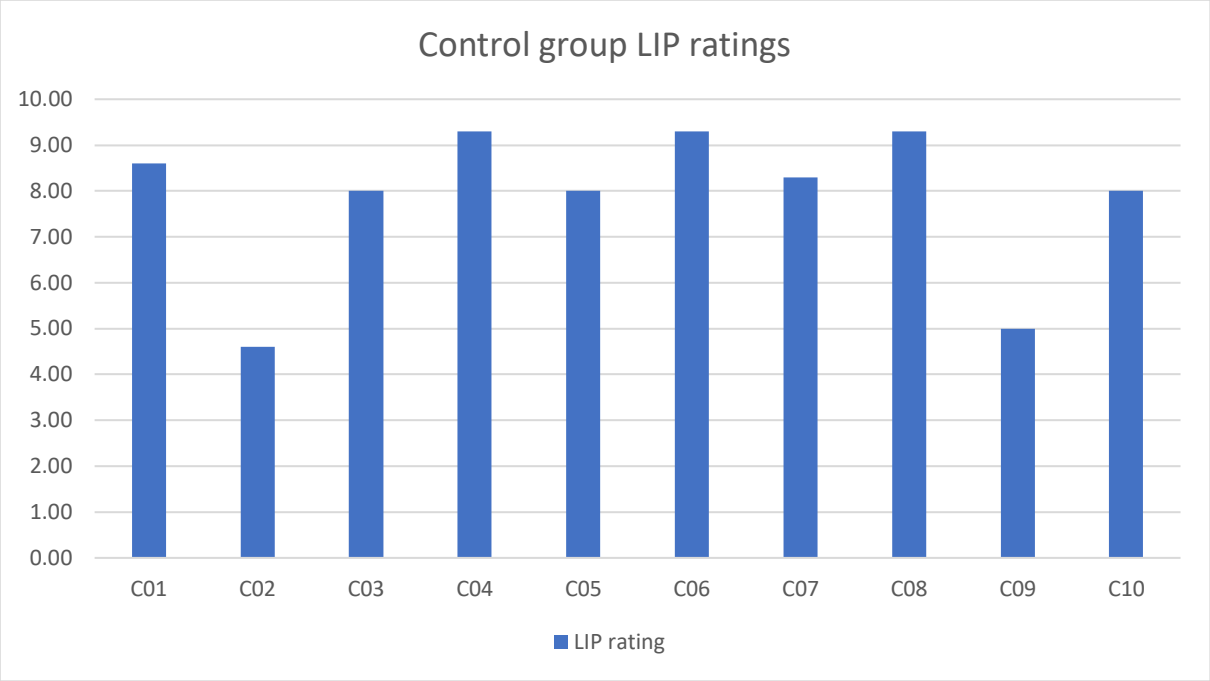

Figure 5.2: Control group LIP ratings

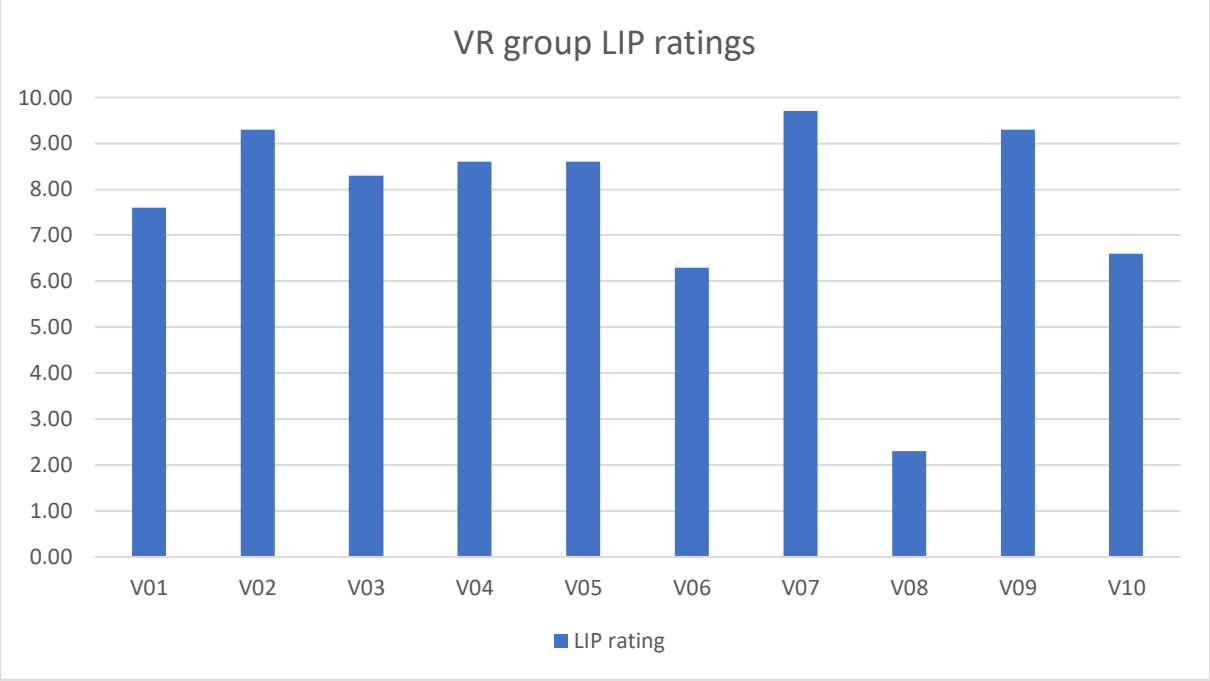

Figure 5.3: VR group LIP ratings

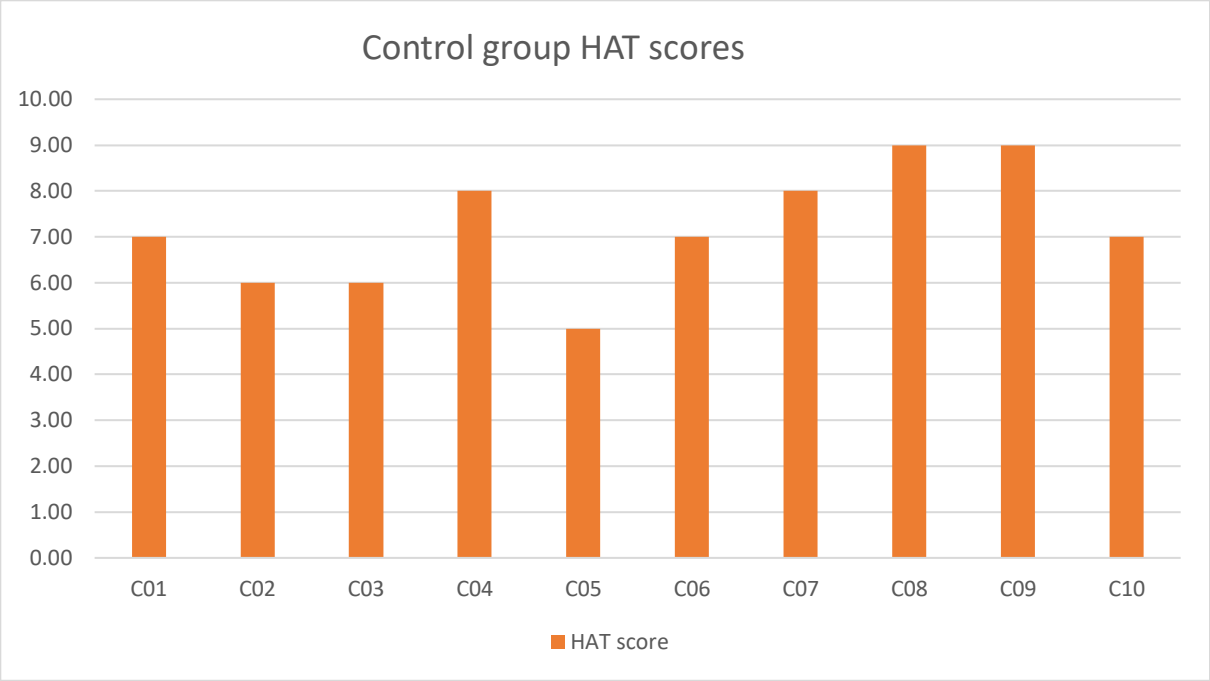

Figure 5.4: Control group HAT scores

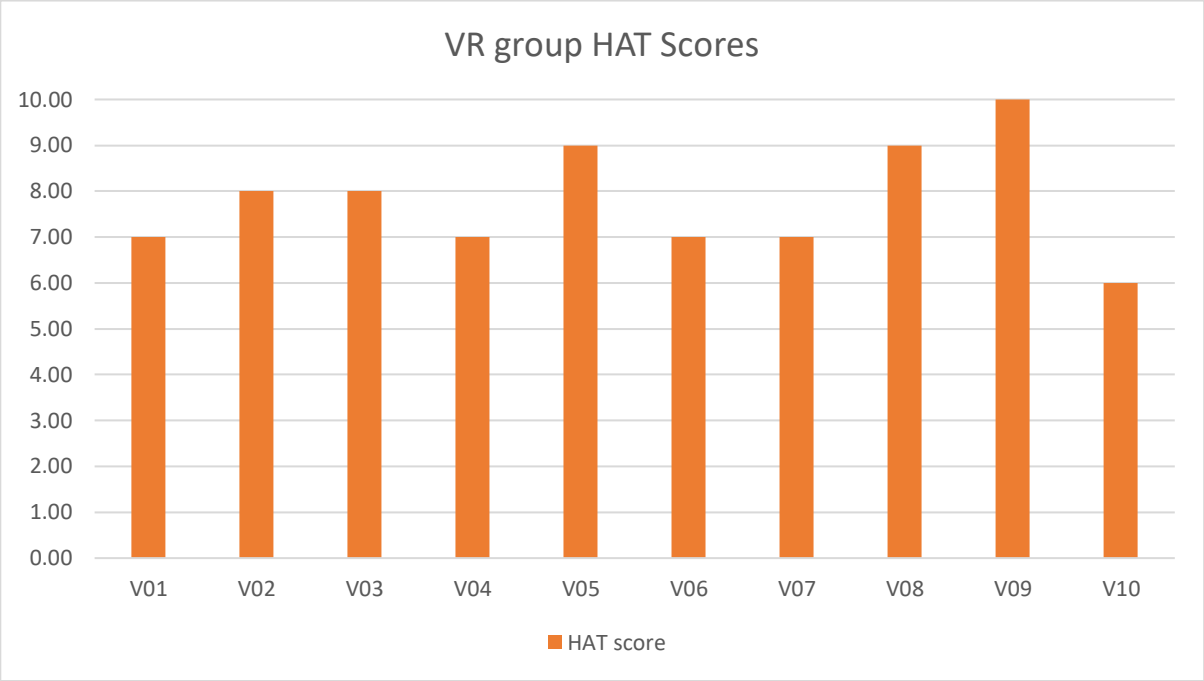

Figure 5.5: VR group HAT scores

5.3.1.1. Significance of VR for low-LIP clients

Participant V08 scored the lowest LIP rating out of all the participants in the study and was unable to visualise anything during their imagination exercise. In the context of SHIP®, there are clients that are unable to visualise the images requested during specific phases (Steenkamp 2010:233). Clients who struggle with visualisation usually means that they would not be able to benefit from SHIP®, since the visualisation is fundamental to a successful SHIP® intervention (J. O. Steenkamp 2018:263). In spite of this inability to visualise any stimuli, however, the participant had a successful

SHIP® session according to the facilitator. This was because the VR simulation provided the participant with the necessary visual stimulus to be able to participate in SHIP® activities—answering questions about the environment, and identifying thoughts and feelings.

Participant V08's LIP rating (2.3) and HAT score (9) indicate that VR met the fundamental requirement for a successful SHIP® session for this particular case, and the events that led to this requirement being met are investigated later in this section. Similarly, participant C09 had a low LIP rating, but in spite of this difficulty to visualise effectively, they had a successful SHIP® session from the facilitator's perspective. Notably, they had no simulation to assist them, and this specific case and the events that led to it are also addressed later in Section 5.3.3.2 under Unfamiliarity with VR.

Because of the small sample size for the current study, the quantitative data gathered could not be used to indicate which of the two methods was the most effective from the facilitator's perspective. What the quantitative data did provide, however, was the means to divide the participants into two reasonably homogeneous groups via the LIP ratings. The quantitative data also provided some insight into two outliers, their experiences with both the imagination exercises and their SHIP® sessions, and what led to these experiences, which is discussed in more detail later in this chapter in Sections 5.3.2.2 and 5.3.3.2.

One of the key focuses of this HCI study is the notion of presence and the role it plays in psychotherapy (as explained in Section 2.5.4). Presence, or the feeling of "being there" separates VR from other media (Rizzo et al. 2015; Garrett et al. 2018; Høeg et al. 2021; Riva 2022) and can help psychology in many different ways (Albakri et al. 2022). However, the role that presence plays in a VR-mediated SHIP® session is still unclear due to the novelty of this approach. The quantitative data gathered cannot be used to determine the role that presence plays within the context of VR and SHIP®, and therefore cannot be used to outright determine the most successful or efficient method. Therefore, the analysis in the current study focused on the qualitative data collected through the answers given in the HAT forms, through the audio recordings and the discussions held during the CI. The following sections look at the qualitative data obtained from the HAT forms completed by the facilitator, and how TA was used to identify various themes that either assisted the process of SHIP® or hindered it.

5.3.2. Assistive aspects of VR

Assistive events to the overall SHIP® process are those where deep and meaningful responses that led to emotional processing were induced during the sessions.

Various responses to the sessions have been described in Section 5.2.4. However, the facilitator saw only certain events that transpired in the VR sessions as assistive. These included responses and system attributes that were directly associated with the specific assistive events identified by the facilitator. The researcher placed these assistive events into two main categories—induced responses and VR attributes.

- Induced responses included all the responses directly associated to the assistive events and were further divided into three main categories: emotional, physical, and mental responses.
- VR attributes' physical and simulated aspects that were directly associated with assistive events were also further divided into two main categories: simulation and headset.

These induced responses and specified VR attributes are seen as assistive aspects of the VR method and are illustrated as all connecting to assist the process of SHIP® in Figure 5.6 below:

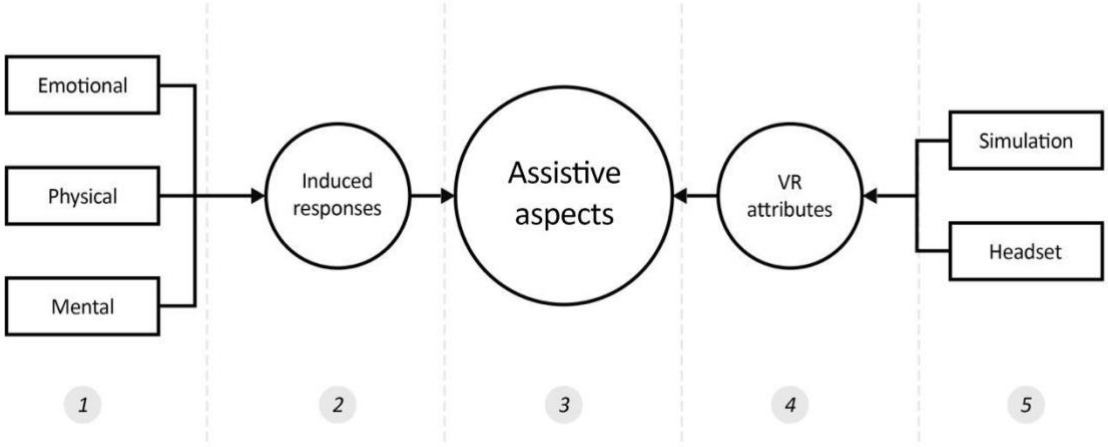

Figure 5.6: Assistive aspects of the VR group

The thematic map in Figure 5.6 illustrates the following:

- The responses identified by the facilitator during the observed assistive events are grouped into three main categories in segment 1: emotional, physical and mental.
- The three categories identified in segment 1 are all grouped under induced responses in segment 2.
- The aspects of the VR system identified by the facilitator as assistive events are shown as two main categories in segment 5: simulation and headset.
- These two categories identified in segment 5 are all grouped under VR attributes in segment 4.
- Both segments 2 and 4 were identified as assistive aspects that were observed during the VR sessions and led to segment 3—assistive aspects of the VR sessions.

5.3.2.1. VR as a cognitive stimulus

As discussed previously in Section 5.2.4.3 about mental responses, participants V05, V07, and V09 experienced profoundly deep and personal memories and thoughts that invoked certain emotions within them that then manifested as physical sensations. In all three sessions, emotional processing took place because in each session the initial emotion that was experienced gradually changed or faded as the session progressed. In the case of participant V05, the facilitator noted the following in the HAT form: *"The key event that defined this participant's session was that the door visual (VR) stimulated or triggered a memory of a rugby injury that still brings up fear, disappointment, uncertainty […] We were able to use SHIP® techniques to process the fear, which actualised as restlessness in their legs. We were able to conduct a deep SHIP® session."*

For participant V07, the facilitator stated in the HAT form that: *"The participant's mind was able to access very deep emotions related to family events and losses. Very deep emotion was activated, allowing for rich data collection."*

It is important to note that imaginal SHIP® sessions, where the participants imagine the requested stimuli, are proven to be able to induce such memories. The experiences of participants V05 and V07 are noteworthy because it illustrates that VR was able to do what imaginal SHIP® sessions are proven to do. It is unlikely, although not impossible, that these participants would have had the same responses if they had had imaginal SHIP® sessions without VR. Their nuanced responses provide some indication that VR would likely benefit those who struggle with imagining the requested stimuli.

During participant V09's SHIP® session, the facilitator noted in the HAT form: *"The participant had a limited experience during our initial [imagination exercise] sessions. In this session they had a significantly richer and deeper experience, which made for an intense and meaningful SHIP® session […] The VR visual seemed to serve as a cognitive stimulus to bring up emotion, memories, or reflections that were less accessible to this particular client in the first round of sessions. Being stimulated with the VR headset heightened the experience for this participant."*

The facilitator added: *"I have a sense that the VR headset or visual does not shape the entire SHIP® process but rather acts as a stimulus to initiate a chain of thought, emotions, or reflections for a client, which is extremely beneficial and powerful in the SHIP® process."*

During the CI, the facilitator explained that visual stimulation is one of the most helpful aspects of the VR group sessions, as it allowed the VR to function as a tool that led to deeper engagement and an enhanced experience: *"The standard group enjoyed the relaxation aspect of the SHIP® sessions. And a lot of them didn't go—or some of them did not go too deep into emotional processing. They just enjoyed the comfort of a positive visual inside their mind and that's where their mind took them. And I found that the VR group was able to go a little bit deeper and in my mind, that is accounted for by the additional brain stimulation that the VR headset provided."*

VR therefore stimulated and enhanced the ability of the participants to visualise the requested stimuli in the VR group, which led to the participants being more deeply immersed within the VE. This is elaborated on later in Section 5.3.2.3.

5.3.2.2. VR as cognitive proxy

Inexpressive nature and inability to visualise effectively

During participant C03's imagination exercise, the facilitator noted that their description was *"authentic"* and *"detailed"*, although *"rather to the point"*, meaning that the participant's *"description was not very rich"* and that they *"[might] not have a high visual processing ability"*. The second description of the imagined stimuli towards the end of the exercise was also shorter and contained less detail than the first description. The participant received a high LIP rating as their description was *"authentic"* and it allowed them to engage in the SHIP® activities completely. However, during the Control group sessions, the facilitator noted that participant C03 was *"not expressive by nature. This led to a session that mostly felt very shallow. As if they were 'sticking to the safe stuff'"*, and added that the participant *"was not extremely expressive and had a very compliant demeanour. This limits the SHIP® process because we can express deeply only if we allow ourselves to be vulnerable."*

The role of vulnerability in SHIP® is discussed in more detail in Section 5.4. Although an inexpressive nature is not directly linked to the traditional SHIP® process, it is worth noting that an individual's inability to express themselves effectively limits the SHIP® process. An inexpressive nature, in tandem with an inability to formulate 'richer' visualisations, could lead to a very ineffective SHIP® session.

Participant C05 experienced calm feelings as described in Section 5.2.3.1, and had unique thoughts regarding a movie, as discussed in Section 5.2.3.3. However, they were not imagining anything unique, but were recalling a scene from a movie. The participant reported no other thoughts, feelings or sensations beyond the sense of calm they felt at the start of the session and the thought of the

movie. The facilitator found that because the participant wasn't able to visualise anything beyond the door, the session was very shallow. The facilitator noted that the *"client could not visualise anything"*. In the audio recording of the session, they stated, *"I can't say I'm feeling anything specific. It's almost like I'm not really feeling anything."* Therefore, no SHRs were induced during this session because their feelings were denied expression, and kept from completion because the participant struggled to imagine the requested stimuli freely (J. O. Steenkamp 2018:263).

Improved visualisation

Participant V08 was also inexpressive by nature and struggled with visualising the requested stimuli during the imagination/relaxation exercise. Participant V08's HAT form reads: *"This participant could not visualise a door the first time, [but] this time they could. They kept their eyes open throughout the session and reported that it helped with the visualisation of the door."* As explained in Section 5.2.4.2, participant V08 was able to identify a physical sensation in their body as well as grow curious towards what may or may not be behind the door. The VE therefore allowed them to engage more with the SHIP® process.

The following was an interaction between the facilitator and the participant:
Facilitator: *"Does the visual help you more compared to the last time or is there no difference?"*
V08: *"Yeah it does […] I'm not searching for an image; you have the image and you just focus on that, you know?"*

Participant V08 scored a 2.3 out of 10 for their first phase imagination or relaxation exercise but scored a nine out of 10 in their VR SHIP® session. As there was no need for the participant to focus their full concentration on imagining the requested stimuli, this requirement was effectively removed from the SHIP® process, allowing the participant to focus all their attention on the SHIP® activities posed by the facilitator.

Participant V06 also felt that the VE greatly improved their ability to visualise the requested stimulus. The facilitator noted regarding participant V06's session: *"Participant reported that the VR headset helped them with visualisation—as compared to the first round of sessions that they participated in where there were no headsets (VR)."* According to the facilitator, the VR assisted with the 'visualisation' of the door; in other words, the simulation meant they could see the door. Eliminating the need for the participant to concentrate on imagining the stimulus, their mind was free to focus on the SHIP® activities posed by the facilitator. The facilitator noted that the participant was *"able to do meaningful processing"* and *"seemed able to give themselves completely to the SHIP® process"*. Even though the VE only simulated a door with the participant's name on it, it *"served as a stimulus to activate, to stimulate brain functioning and to stimulate memories"*. This statement by the facilitator would account for the participant being able to

visualise everything and anything beyond the door, because the simulation essentially helped initiate the imagining process more effectively.

During the CI, the facilitator stated: *"What it provided is [that] it cut out the physical world […] and it forced your conscious mind to get immersed to be present in the virtual reality world. And I think that is advantageous. What happens when you do that [is that] your energy becomes more concentrated on the task in front of you; that door [and] you visualising the door; doing, going through all the SHIP® processes basically."*

The quote mentions SHIP® processes, which are the additional questions and imaginative and non-imaginative tasks given to the participant during their session. Therefore, the quote explains that the participant was better able to visualise additional requested stimuli and memories beyond the simulated door. Whereas the previous section highlighted how VR functions as a cognitive stimulus for those who can visualise effectively and express themselves, this shows how VR can serve as a proxy for an individual who struggles to imagine the requested stimuli, and frees up their minds to focus on engaging with the SHIP® process.

5.3.2.3. Immersion, presence, and engagement

The facilitator considered the most hindering aspect of both the VR and Control group sessions to be the height of the air mattress the participants were asked to lie down on. During the CI, the facilitator stated: *"If you think of very caveman, fight-or-flight-type of thinking, if you are on the floor, you're not safe. Because if you need to respond to a risk or a threat, it takes a long time to stand up before you can fight."*

For the Control group, in addition to the height of the air mattress, the fact that participants had to lie down with their eyes closed made the process more difficult for them. The facilitator noted: *"Some participants, lying down, feel a little bit self-conscious about lying there with their eyes closed. It's a vulnerable position. You don't lie down and fall asleep in front of just anybody, you know?"*

This hindering aspect of feeling vulnerable is discussed in more detail in Section 5.4, as it pertains more to the SHIP® process as a whole and not to VR itself, but is raised here to show the assistive role that immersion and presence played during the SHIP® process in the context of VR.

Immersion

In the facilitator's opinion, the VR group experienced higher levels of immersion, and the VE contributed to this. They noted, *"I found that the VR group was able to go a little bit deeper and […] in my mind, that is accounted for by the additional brain stimulation that the VR headset provided."* The Control group

experienced the hindering aspects observed more vividly than the VR group. For example, for the Control group there was no escaping the reality where they were lying on an air mattress that was too low with their eyes closed. The VR group, on the other hand, was able to deal with those hindrances more effectively because of the visual simulation and the nature of the VR headset. Because of the stereoscopic display provided by the VR, it effectively 'cuts off' the user's peripheral vision, removing them from their immediate surroundings.

The ability of VR to immerse the user into a simulated environment also overcame other more general distractions that arose during the sessions, such as construction noises outside the VRI lab and other potential distractions such as uncomfortable seating. During the CI, the facilitator had the following to say about the VR headset: *"By placing a physical thing on your face that gave you a visual image that is so close to your eyes, […] it cut out the physical world: how high the bed is, what chair you're lying on; all of that, and it forced your conscious mind to get immersed to be present in the virtual reality world. And I think that is advantageous."* This ability of VR to essentially allow the participant to detach themselves from the physical world indicates VR's ability to instil a sense of presence within the participants.

Presence

One implication of 'removing the participant from the real world' was that it almost forces an individual to become fully present in the VE, as explained by the facilitator (quoted in the paragraph above). Therefore, the role of presence is important in the realm of SHIP® and psychotherapy.

According to the facilitator, the VR headset and the simulation it provided was the most helpful contributor to the SHIP® process: *"I think the VR goggles served as almost a healthy distraction because it allowed them to immerse themselves into the VR world. And it's almost like a personal world that [they] had in the back [of their mind] that functions in there because [I] don't know what [they're] seeing and it's not a shared experience, and that maybe allows them to feel a sense of psychological safety."* The role of psychological safety with regards to the SHIP® process is addressed below in Section 5.4.

As stated previously in Section 2.5.4, presence is when a user feels as though they are actually 'there' in the simulated world (Wilson & Soranzo 2015; Botella et al. 2017; Albakri et al. 2022). An individual's level of presence experienced also comes from the degree to which they can respond naturally in virtual environments (Slater et al. 2009; Kober, Kurzmann & Neuper 2012; Wilson & Soranzo 2015). The facilitator noted that *"reducing [or limiting] your consciousness to the VR world […] was helpful in enhancing presence"*. It makes sense that if an individual experiences a greater sense of presence, they are more likely to respond more naturally to the simulated environment. Being 'cut

off' from the distractions of the physical world, as suggested by the facilitator, leads to a greater feeling of 'being there' within the simulated environment with the door and the specific participant's name on it. In the context of SHIP®, this heightened sense of presence would allow the participants to respond more naturally to the SHIP® activities emotionally, physically, and mentally.

SHIP® uses a client's natural or spontaneous psychological and physiological responses while immersed within the SHIP® Frame to allow validation of past, 'frozen' experiences to treat clients' TSMs (Sevenster 2007; Hoffman & Steyn 2010; J. O. Steenkamp 2018:239–261). It is important to note that successful emotional processing in the context of SHIP® is not solely dependent on the level of the engagement with the imagined stimuli, but also on the authenticity of the spontaneous responses to the SHIP® activities administered in tandem with a client's experience with the imagined stimuli.

Engagement

During the CI, the facilitator noted that the levels of engagement in both groups were very similar, explaining that engagement within the context of SHIP® is *"a result of mutual engagement"* and elaborated that: *"If the therapist doesn't come to the table, then the client doesn't come to the table […] There wasn't, for me, any participant that didn't engage [in] activities, in the instructions that I gave to them. Everybody engaged [in] it to the best of their ability and it was at a good level overall."*

Even though the facilitator deemed the engagement levels as being similar, they did experience the VR group as having experienced higher levels of immersion as discussed above. The facilitator was referring to the VR group's ability to respond to the SHIP® activities with more spontaneity and authenticity because they were more connected with the required stimuli on an emotional level. This higher level of connection or immersion was a result of VR's ability to instil a greater sense of presence within the participant by almost disconnecting them from their physical world. This was accomplished by visual simulation and the ability of the VR headset to 'cut off' the peripheral vision of a user to completely 'cut out' the physical world. This greater sense of presence, however, did not lead to greater engagement (with more detailed responses and descriptions towards the SHIP® activities posed by the facilitator). Rather, it led to more natural engagement that was more authentic, spontaneous, and unique to each participant, thus allowing them to express their vulnerabilities more truthfully, experience them more fully, and subsequently process them more effectively.

This section has discussed the assistive aspects of VR and how they influenced the responses and events that were deemed helpful by the facilitator. These assistive events and their relationship with

the induced responses and attributes of VR were illustrated in Figure 5.6. The following section discusses the hindering aspects of VR.

5.3.3. Hindering aspects of VR

In the HAT forms, the facilitator noted some hindering events. Not all these events pertain to VR, so only relevant events caused by VR directly are addressed here.

Similar to the assistive events discussed above in Section 5.3.2, the facilitator identified responses and/or attributes of the VR system that were directly associated with the hindering events The hindering events were placed into two main categories—induced responses and VR attributes. These categories in turn feed into the overall hindering aspects of the VR system as observed by the facilitator. This process of identification and categorisation is illustrated in Figure 5.7 below.

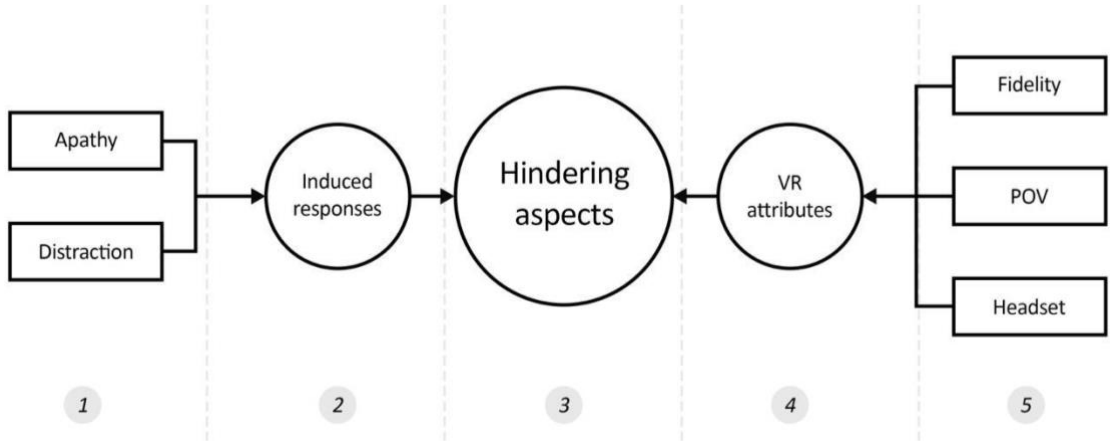

Figure 5.7: Hindering aspects of the VR group

The above thematic map illustrates the following:

- The responses identified by the facilitator during the observed hindering events are categorised into two main categories in segment 1: apathy and distraction.
- The two categories identified in segment 1 are all grouped under induced responses in segment 2.
- The aspects of the VR system identified by the facilitator during the observed hindering events are categorised into three main categories in segment 5: fidelity, POV and headset.
- These three categories identified in segment 5 are all grouped under VR attributes in segment 4.
- Both segments 2 and 4 were identified as hindering aspects that were observed during the VR sessions and led to segment 3, i.e., hindering aspects of the VR sessions.

5.3.3.1. Low fidelity

During participant V02's session the facilitator and the participant had the following exchange:
V02: *"What's also interesting is when I open my eyes and I see this picture, it's such a boring door, and the white background and the floor is boring. But then when I close my eyes, it's such a more..."*
Facilitator: *"Vibrant almost?"*
V02: *"... yes... sight."*

For this participant, the simulated door was very dull, whereas the door that they imagined for themselves was much more interesting and appealing. The facilitator noted that the *"participant felt that their own door was a more vibrant picture than the VR picture and they were often tempted to close their eyes"*. This event was described as only slightly hindering by the facilitator, but nonetheless the lack of a vibrant, more visually appealing simulation reduced the immersion levels, leading them to feel less present within the VE. By closing their eyes, V02 essentially tried to escape the VE to an imagined environment where they felt a greater sense of 'being there'. As discussed in Section 5.3.2.3 (on immersion, presence and engagement), this lowered sense of presence could result in their responses to the SHIP® activities being less authentic and spontaneous, leading to less effective emotional processing.

5.3.3.2. VR as a distraction

Distractions—such as becoming aware of too many feelings and everyday events simultaneously, or from one's day-to-day life and routine—can hinder the traditional SHIP® method. For example, during a Control group session with participant C07, the participant's mind wandered to their work, and the facilitator noted that too many emotions and thoughts occurred simultaneously. All of this hindered the process of SHIP®: *"Many different emotions or thoughts came up simultaneously for this participant. This made it difficult to process each one individually because he got distracted at times with other thoughts."*

Similarly, the VR group encountered certain distractions that were hindering to the process of SHIP®, as described next.

VR hardware distractions

During participant V07's session, they preferred to sit up on the chair rather than lying down on the mattress. The participant indicated that the initial setup of the headset was adequate and that it was properly fastened. Throughout the session, however, the weight of the headset started to loosen the straps, causing the headset to sag downwards on the participant's face. The participant had to

physically hold up the headset to see the simulation properly. The facilitator was unfamiliar with the headset mechanics and so did not attempt to rectify the loose straps. The researcher was unsure whether to enter the session while it was ongoing, as it would have taken the participant completely out of the therapeutic space created by the facilitator. The facilitator wrote the following in the HAT form: *"Participant preferred to sit up on a chair. The headset needed to physically be held in place, because of its weight, to keep the door image orientated. This may have distracted them from the SHIP® activities by shifting their focus."* In this instance, the physical nature of VR was a distracting element and hindered the process of SHIP®.

Other distractions noted by the facilitator included a power outage with participant V04, and a skewed POV with participant V05:

- A power outage interrupted Participant V04's session. Because the VE was being run through Unreal Engine on a computer, the power outage terminated the VE when the session was already underway. After the backup power of the venue was restored, the wall sockets in use no longer worked. Thus, the researcher had to interrupt the session to move the computer to a different wall socket to restore power and restart the VE and the control panel for the facilitator. Then, the facilitator restarted the session.

The researcher and facilitator discussed this incident and the impact it had on the session during the CI, and the facilitator explained that they were able to handle the incident very well and that it was only a minor hindrance: *"If we were to use this in a practice consistently, those are things you would be prepared for. You know that I'm using electricity, so […] I would before the session, tell [the client that] if this happens—if we do have a power outage—I'm prepared for it."*

- Participant V05 experienced a distractor in the form of a skew virtual door. When they initially sat down on the mattress and put on the VR headset, it seemed to be straight and fixed. Once the participant lay their head down on the pillow, the headset shifted, causing the virtual door to appear skew within the VE. The facilitator unpacked this incident during the CI: *"I feel like they again acknowledged the skewedness [sic] of the visual and adapted to it. So it wasn't necessarily—it added an additional element to cope with in the session, but it was something the client was able to cope with."*

Unfamiliarity with VR

For some participants, the concept of VR as a new and unfamiliar experience was in itself a distraction.

Unfamiliarity with a process can be a hindrance. For example, during Control group participant C09's session, the participant took a while to *"warm up to the SHIP® process"* as explained by the facilitator. The participant only started to engage with the SHIP® activities fully towards the end of their session. The facilitator observed: *"This participant is not accustomed to expressing themselves easily and freely, so the SHIP® process was new and it took them a little time to warm up to the process and engage with it fully."* The unfamiliarity with the SHIP® process led to slow acclimatisation, which the facilitator deemed as being slightly hindering.

In the VR group, in addition to the unfamiliarity with the SHIP® process, the facilitator noticed what they described as *"anxious anticipation"* towards the sessions with the VR headset:

"I think some of the participants had a form of anxious anticipation […]—excitement and healthy anticipation. But there was also a bit of anxiety of 'what's this new thing going to be like; I have never used a VR headset before; what is this experience going to be like?' And I would term it as anxious anticipation, because anticipation is a positive word and anxiety is a negative word, but there was a combination of those two."

This feeling and the novelty of VR distracted some of the participants from the SHIP® activities. For example, participant V10 was experiencing VR technology for the first time, and the facilitator noted that this moderately hindered the SHIP® process: *"Participant was fascinated with the VR headset, and it slightly distracted them from the SHIP® process."* Early in the session, when the simulated door was first introduced to the VE, the participant can clearly be heard saying *"Whoa..."* as the door faded into view. The new experience clearly captivated them to the point of being distracted. Section 5.2.4.3 explained how V10 imagined an entire lab behind the simulated door. They were so fascinated by that imagined space that the facilitator struggled to keep them focused on the SHIP® process, noting in the HAT form, *"I had to 'bring them back'. They got distracted with activities behind the door and struggled to focus on the feelings in their body."*

The distractions that VR posed to some of the participants were noted as hindering the SHIP® process, but during the CI the facilitator explained that the traditional SHIP® method experiences similar distractors frequently, to the point where facilitators are trained to acknowledge and handle distractions. While it is valuable to note these and be aware of them when developing a VE for SHIP®, a trained SHIP® psychologist should be able to deal with unforeseen distractions or disturbances, as discussed in the following section.

Distractors in SHIP®

Distractions can make the SHIP® process a bit more difficult. During the CI, the researcher asked the facilitator to elaborate on these. The facilitator explained that the distractions typically weren't hindering to such an extent that it would completely invalidate or nullify a SHIP® session. Moreover, in the traditional SHIP® therapeutic process, distractors are common: *"So, what I try to do with clients is identify the distractor. It's almost like […] 'What do you do when there's an elephant in the room?' You introduce the elephant, you say, […] 'the VR goggles seem to be hindering you, and they keep slipping down. I want you to hold it, prop your arms up in this way' [sic] and try and make it as easy, as reasonably possible under the circumstances. And then most importantly, you redirect attention where you want the client to focus. So, we redirected attention onto what they were seeing, rather than how they were seeing it with holding the glasses up* [referring to participant V07]*, holding the headset up, and that was the coping mechanism to cope with that."*

The facilitator continued: *"Whether it's a headset being too heavy that you need to prop up or it's unexpected and avoidable things like […] power outages, […] you need to be prepared to cope with unexpected things because that is the nature of the human experience."*

Nonetheless, VR aspects such as POV and headset stability still need to be kept in consideration when designing a SHIP® VE to minimise the amount of distractions the SHIP® psychologist has to deal with. These hindering events and their relationship with the induced responses and attributes of VR are illustrated in Figure 5.7.

This section (5.3) has discussed the various aspects of VR that assisted or hindered the SHIP® process. The data collected and analysed during this section came primarily from the HAT forms, where the facilitator noted their observations of the sessions, and the CI where the facilitator elaborated more on these aspects and how they compared between the two groups. Within the VR group, the TA revealed that the simulation of the VR and the nature of the VR headset allowed the participants to experience a greater sense of presence, which led to them responding more naturally to the SHIP® activities. These responses tended to be more authentic and spontaneous, two very important qualities required in the process of SHIP® to achieve effective emotional processing. Not only did VR instil a greater sense of presence in some participants, but the VE was also able to enhance and stimulate the image-creative neural-visual facility in others, such as those participants that could more easily visualise the requested stimuli during the imagination exercise. For those participants who struggled to visualise stimuli, the VE was able to serve as a proxy for their imagination, which allowed them to focus all their concentration in engaging with the SHIP® activities.

The section also looked at the hindering aspects of VR, where the visual fidelity of the VE led to one participant experiencing a lowered sense of presence, which motivated them to close their eyes. Another hindering aspect of VR that was discussed was its ability to distract the participant from the SHIP® activities. These distractions took the form of hardware issues, but also anxious-anticipation that some participants felt towards experiencing VR for the first time. As distractors are frequent occurrences within the traditional process of SHIP®, it was discussed that facilitators have been trained to deal with them.

The following section looks at other aspects that arose through the TA on the CI transcript that pertain to SHIP® as a whole.

5.4. The role of comfort, safety, and vulnerability in the SHIP® process

The facilitator noted various events, pertaining to SHIP® as a whole, that were present in both the VR and the Control groups. These either assisted the process of SHIP® or hindered it in both groups.

This section explains these events and how they occurred within the Control group as well as the VR group.

As stated in Section 5.3.2.3, the height of the air mattress was the most hindering aspect of both the Control and VR sessions. The section explained what impact immersion and presence in VR had on this hindering aspect, but it is helpful to understand why the height of the air mattress was deemed hindering in the first place. It is vital for a SHIP® client, or any individual undergoing some form of psychotherapy, to feel a sense of security or safety within the specific psychotherapeutic space. As noted by the facilitator: *"The most basic primal need for a human being is psychological safety,"* because during most psychotherapeutic treatments, the individual undergoing the therapy must be able to be vulnerable to effectively express their emotions and thoughts. Furthermore, as VR and psychology together is a very new and unfamiliar concept to some, participants might feel less comfortable and safe within the therapeutic space. In the facilitator's experience, familiarity with the traditional SHIP® process was very helpful to them during the Control group sessions: *"From a therapist's perspective, familiarity makes it easier. Familiarity is literally a foundational element of ease."*

The facilitator felt that the phase 1 data collection was the most important event that assisted the VR group. The phase 1 data collection introduced them to this unfamiliar concept before they were placed in the vulnerable state of lying on the low air mattress with their eyes closed. According to the

facilitator, the phase 1 data collection *"really enhanced the quality of our research results because […] it normalised the research process between interlinking VR or IT and psychology."* In other words, it made the process more familiar for the participants of the VR group, and familiarity leads to feeling a sense of safety. People are able to be vulnerable when they trust the space they are in and feel safe inside it.

For the current study, the facilitator *"had not noted anybody not being comfortable,"* referring to participants' comfort (within both groups) with the new and unknown process of SHIP®. Furthermore, it is important to emphasise that the VR group felt comfortable with the SHIP® process, similar to the Control group, despite the sense of the unknown added by the VR headset. The emotional responses discussed in Section 5.2.4.1 suggest that all the participants in the VR group felt comfortable during their sessions and that they each had formed the required therapeutic alliance with the facilitator. Therapeutic alliance is deemed to be an assistive aspect of the SHIP® process and does not relate directly to VR itself, but the following section discusses the importance of therapeutic alliance and how it was achieved in the VR group and in the Control group.

5.5. Therapeutic alliance

The facilitator said during the CI, *"Therapy requires vulnerability; the therapeutic alliance facilitates the vulnerability, and that therapeutic alliance—you'll find that it's a massive contribution to absolutely any therapeutic process, regardless of the techniques being used, whether it's SHIP® therapy, talk therapy, or anything else."* This contribution was noted during participant C04's session, where the participant was very honest about not experiencing any emotions or sensations at the start of the session. According to the facilitator, this admission allowed them to *"build a good therapeutic alliance"*. This enabled the facilitator to engage the participant more honestly, and the participant was then able to engage in the SHIP® activities better as the session progressed, which allowed them to effectively process their emotions that eventually came up.

For this study, it is important to highlight that a therapeutic alliance existed between the facilitator and the participants in the VR group similar to that in the Control group, despite the added unfamiliarity of the VR technology.

The facilitator thought that the therapeutic alliance contributed positively to the success of the VR sessions. For example, in the session with participant V01,the facilitator noted that the participant was comfortable and feeling safe within the VE and therapeutic space. This feeling, in combination with the therapeutic alliance, led to the participant sharing information without being prompted:

"They seemed to also feel very much at ease or safe during the session, because they volunteered personal information or thoughts and reflections at intervals."

The previous two sections have identified which attributes of VR assisted or hindered the process of SHIP®. These sections explained how certain hindering attributes are not that different to the hindering attributes that already exist within the realm of traditional SHIP® therapy, and highlighted that SHIP® psychologists are equipped to handle these hindering aspects within their everyday practice. Although SHIP® facilitators are trained to handle most distractions that might occur during a session, it is important to address the hindering aspects when designing VR systems to be used in the realm of SHIP®. These hindering aspects can be addressed in future system designs to mitigate them, so that SHIP® facilitators can focus on the SHIP® activities. The above sections also demonstrated that both groups established therapeutic alliances, as well as engaging with the SHIP® activities. However, as stated, there were several differentiating factors between the VR group and the Control group as observed by the facilitator: the level of presence that participants experienced (higher in the VR group); VR being able to stimulate and enhance the image-creative neural-visual facility of individuals; and VR being able to serve as a cognitive proxy for participants who struggle to visualise. These factors lend credence to VR's potential of being used as a therapeutic tool to assist in the SHIP® process, which is examined further below.

5.6. VR as a therapeutic tool

During the analysis of the data, a common theme identified was that of VR potentially being used as a tool to assist the existing SHIP® process rather than shaping it, from both the facilitator's side as well as the participants that underwent the VR sessions. This section explores the use of VR as a therapeutic tool.

As reported in Section 5.3.2.1, VR assisted in stimulating and enhancing the image-creative neural-visual facility of participants, allowing them to induce more authentic responses. In Section 5.3.2.2, it was shown that VR can serve as a kind of proxy for a participant's imagination when they are unable to effectively visualise the required stimuli. This proxy allowed the participants to focus their energy on engaging the SHIP® tasks and led to more effective SHIP® sessions. The facilitator noted that the simulated environment acted as an effective stimulus that stimulated brain function and memories. They explained, *"It's almost like the VR group had additional tools [and] additional resources at their disposal."*

VR's role as both a cognitive stimulus and a cognitive proxy link to the discussion in Section 5.3.2.3, about VR's ability to instil a sense of presence within a participant and remove them from reality on a psychological level. This led to the participants responding more naturally and with more authenticity to the SHIP® activities. Another aspect of VR that came up during the analysis was that VR acts as a type of anchor to assist participants when their minds wander from the activity. After their session, Participant V03 noted that they preferred to close their eyes to visualise a richer image, but whenever their mind began to wander or lose focus, they opened their eyes again to look at the simulation and to refocus on the current task.

According to the facilitator, the VR did not influence SHIP® experiences of the VR group, but rather enhanced them. Comparing the experience to that of a computer receiving input and producing output, the facilitator stated that: *"Your brain […] works on the same principle, where it takes in information. It has input through the five senses. There's processing in different parts of your brain—integration [and] analysing for conclusions, and then there's output. You either speak your answer, [or] write your answer down, or through your actions or behaviour, you will demonstrate an answer. And the VR group had greater input and that is what heightened their experience."*

The facilitator also explained during the CI that, even though the SHIP® process administered through the VR was very much simplified and that the participants' experiences were limited by this simplified version, the VE was still able to induce authentic responses. They noted: *"If I look at therapeutic principles and what I would aspire for my clients to have, in order to facilitate the goals of research of the psychotherapy session, and specifically SHIP® psychotherapy, I was very happy with the induction of the VR sessions. I think it gave them, at this point, as much as we could expect. And in our simplified version of SHIP® that we facilitated through our sessions, I was very happy with it."*

As explained in Section 5.3.1, the facilitator experienced both treatment methods as being assistive to the overall process of SHIP®, with neither method clearly perceived as superior. During the CI, the facilitator stated that the participants in both groups were able to describe their experienced emotional and physiological responses well during their sessions. The facilitator affirmed the following regarding the immersion levels between the two groups: *"If I had to pinpoint one [where the participants] immersed themselves more, I'm going to go to my current memory and understanding with the VR group."*

This perceived higher level of immersion can be attributed to what the facilitator said regarding VR's ability to essentially 'cut out' the external world. However, more research is needed to be certain that VR immerses clients more effectively than the imaginal method. The facilitator stated regarding engagement, *"I think engagement was of a good quality in both groups,"* and attributed this to the mutual

engagement that they experienced with each participant because of the therapeutic alliance that formed during phase 1 of the data collection process.

Regarding the induction efficacy of unique memories in the VR group, the facilitator said, *"The VR induction was able to allow us to stimulate very significant memories there [as well],"* and reflected, *"I don't think there was a significant difference between the standard and the VR group."* However, according to the facilitator, VR has great potential in the world of psychotherapy, not just for SHIP®. One of the main advantages raised by the facilitator was that *"it cut out the physical world […] reducing [or limiting] your consciousness to the VR world. I think that was helpful in enhancing presence."*

The facilitator concluded the CI by stating: *"It's very exciting to think of the idea of Tony Stark glasses being a reality, and all of those very fun, exciting tech things that are going to come about and how they can be useful to us, because I think psychotherapy can be highly enhanced with the stimulation of VR and I use those words very deliberately."*

5.7. Summary

This chapter started with a full discussion on the first phase of the study's data collection process. Specific changes were made to the first phase data collection to ensure that no participant would have an adverse reaction or response to the session, and this allowed the researcher to identify potential participants that might not be suited for a full SHIP® session. Other changes included giving the participants alternatives to lying down, to ensure that each participant was as comfortable as possible. The imagination exercise was then described, along with the process of determining each participant's score. Participants who exhibited signs of past traumas or phobias were excluded from the remainder of the study. The final LIP group of 20 participants was specified, explaining the selection of the two randomised groups chosen for the remainder of the study—the Control group and the VR group. Each participant in the LIP group was placed into one of the two groups.

The second phase of data collection, the RCT, was introduced. The section explained how the intent of these sessions was not to administer any psychotherapeutic treatment, but to observe whether a participant would be able to connect to the requested or simulated stimuli on a personal level. The section addressed what happened to a few participants who experienced adverse reactions, and the actions taken by the facilitator to protect them. Each group's audio recordings were then analysed by using TA and the identified themes were discussed in detail. For each group, the induced responses were identified and grouped under emotional, physical, and mental responses.

An in-depth discussion followed regarding the data uncovered from the HAT forms as well as the CI conducted with the facilitator a month after the RCT concluded. The data gathered were analysed using TA, to identify which aspects of the VR sessions assisted or hindered the SHIP® process. The researcher found that VR attributes such as the headset and simulation were able to contribute to assistive events, such as:

- VR functioning as a cognitive stimulus
- VR serving as cognitive proxy
- increased immersion, instilling a greater sense of presence.

These assistive events allowed participants to not only engage more effectively with the SHIP® activities, but to engage them with more authenticity and spontaneity, which leads to more effective emotional processing and is helpful to the process of SHIP®. The hindering aspects of the VR group were also discussed as well as the attributes of VR technology that contributed to these events. Mainly, it was discovered that VR itself can distract individuals from engaging effectively with the SHIP® activities, although the low fidelity of the VE also indicated some degree of apathy towards the simulated stimulus. This led to a participant feeling less present in the VE than in their own imaginations. This weakened sense of presence led to less authentic responses and was noted as a hindering event. It was discussed how the traditional SHIP® method also deals with various distractions on a day-to-day basis, thus, requiring facilitators to be trained to handle them.

A discussion regarding assistive events of the SHIP® process as a whole followed. It started by explaining the important role that comfort, safety, and vulnerability play within the psychotherapeutic space. It highlighted that the VR group was able to achieve the required levels of comfort and safety despite the fact that VR and SHIP® is a completely new and unfamiliar concept to most. It considered the importance of the initial group data collection and how that helped to form the therapeutic alliance that the facilitator had with all the participants. It discussed this therapeutic alliance, and explained how the VR group achieved the required alliance similar to the Control group. This was done to demonstrate that the VR group complied with all the traditional requirements associated with a traditional SHIP® process, to emphasise the other differences between the two groups.

This chapter concluded with a detailed discussion around the use of VR as a therapeutic tool to assist the facilitator during the traditional method of SHIP® rather than shaping or replacing the traditional method. The next chapter discusses any conclusions that were drawn from administering the various data collection techniques and their subsequent analysis.

6. Chapter 6: Conclusion

This chapter concludes the dissertation. It summarises the results of this study and includes a detailed discussion of the results to answer the research questions posed at the beginning. It outlines the contributions made by the study and concludes with recommendations for future research.

6.1. Summary

This study focused on the VR induction of unique responses and memories and assessing how effective VR is in eliciting these responses within the realm of SHIP® therapy. The researcher began by conducting detailed research into existing literature around topics such as:

- the emotional processing theory (EPT),
- the application of EPT within exposure therapy (ET),
- the use of virtual reality (VR) alongside ET within virtual reality exposure therapy (VRET),
- the role of immersion and presence within VR.

The review of literature in Chapter 2 concluded with an introduction to SHIP®, how it relates to and differs from ET, and how VR could potentially be used within SHIP® similarly to VRET.

The researcher's investigation into related topics led them to develop guidelines for creating a VR system to assist in the process of SHIP®. The researcher identified and constructed the following guidelines from the literature, which assisted in developing the PENSIEVE prototype used during the RCT:

- **Hardware integration:** From identifying and investigating existing VRET systems, it seemed viable that a head-mounted display such as a Meta Quest could provide the necessary immersion into scenarios that are otherwise inaccessible to clients in SHIP®. A user-friendly interface would be required to control the VE via an external third-party and not the user themselves.
- **Induction:** For a VR system to successfully assist with SHIP®, the VE would need to simulate images that fall under the client's current phase in the SHIP® Frame, to successfully induce activation of the trauma state of dissociation, i.e., to 'unfreeze' trauma and help the client effectively process it.
- **Disruption:** It was noted during the literature review that existing VRET systems use simulated scenarios as disrupting activators to facilitate therapy and restructure or destroy existing fear structures within the patient's psyche. These systems motivated the researcher to incorporate the participants' names in the simulation, allowing for a unique connection

between the participant and the VE to make the experience more personal. This would ensure that the SHIP® VE not only induces activation of the TSMs but also disrupts them.

- **Presence:** VRET systems that were able to increase a user's sense of presence were more effective at triggering and even changing existing fear structures in some cases. The need for an increased level of presence also motivated the researcher to include the participant's name (appearing on the virtual door), as stated in the previous point.
- **Achieving a state of flow through integration:** The researcher found signs to look out for in the event of successful integration, i.e., whether or not the prototype was able to induce an inter-systemic disrupting activator within a client and assist in the healing dialogue of TSMs.

Section 2.9 explained the problems with ET and how this served as motivation for investigating a potential SHIP® VR system, mainly because SHIP® does not desensitise its clients. Instead, the fact that SHIP® focuses on the completion of frozen trauma and not on treating the symptoms individually could allow it to succeed in the areas where ET fails, and a VR SHIP® system might be able to assist those patients who have not been able to benefit from VRET.

The researcher designed a prototype based on the abovementioned guidelines and implemented it to gather data to answer the research questions. The research design took the form of an RCT and included 20 participants divided into two homogenous groups, a Control group and a VR group, through the use of purposive sampling. The researcher gathered data using questionnaires in the form of HAT forms and a semi-structured interview with the facilitator who ran the SHIP® sessions with each of the participants. Further data included the facilitator's observations of each of the participant's experiences and audio recordings of each session. The facilitator was asked to conduct the sessions as it would have been unethical for the researcher to run such a SHIP® session. The researcher focused on the qualitative data gathered in this study, and analysed data using TA. The data and results obtained from this analysis were discussed in detail in Chapter 5.

6.2. Findings of the study

This section presents the findings of the study. First it answers each of the study's sub-questions, and then it addresses the main research question.

6.2.1. Sub-questions

To be able to answer the main research question of the study, each one of the sub-questions is answered in turn below.

6.2.1.1. Which specific visual qualities of virtual reality contribute to improving the neural-visual facility of participants?

The first sub-question of this study was answered through the literature reviewed in Chapter 2, as well as the empirical data gathered during the RCT (as discussed in Chapter 3). By investigating the literature surrounding the five pillars of a VR experience (as discussed in Section 2.5.1), VR technology (as discussed in Section 2.5.2), and VRET (as discussed in Section 2.6.1), the researcher was able to develop a prototype to gather the necessary empirical data used to answer this first research question.

Through the RCT, two attributes of VR were identified, both hardware- and software-related, that contributed to improving the neural-visual facility of participants within the VR group. These attributes of VR are as follows (as explained in Section 5.3.2):

- **Visual, i.e., the virtual environment:** The VE provided by the HMD enhances the imaginative capabilities of some participants or effectively replaces the imagination of others.
- **Physical nature of the HMD, i.e., cut-off from the external world:** The nature of the HMD is that when worn effectively, it removes the user from the external world by cutting off their peripheral vision.

These attributes contribute to simulating the virtual world and immersing the participant within it. The virtual world and immersion are two of the five pillars needed for something to be considered VR (as established in Sections 2.5.1.1 and 2.5.3). As important attributes of VR that contributed to improving the neural-visual facility of participants within the VR group, these are explored in more detail below.

The virtual world

The VE simulated by the HMD provides a virtual world for participants to be immersed in. This improves the neural-visual facility of the participants in one of two ways: (1) serving as a proxy for a participant's imagination, or (2) enhancing their imaginative capabilities to create more nuanced connections to the stimuli (as explained in Section 5.3.2). In cases where participants struggle to visualise the requested stimuli, the virtual world can effectively replace their neural-visual facility, allowing them to carry on with the rest of the SHIP® process and engage with the required activities. In other words, the virtual world serves as a cognitive proxy for the participants. Participants who are able to visualise the requested stimuli effectively also benefit from the VE, as it enhances their

neural-visual facility, allowing them to connect to the VE on a deeper level to have more nuanced experiences during the SHIP® process. In other words, the virtual world serves as a cognitive stimulus.

Immersion

In Section 5.6, the facilitator described how the VR group effectively had *"additional tools"* to use during their sessions. The virtual world as well as the HMD provided these tools, leading to high levels of immersion for the participants in the VR group (as laid out in Section 5.3.2.3). Therefore, allowing the participants to physically see the environment they are being tasked with imagining improves their neural-visual facilities by either replacing or supporting them. The virtual world serves as a foundation for their imagination and removes the need for the participant to concentrate sufficiently to imagine the requested stimuli from scratch (as explained in Section 5.3.2.1). This allows participants to immerse themselves immediately into the virtual world, without the struggle of having to construct one first.

With the small sample size of the current study and the lack of quantitative data regarding the levels of immersion they experienced, it is difficult to know whether the VR group experienced higher levels of immersion than the Control group. However, the qualitative data suggest that they experienced more effective immersion due to having the virtual world stand in for their imagination, providing them with additional stimuli from which to build on when using their imaginations (as described in Section 5.3.2.3). This immersion was further enhanced by the HMD and its ability to isolate the user, effectively removing the participant from their immediate environment. Distractions and other hindering aspects identified were reduced or completely removed for the participants, allowing them to relinquish themselves more effectively to the virtual world.

The empirical data collected showed that simulating a virtual world using an HMD aided in improving the neural-visual facility of the participants in the VR group (as discussed in Section 5.3.2). The simulated VE and the physical nature of the HMD enabled the two fundamental attributes that make up a VR experience, namely the virtual world and immersion. These two attributes were identified and explored in the literature review (as explained in Section 2.5.1). While investigating various VRET systems to inform the design of the PENSIEVE prototype, the researcher discovered that they have both these fundamental attributes as well. Therefore, to answer the question, the two attributes of VR that contributed to improving the participants' neural-visual facility were the simulated VE or virtual world, and immersion.

6.2.1.2. What effect do simulated environments have on the induction of memories within participants?

To answer this question, the researcher examined data from two sources: the literature regarding existing VRET systems—to find out what effect successful VRET systems have on patients within the context of their psychotherapeutic treatment—and the empirical data gathered through the RCT.

By investigating existing VRET systems, two main effects that simulated environments have on patients undergoing VRET were identified: the ability of the simulated environment in these systems to (1) induce unique memories or responses, and (2) restructure or change existing fear structures. The systems explored in Section 2.8 demonstrated how the simulated environments were able to do this by exposing users to specific feared stimuli to elicit certain voluntary or involuntary responses. Responses such as increased heart rates, self-reported levels of discomfort, or even progression through higher levels of exposure to the feared stimuli were all desired effects that one would want from a VR SHIP® system. Thus, the answer to this sub-question is two-fold. Firstly, as demonstrated by the PENSIEVE prototype, by introducing the participants to a disrupting activator, a simulated environment is able to induce unique emotional responses, physical responses, and unique thoughts and memories (described in Section 5.2.4).

Secondly, there is a need to confirm whether these induced responses and memories were able to activate the trauma state of dissociation of a participant, i.e., triggering existing TSMs similar to how existing VRET systems trigger fear structures. This is a state that is necessary to progress through the SHIP® process (as established in Section 2.7). During the RCT, some participants exhibited nuanced and deep experiences that led to emotional processing. This was discussed in Section 5.3.2 and showed that some participants experienced spontaneous healing reactions (SHRs) as a result of the simulated environment of the PENSIEVE prototype. Thus, the PENSIEVE prototype was effectively able to induce unique memories that were capable of triggering existing TSMs that aided with emotional processing within the context of SHIP®. This effect on the induction of unique memories was aided by two other effects that the PENSIEVE prototype had on the participants, namely psychological safety and presence.

Psychological safety

Section 5.4 explored the role of comfort, safety, and vulnerability within the SHIP® process. The VR attributes discussed under the first sub-question explained that because of the nature of the HMD, the participants were essentially "cut off" from their immediate surroundings. This brought two advantages to the SHIP® process:

- The participants were better able to focus all their energy on the virtual world and SHIP® activities because all other distractions outside of the virtual world were either reduced or completely removed.
- The participants felt less vulnerable while lying on the air mattress because their peripheral vision was limited to the stereoscopic display of the HMD, enhancing their immersion, and thus reduced their awareness of the facilitator watching them.

Thus, a valuable effect that the overall system had on participants within the VR group was feeling safe in a psychotherapeutic environment. As shown in Section 5.3.2.3 and Section 5.4, the experience of undergoing any form of psychotherapy can be intimidating and uncomfortable for any patient or client. VR was shown to assist in alleviating these feelings of unease by effectively removing the participant from their immediate environment and immersing them in their personal world. VR's ability to immerse and instil a sense of presence allowed participants to feel less self-conscious and to experience a greater sense of psychological safety. Thus, they could respond naturally to the VE and the tasks given by the facilitator.

Presence

As part of the answer to the previous sub-question, it was suggested by the qualitative data that the virtual world and the HMD assisted in more effective immersion of the participants within the VE. Section 5.3.2.3 explained how these attributes aided in detaching the participant from the physical world. During the RCT and the CI, the facilitator and researcher found that the VR group participants were able to respond naturally to the VE by feeling certain physiological and psychological responses induced by the VE and the SHIP® process. A review of the literature on presence (in Section 2.5.4) revealed that the level of presence that an individual experiences comes from the degree to which they can respond naturally in VEs. The VE and HMD's ability to detach the participant from the physical world, and having these participants respond naturally to the environment and the facilitator, instilled a sense of presence or a feeling of 'being there'. This was a valuable effect that the system had on the participants, allowing them to experience authentic responses during the VR SHIP® process.

Thus, the two most valuable effects that the PENSIEVE prototype had on the participants was instilling a sense of psychological safety as well as a sense of presence. These two impacts of the simulated environment enabled the VE system to have its intended effects: (1) being able to induce unique responses and memories, and (2) having these responses and memories activate and assist in the healing dialogue of TSM of the participant and evoke the accompanying SHRs.

6.2.1.3. How does the induction of memories in participants experiencing a simulated environment compare to the induction of memories when stimuli are imagined?

This sub-question was answered by the empirical data gathered during the RCT and the CI. The empirical data indicated that both methods, VR and traditional, were effectively able to induce unique responses, memories, and thoughts, which led to both methods being perceived as assistive to the overall process of SHIP® (as discussed in Sections 5.3.1, 5.3.2.3 and 5.6). Even though the facilitator experienced the VR group as more able to immerse themselves into the virtual world to induce more nuanced memories and responses, the small sample size of the current study made it difficult to conclusively state whether the simulated environment was more effective than the imaginal process. The data gathered during the CI also did not suggest a significant difference between the induction of unique memories between the two methods.

However, during the imagination (LIP) exercise of the current study, there were some participants who struggled to imagine the requested stimuli, and one participant could not imagine anything at all. Some of these participants benefited from the simulated environment, because it either served as a proxy for their imagination or supported it, which helped them develop a deeper connection with the virtual world to induce more nuanced memories, thoughts, and responses (as explained in Section 5.3.2). For these individuals, a successful induction might not have happened during a typical imaginal SHIP® process. While it is possible that they might eventually induce unique memories and responses with time and effort (if they were to undergo the traditional method regularly and for an extended period), the data from the RCT suggests that this might be significantly reduced using VR, which helped them visualise and focus all their energy on engaging with the SHIP® activities and VE (as stated in Section 5.3.2.3). This enhanced engagement led to at least one participant experiencing the VE on a more nuanced level, and having more induced unique thoughts and responses. This suggests that an important difference between the two methods is that traditional SHIP® sessions may fail if participants cannot visualise the requested stimuli. In contrast, VR delivers visual stimuli directly, enabling participants to see, experience, and engage with the stimuli and the SHIP® activities, ideally leading to the induction of unique memories.

6.2.2. Main research question

Each of the three research sub-questions has been answered based on the literature review and/or the empirical data gathered. The main research question can now be addressed: *How can a simulated VE stimulate and enhance the image-creative neural-visual facility to assist participants who find it difficult to imagine the requested images?*

Notably, it is important to consider VR as a tool to assist the existing SHIP® method rather than a new method to replace it. In Section 5.5, the recurring theme of the therapeutic alliance between the facilitator and participant was explored. The facilitator and researcher agreed that the method of intervention does not necessarily guarantee success in therapy; rather, success in therapy is determined by a mutual engagement from both the client and the psychologist in the psychotherapeutic process. This means that it does not matter whether the client is imagining the requested stimuli, or it is simulated for them via an HMD. What matters is the trust, security, and comfort that exists between the two parties, as was established in Section 5.4. Once a client feels comfortable and safe, they can be vulnerable, and then the psychologist can facilitate the emotional processing that results from induced memories and responses by imagining stimuli or viewing it through an HMD. However, the SHIP® process is hampered if an individual is unable to imagine effectively, an issue that has been demonstrated by some outliers in this study (as described in Sections 5.3.1 and 5.3.2.2).

Therefore, to answer the main research question, one needs to start with the overall system and how it can be integrated into the traditional, imaginal process of SHIP®. The VRET systems investigated in the literature review all simulated scenarios, phobias, or other relevant stimuli that are sometimes considered to be inaccessible or dangerous, via an HMD. For SHIP®, the SHIP® Frame (as explored in Section 2.7.4) provides an effective means to integrate a VE with the process of SHIP®. The PENSIEVE prototype simulated the door image (as described in Section 2.7.4.2) on an HMD, which was worn by participants during their sessions. As discussed above for sub-question 1 (in Section 6.2.1.1), the prototype aided participants who struggled to imagine stimuli by acting as a proxy for their imaginations, and aided participants who did not struggle by enhancing their imaginations.

The prototype's integration into the SHIP® process did not hamper engagement with the SHIP® activities, and participants were able to respond to the facilitator's questions and tasks. Sub-question 2 confirms this, as the nature of its integration into the SHIP® process allowed the participants to feel a sense of psychological safety and presence. The participants in the VR group (as stated in Section 5.6) showed levels of engagement similar to the Control group in SHIP® process activities, and sub-question 3 highlighted that there were no significant differences in the induction of memories between the two methods. The facilitator observed that the PENSIEVE prototype allowed for higher levels of immersion and presence than the traditional SHIP® method because of the attributes of VR that detach the user from their immediate surroundings. However, the

prototype was able to replicate every aspect of the traditional SHIP® process that is needed for successful treatment:

- Make a client feel comfortable and safe within the psychotherapeutic space.
- Promote and facilitate engagement with the SHIP® activities through therapeutic alliance.
- Induce unique memories and responses through specific stimuli.

Thus, the PENSIEVE prototype was successful in simulating a VE that was able to stimulate the image-creative neural-visual facility of participants. The success of the prototype relied mainly on the VR system's ability to instil a sense of presence and psychological safety within the participants, which strengthened the therapeutic alliance between them and the facilitator. This sense of presence allowed the individual to experience authentic responses, memories, and feelings when immersed within the VE. The sense of psychological safety in turn allowed the participant to respond naturally and with vulnerability to the facilitator's questions and instructions. For those participants who struggled to imagine requested stimuli during the LIP imagination exercise, the prototype was able to aid them in participating and engage in SHIP® activities during their SHIP® sessions, in a way that would otherwise have been difficult or impossible.

6.3. Contributions of this study

Chapter 1 stated that various studies have focused on VR and its potential application and effects in the realm of ET; however, the scientific community has not paid as much attention to research on VR and its potential application or effects within the realm of SHIP®. To the researcher's knowledge, there have been no studies investigating VR working in tandem with SHIP® as a psychotherapeutic intervention (as stated in Section 1.3). Thus, the main contribution of this study is the design and implementation of the Psychological quasi-Experimental Neural Study of Induction Efficacy of Virtual Environments (PENSIEVE) prototype: a VR system that uses the existing SHIP® Frame to induce unique memories and responses to assist with the internal spontaneous healing dialogue of clients (as explained in Section 2.7.1).

The prototype achieved its goal of inducing unique memories and/or responses within participants and stimulating their image-creative neural-visual facility. This stimulation was present for both participants who struggled to visualise requested stimuli and those who had no trouble imagining the requested images. These memories and responses elicited from the visual stimuli were unique enough to each participant that the facilitator was able to use their responses to drive the SHIP® activities to facilitate emotional processing. The participants were also able to feel levels of presence that were robust enough to allow them to respond naturally to the VE and experience authentic psychological

and physiological responses. Thus, it was successfully able to replicate similar outcomes to the traditional, imaginal SHIP® process that has been experientially proven to aid in the relief from TSMs (as discussed in Section 2.7).

The prototype's integration has also led to a better understanding of how the hardware attributes of a VR headset can enhance a user's sense of presence in the context of SHIP®. This understanding contributes to the knowledge of clients' behaviour within a SHIP® session, illustrating that engaging with the SHIP® process and activities is not merely about being able to effectively visualise the requested stimuli, but also (1) being able to disregard any distractions, and (2) not invoking any coping styles (to avoid engagement). The hardware attributes of a VR headset aided with some of the main difficulties experienced during the SHIP® process. Coping styles (as discussed in Section 2.7.5.1) were, in some cases, neutralised by allowing the participant to feel present, safe, and comfortable enough to respond more authentically to the VE and the facilitator's instructions and questions. The same applies to distractors (as explained in Section 2.7.5.2) because the HMD was able to limit the users' peripheral vision to that of the VE.

This added understanding of the nature of VR also led to additional contributions to the overall psychotherapeutic process followed by facilitators and psychologists alike, i.e., the crucial role that safety, comfort, and vulnerability play within the psychotherapeutic process (as discussed in Section 5.4). The ability of VR and the HMD to remove the user from their immediate reality had a positive effect in some cases where the user felt increased levels of safety and comfortability, which in turn allowed them to be more vulnerable during the SHIP® process. As explored in Section 5.5, vulnerability is a crucial aspect in any psychotherapeutic process. This insight emphasises the importance of the therapeutic alliance between a psychologist or facilitator with their patient or client.

Lastly, the development and integration of the PENSIEVE prototype with the process of SHIP® led to a better understanding of how VR should be used within the realm of psychotherapy. At the start of this study, it was theorised that VR might be able to replace the traditional, imaginal SHIP® process. However, that was found not to be the case, and the data illustrated that it is not a matter of replacing existing interventions, but rather assisting them. Some participants preferred using their imaginations, whereas others felt the VE made it possible for them to partake in the SHIP® process when previously they were not able to. This understanding contributes to the wider knowledge of VR technology used in the treatment of patients with PTSD, phobias, or any other disorders.

Understanding that the therapeutic alliance is, in essence, the most important element of any psychotherapeutic process better explains the need for VR to be seamlessly integrated into existing methods and interventions rather than replacing them. VR is a tool to help discover potential answers, and not the answer itself. One manner in which VR can be integrated within the process of SHIP® would be to evaluate the client's current status within the therapeutic process, i.e., determining what image they are currently struggling to visualise within the SHIP® Frame. A VE would need to be constructed to either substitute or enhance the required image or stimuli, and it would need to be introduced to the client. Ideally, the VR experience should be moulded around the client's unique SHIP® experience and introduced to their therapeutic context and environment via an HMD that is lightweight and non-disruptive. The client should be on the comfortable bed or chair that they are accustomed to within the context of their ongoing therapy.

6.4. Limitations of the study

While the prototype successfully achieved its goal of inducing unique memories, and physiological and psychological responses, the sample for the current study, the simplistic nature of the imagination exercise, and the chosen SHIP® Frame limited the results of the study somewhat from preventing to determine which of the two intervention methods were more assistive to the overall SHIP® process. These limitations are examined below.

6.4.1. Small sample size

The LIP group that took part in the RCT trial consisted of 20 participants, however these participants were selected from a group of 22. This small population from which the LIP group was selected prevented the researcher from recruiting participants who truly have difficulty with imagining requested stimuli. As a result, mostly participants who did not really have any visualisation deficiencies took part in the RCT which lessened the credibility of the results that VR did serve as an effective cognitive proxy and/or stimulus.

6.4.2. Simplistic imagination exercise

During the imagination exercise that was used to recruit the LIP group that would partake in the RCT (as outlined in Sections 3.3.2.3 and examined in 5.1.2) it was found that most of the participants obtained very high LIP scores. The researcher determined that this was as a result of the imagination exercise being oversimplified. As a result the "low" LIP group consisted mostly of participants who did not have trouble with visualising the requested stimuli. This makes the answer to the question "Which specific visual qualities of virtual reality contribute to improving the neural-visual facility of

participants?" less credible, as we could not effectively measure an improvement between a participant's ability to visualise before the RCT and after the RCT.

6.4.3. Shallow SHIP® Frame

While the door frame was still the best choice for a study of the current time and resource constraints, it should still be noted that the shallow nature of the chosen SHIP® Frame did lead to data that was less rich. An image of a door is quite general, and even though the addition of the participant's name on the door did induce some significant responses, it is this researcher's belief that a more personalised VE would have garnered even richer data. The impact of this limitation is not as severe as the two prior, but is something to consider for future research.

The limitations outlined above assist in identifying the key areas that warrant further research and are outlined in the following section.

6.5. Recommendations for further research

While the prototype successfully achieved its goal of inducing unique memories, and physiological and psychological responses, the sample for the current study did raise some concerns and topics that could inspire future research. These concerns and topics are discussed here.

6.5.1. Larger sample size

It is recommended that future researchers recruit more participants to form the initial population for administering the imagination exercise. This should increase the credibility of the study's results and compliment the need for a more complex imagination exercise as outlined below.

6.5.2. Improved imagination exercise

The current study used an imagination exercise at the start of data collection to determine which participants within the population had the lowest levels of imagination potential (lowest LIP ratings). Section 5.1 discussed in detail how most of the participants scored relatively high LIP ratings. This did not hinder the progress of the study, but made it difficult to answer definitively whether VR has the ability to aid those who struggle to imagine requested stimuli.

In future research, a more complex imagination exercise could be developed to filter out those participants with high imaginative potential and to recruit more participants who truly struggle with visualising images of their own accord. Such a complex exercise would allow for a clearer indication of who would benefit the most from the VR intervention.

6.5.3. VR's role as cognitive proxy for client's imagination

The SHIP® frame consists of four phases, each with unique images that need to be visualised by clients. For some participants, the door image simulated by the VE was able to replace their imaginations, bridging the gap that would have made undergoing a traditional imaginal SHIP® session difficult (as explained in Sections 2.7.5 and 6.2.1.1). However, further research is needed to understand the effects of other simulated stimuli. Future research could simulate different phases from the SHIP® frame for participants who do not have high imaginative potential. SHIP® phases such as the Tunnel and the Well are two fairly common geographical and physical structures that participants might have had prior experiences with. By using the complex imagination exercise recommended above, the simulation could be introduced to individuals who truly might benefit from the VR intervention. Moreover, researchers could establish additional preliminary criteria, such as whether participants have ever been inside a cave or interacted with a well in reality; they could then compare the participants' real experiences with their VR experiences. This should provide better insight as to the extent to which VR is able to serve as a cognitive proxy for a client's imagination.

6.5.4. VR as a therapeutic tool

The above topics culminate in the main recommendations for future research. Two paths for researching VR as a therapeutic tool have been identified and are outlined below.

6.5.4.1. VR as a therapeutic tool: a quantitative study

The current study provides a preliminary indication suggesting that VR is able to assist with the SHIP® process. The results can be used to inform a follow-up study to research the degree to which it can be integrated and assist in the overall SHIP® process. This researcher recommends that a purely quantitative study be carried out on a much larger sample size. The study should focus on the following areas:

- Recruit a larger and more diverse sample. For the current study, the HAT score was used to determine the effectiveness of the two interventions. Using the results of the current study, researchers could formulate more robust quantitative measures to allow for a more in-depth and meaningful comparison between the two interventions. A large sample size would also make such comparisons more valuable.
- Run a more complex imagination exercise with the initial population and develop stricter LIP rating criteria to have the study focus purely on those individuals who struggle to visualise images. By conducting a study with very strict criteria to choose low-LIP individuals only, the study could be purely quantitative. The researcher could simply

compare the participants' scores from the Control group (during the traditional, imaginal SHIP® session) with the participants' scores from the VR group (during the VR SHIP® session).

Alternatively, such a study could take the form of a pre- and post-test comparison between LIP scores. With such a study the researcher could recruit a very large sample, take a base reading of the participants' LIP scores before the intervention, administer the intervention, and afterwards take a second reading with the same imagination exercise to compare the scores.

Such a quantitative study would require far more resources and time to carry out, for each participant would need at least a 30-minute session. However, such a study would better determine whether the VR intervention:

- leads to higher levels of immersion
- instils a greater sense of presence
- promotes more authentic engagement with the SHIP® activities.

Such a study would thus effectively be able to determine the effect of a VR intervention on the induction of unique memories, responses, and thoughts within participants, and compare these to the traditional, imaginal SHIP® intervention.

The quantitative study proposed would assist in determining how well VR can enhance or even replace an individual's imagination. However, this would not necessarily indicate how effective VR is in aiding a psychotherapeutic process, i.e., whether or not it helps a client progress through their therapy.

6.5.4.2. VR as a therapeutic tool: a qualitative study

The current study did not administer therapeutic treatment during the sessions, as this would have been unethical. However, because this study has demonstrated the viability of VR being used within the context of SHIP®, one could deploy it within a SHIP® session with the purpose of administering psychotherapy. A second study is thus recommended, with a focus on improving a SHIP® client's PTSD, mental disorder, or phobia. A study such as this one would probably need to do the following:

- Have a small sample size of participants who are currently undergoing SHIP®.
- Use well-developed high fidelity and personalised virtual worlds that connect to the client's current phase within the SHIP® Frame. Section 5.6 explained that the VE and SHIP® process was very much a simplified version and thus limited the experiences had by the

participants. Developing VEs that have higher fidelity and are more personalised, or are customisable by the user, should enhance the experiences of participants in such a study.

- Observe the client over the span of a couple of SHIP® sessions as they experience the personalised virtual world.

Another important factor that would have to be considered by a study such as this is how VR could potentially be integrated into therapeutic environments. The complexity of the SHIP® process, the limitations of a psychologist's office (or wherever they administer treatments), and the psychologist's technical skills to operate such a VR treatment system would also have to be investigated thoroughly. One would have to consider the collaboration necessary between the VR programmer and the psychologist/facilitator to integrate such a VR system into a therapeutic environment to assist low-LIP individuals.

Such a study would provide better insights into the extent that VR is able to improve a client's PTSD, phobia, or mental disorder. It would also require more resources and a longer timeline to carry out. Because psychotherapy would be administered to clients as well, the sessions would have to be conducted by a SHIP® professional and the necessary permissions would have to be obtained from specific departments and the participants. It would also require clients who have been undergoing SHIP® for a while, so the clients' specific SHIP® psychologist would likely need to conduct the sessions.

6.5.4.3. VR and other CBT treatments

The current study focused on examining VR's integration with ET, a CBT therapy that is proven to be successful in the treatment of various disorders (as examined in Section 2.4). However, there are many different forms of cognitive and behavioural therapies that could potentially benefit from VR as well and it is this researcher's recommendation that they be investigated in future research. Apart from SHIP® there are also other mindfulness-based treatments that aim to make patients aware of how their autonomic responses, whether it be cognitive or behavioural, impact their emotional health (Hofmann, Sawyer & Fang 2010). For example treatments such as mindful meditation and mindfulness-based stress reduction (MBSR) (Hofmann, Sawyer & Fang 2010) could also potentially be integrated with VR to make treatment not only more effective, but more accessible.

6.6. Summary

This chapter concludes the dissertation. During the course of this study, a VE was developed that was successfully integrated with the existing process of SHIP®. This VE was able to induce unique memories, and physiological and psychological responses, similar to those that the traditional, imaginal SHIP® process has been proven to induce.

The results and analysis of the current study indicate that VR has the potential to stimulate and enhance the image-creative neural-visual facility of the client, or act as a proxy for a client's image-creative neural-visual facility. In other words, VR can help participants who have difficulty visualising requested images, and in doing so, aid them in successfully progressing through the process of SHIP®.

The research question and sub-questions were answered in this chapter using the data gathered and subsequent analysis provided in Chapter 5.

This chapter concluded with the contributions made by the study to the realm of VR and SHIP® as well as the wider understanding of psychotherapeutic treatments, and how VR should be used as a tool to aid therapists rather than as a technology to replace the method with which they administer therapy. Finally, the researcher made recommendations for further research and outlined suggestions for future studies.

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APPENDICES

Appendix A: Helpful Aspects of Therapy Form (HAT)

Helpful Aspects of Therapy Form (H.A.T.)

Instructions:

We are interested in determining whether virtual environments are able to induce memories in the same manner as a traditional, imaginal SHIP® session. The questions are applicable to the type of session you just facilitated. This means that if you just facilitated a VR session, all the questions will refer to that specific method of treatment and ONLY that method of treatment.

We use the term "EVENT(S)" to refer to anything that happened during the session with the participant, be it a physiological or psychological response, something the participant said, or anything else they might do that is a result of the specific treatment being administered. It will be up to you to use your insights as a trained SHIP® therapist to observe and identify any and all of these events that might be considered useful or hindering.

There is a single Likert scale question at the beginning of the questionnaire, followed by 6 open ended questions. There are no right or wrong answers. Any event that you consider to be useful or hindering must be listed and described in as much detail as possible. This questionnaire should not be shared with the participant and should only be seen and filled in by you, the facilitator.

Facilitator:	
Participant:	
Date:	
Session: (VR or Standard)	

1. To what extent was the **session** useful to the process of SHIP®? Rate it on the following scale. (Put an "X" at the appropriate point)

Not at all useful				Neutral			Extremely useful		
1	2	3	4	5	6	7	8	9	10

2. Of the events which occurred in this session, which one do you feel was the most important or helpful with regards to facilitating the session? (By "event" we mean something that happened in the session related to the type of treatment administered i.e., VR or standard. It might be something the participant said or did, or something you said or did.)

3. Please describe what made this event important/helpful and what it helped achieve in the context of the SHIP® session.

4. During which section of the session did this event occur?

_____

5. How long did the event last?

_____

6. Did anything else particularly **helpful** happen during this session that was related to the treatment method administered i.e. VR or standard? (Put an "X" at the appropriate box)

YES	
NO	

a.) If yes, please rate how **helpful** this event was: (Put an "X" at the appropriate box)

Slightly		Moderately		Greatly		Extremely	

b.) Please describe the event briefly and explain why you consider it helpful:

_____

_____

_____

7. Did anything happen during the session which might have been **hindering** that was related to the treatment method administered i.e. VR or standard? (Put an "X" at the appropriate box)

YES	
NO	

a) If yes, please rate how **hindering** this event was: (Put an "X" at the appropriate box)

Slightly		Moderately		Greatly		Extremely	

b) Please describe the event briefly and explain why you consider it hindering:

_____

_____

_____

Research information:

Researcher

Mr AW Malan
[redacted]

Research Supervisors

Mr ID Bosman
[redacted]

Prof. TJD Bothma
[redacted]

Appendix B: Change Interview Question List

Change Interview

Note:

- The interview will be semi-structured with the questions listed below.
- The interview will only be conducted once with the facilitator that facilitated all the sessions.
- The interview will take place in the SHIP® facilitator's office and the audio of the interview will be recorded.
- Refreshments will be given to the facilitator and researcher before the interview commences.
- Information regarding the helpful aspects of the two treatments will be gathered from the HAT forms filled in by the facilitator after each session to assist in the interview and to help guide it to uncover new information and to compare the two treatments effectively.

Instructions to be read to the interviewee before the interview starts:

Just to reiterate, we are interested in the overall experience of each of the treatment methods and which aspects of each lead to your experience. The focus is on comparing the helpful and hindering aspects of both treatments to determine the viability of utilising a virtual environment in the context of the SHIP® process. There are no incorrect answers during this interview. The only correct answers are your experiences of each treatment based on your professional opinion as a trained SHIP® therapist.

Section A: General experience

Question 1

The HAT forms you filled in for the standard induction indicated that you experienced the sessions as X*. Can you please explain this overall experience of the standard induction?

**x will refer to the overall perceived usefulness of the standard induction as indicated on the HAT forms Likert scale*

Question 2

The HAT forms also indicated that you experienced the VR induction sessions as Y*. Can you please explain this overall experience of the VR induction?

**y will refer to the overall perceived usefulness of the VR induction as indicated on the HAT forms Likert scale*

Section B: Attributions

Question 3

What events occurred during the standard induction sessions that attributed to this overall experience?

Question 4

What events occurred during the VR induction sessions that attributed to your overall experience of the VR sessions?

Section C: Helpful aspects

Question 5

What were the most helpful aspects of the standard induction? Why were they helpful?

Question 6

What were the most helpful aspects of the VR induction? Why were they helpful?

Section D: Hindering aspects or lacking aspects

Question 7

What were the most hindering aspects of the standard induction, or did you find any aspects missing during the standard induction?

Question 8
What were the most hindering aspects of the VR induction, or did you find any aspects missing during the VR induction?

Question 9
What aspects of the standard induction made the process more difficult, but that you still perceived as helpful or "OK"?

Question 10
What aspects of the VR induction made the process more difficult, but that you still perceived as helpful or "OK"?

Section E: Immersion, presence, and level of descriptive detail
Question 11
What differences did you experience between the standard and VR induction in terms of the level of immersion of the participants?

Question 12
During which treatment do you think the participants were more involved/engaged with the imagined/simulated stimuli during the sessions?

Question 13
What aspects of the chosen treatment at Q12 do you think contributed to this?

Question 14
On a scale of 1 to 10, how well did the participants describe their emotional or physiological responses experienced during the standard induction? Please explain your answer.

Question 15
On a scale of 1 to 10, how well did the participants describe their emotional or physiological responses experienced during the VR induction? Please explain your answer.

Section F: Effects on the induction of memories

Question 16

What effect on the induction of unique memories did the standard induction have on participants?

Question 17

What effect on the induction of unique memories did the VR induction have on participants?

Section G: Final thoughts

Question 18

Do you have any suggestions regarding the research or the VR treatment as to how to improve it?

a.) Research:
   i. The participant sessions.
   ii. The virtual environment.
   iii. The sample size and recruitment criteria.

b.) The VR induction:

Question 19

In your professional opinion, how successful do you think the VR induction is compared to the standard induction?

Question 20

Is there anything else that you would like to add?

Appendix C: Initial Group Consent Form

Informed consent form: Initial group
Note: This consent form will be handed out to the initial sample of at least 40 participants. This consent form explains the initial selection test and asks the participants' consent to take part in this test. Whether or not a participant gets recruited for the remainder of the study depends on the outcome of this initial selection test.

Note: For a detailed description of the project please refer to the consent form cover letter.

1. Project information

1.1. Title of research project: The PENSIEVE – Psychological quasi-Experimental Neural Study of Induction Efficacy of Virtual Environments.

1.2. Researcher details:
- Mr. Adolf Weich Malan
- Information Science Department
- Contact Number: [redacted]
- Email Address: [redacted]

1.3. Supervisors' details:
- Prof. TJD Bothma - Student's Supervisor
- Information Science Department
- Email: [redacted]
- Contact number: [redacted]
- Mr. ID Bosman – Co-supervisor
- Information Science Department
- Email: [redacted]
- Contact number: [redacted]

1.4. Research study description: The purpose of this study is to examine whether a simulated virtual environment has the potential to stimulate and enhance the image-creative neural-visual facility of participants by simulating propositional images based on the SHIP® Frame. Participants will be required to undertake a single SHIP® session with a trained SHIP® facilitator, during which participants will be tasked with imagining and describing the requested visual stimuli in as much detail as possible, utilising all your senses.

2. Informed consent

2.1. I, _____hereby confirm that I have read and understand the information provided in the cover letter for the study as mentioned. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. I voluntarily agree to participate in the study as explained.

2.2. The nature of the study as well as its goal, possible safety and health implications have been explained to me and I understand them.

2.3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. All information gathered and data obtained will be handled confidentially. I understand that notes taken during my session may be looked at by the facilitator and used to determine whether I will take further part in the study. I give permission for the facilitator to do so.

2.4. Upon signature of this form, the participant will be provided with a copy.

Signed:	_____	Date:	_____
Witness:	_____	Date:	_____
Researcher:	_____	Date:	_____

Appendix D: Low LIP Group Consent Form

Informed consent form: Low-LIP group

Note: This form will be given to the sample of at least 20 participants that were determined to best fit the criteria required for the remainder of the study. The remainder of the initial group of at least 40 participants will not partake any further in this study.

Note: For a detailed description of the project please refer to the consent form cover letter.

Based on your experience in the initial session, you have been selected to participate in the remainder of this study.

1. Project information

1.1. Title of research project: The PENSIEVE - Psychological quasi-Experimental Neural Study of Induction Efficacy of Virtual Environments.

1.2. Researcher details:

- Mr. Adolf Weich Malan
- Information Science Department
- Contact Number: [redacted]
- Email Address: [redacted]

1.3. Supervisors' details:

- Prof. TJD Bothma - Student's Supervisor
- Information Science Department
- Email: [redacted]
- Contact number: [redacted]
- Mr. ID Bosman – Co-supervisor
- Information Science Department
- Email: [redacted]
- Contact number: [redacted]

1.4. Research study description: The purpose of this study is to examine whether a simulated virtual environment has the potential to stimulate and enhance the image-creative neural-visual facility of participants by simulating propositional images based on the SHIP® Frame. Participants will be divided into either one of two research groups: standard or VR. The standard group will undergo a traditional SHIP® session where they will be asked to lie on a bed with their eyes closed and visualise specific images, whereas the VR group will be asked to wear a head-mounted display and will not be tasked to imagine any images. It must be noted that the participants of the VR group might experience some virtual reality induced side effects, and that participants of both groups might experience some physiological or psychological responses to the SHIP® treatment. Precautions have been put in place to avoid this and to refer participants to qualified therapists in the event of the imagery triggering a response that the participant finds uncomfortable in any way.

2. Informed consent

2.1. I, _____hereby confirm that I have read and understand the information provided in the cover letter for the study as mentioned. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. I voluntarily agree to participate in the study as explained.

2.2. The nature of the study as well as its goal, possible safety and health implications have been explained to me and I understand them.

2.3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. All information gathered and data obtained will be handled confidentially. I understand that notes taken during my session may be looked at by the facilitator and used to determine whether I will take further part in the study. I am aware that the data and results from this study are gathered with the intent to be published.

2.4. I hereby agree to my session's audio being recorded. I am also aware that my identity will be kept anonymous with no information being recorded that might be able to identify me.

2.5. Upon signature of this form, the participant will be provided with a copy.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

Appendix E: Helpful Aspects of Therapy Form (Elliott 2008)

HELPFUL ASPECTS OF THERAPY FORM (H.A.T.)
(Version 3.2; 05/2008)

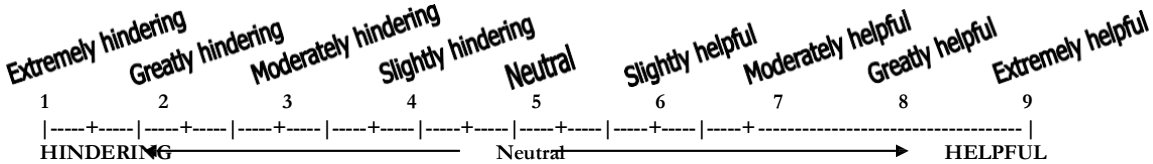
Therapist _____ Client ID _____

Date _____ Session _____

1. Of the events which occurred in this session, which one do you feel was the most **important** or **helpful** for you personally? (By "event" we mean something that happened in the session. It might be something you said or did, or something your therapist or counsellor said or did.)

2. Please describe what made this event important/helpful and what you got out of it.

3. How **helpful or hindering** was this particular **event**? Rate it on the following scale.
(Put an "X" at the appropriate point; half-point ratings are OK; e.g., 7.5.)



4. About where in the session did this event occur?

5. About how long did the event last?

Please turn over

6. Did anything else particularly **helpful** happen during this session? **YES NO**

(a. If yes, please rate how **helpful** this event was:

Slightly ☐ 6 Moderately ☐ 7 Greatly ☐ 8 Extremely ☐ 9

(b. Please describe the event briefly:

7. Did anything happen during the session which might have been **hindering**? **YES NO**

(a. If yes, please rate how **hindering** the event was:

Slightly ☐ 4 Moderately ☐ 3 Greatly ☐ 2 Extremely ☐ 1

(b. Please describe this event briefly:

Appendix F: Ethics approval for data collection (EBIT)

Deputy Dean of Research and Postgraduate Studies Preliminary Approval

04 March 2022

Mr AW Malan
Department of Information
Science Faculty of EBIT
University of Pretoria

Dear Mr AW Malan

PERMISSION FROM DEAN'S OFFICE FOR RESEARCH PROJECT EBIT/30/2022

The letter serves to confirm that I am supportive of the following Masters research project:

THE PENSIEVE: PSYCHOLOGICAL QUASI-EXPERIMENTAL NEURAL STUDY OF INDUCTION EFFICACY OF VIRTUAL ENVIRONMENTS

I have no objection to the research team requesting the staff/students from the Faculty of Engineering, Built Environment and Information Technology to participate in this research project, **subject to ethics approval by the Faculty of EBIT Research Ethics Committee and the Registrar**.

Kind regards

Professor J Joubert
Acting Deputy Dean: Research and Postgraduate Studies
Faculty of Engineering, Built Environment and Information Technology

Appendix G: Ethics approval for data collection (FHS)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0278 Approved for use through August 31, 2023.

Faculty of Health Sciences **Research Ethics Committee**

15 June 2022

Endorsement Notice

Dear Mr AW Malan

Ethics Reference No: EBIT/30/2022
Title: The Pensieve: Psychological quasi-experimental neural study of induction efficacy of virtual environments

The **New Application** as supported by documents received between 2022-04-25 and 2022-06-15 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-06-15 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2023-06-15.
- Please remember to use your protocol number (EBIT/30/2022) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers
MBChB, MMed (Int), MPharmMed, PhD
Deputy Chairperson *of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria*

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health).

Research Ethics Committee
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Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo