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Research Article

An investigation into the feasibility of using virtual environments as an induction method in SHIP® therapy

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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. SHIP® is a form of psychotherapy that suggests that spontaneous healing is a natural tendency that emerges from within a person. It identifies certain activator images as essential pathways for accessing unconscious trauma material that needs healing. The purpose of this study was to examine whether virtual reality can be used as a medium to induce memories through the utilisation of neutral images based on the SHIP® Frame. Two groups of participants were gathered: one group underwent a traditional SHIP® session while the other group underwent the virtual induction with the aid of a head mounted display. A random clinical trial was used to determine the level of induction and identify the helpful aspects that contributed to the induction. The results indicated that virtual reality was able to assist as a cognitive stimulus as well as a cognitive proxy in the overall process of SHIP®.

Keywords virtual reality, psychotherapy, exposure therapy, virtual environment, SHIP®

Categories • **Human-centred computing** ∼ **Human computer interaction** • *Applied computing* ∼ *Life and medical sciences*

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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) (Bryant et al., 2019; Levinson et al., 2020; Steenkamp, 2018). 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; Steenkamp, 2018). Virtual reality (VR) could provide a solution to this problem by helping a patient see the requested stimuli.

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VR has already contributed to the successful treatment of psychotherapeutic patients when used in tandem with exposure therapy (Donker et al., 2019; Hodges et al., 1995). This success can be partly attributed to VR's ability to simulate virtual environments (VEs) within which to immerse patients (Vienne et al., 2020). This enables the user to feel present or have the sense of 'being there' (Høeg et al., 2021; Riva, 2022) which makes it a useful tool for psychotherapy, particularly in exposure-based treatments (Albakri et al., 2022; Wilson & Soranzo, 2015). However, exposure therapy and, by extension, virtual reality exposure therapy (VRET) are both based on systematic desensitisation therapy (Markowitz & Fanselow, 2020) and many post-traumatic stress disorder (PTSD) patients still do not benefit from it (Foa & Mclean, 2015; Markowitz & Fanselow, 2020). Another PTSD treatment method, SHIP®, differs from this approach and attempts to heal the client through completing a frozen traumatic memory (Steenkamp, 2018).

In the realm of VR as a psychotherapeutic tool, research tends to focus on VR exposure therapy and not on other forms of treatment. Through a random clinical trial (RCT) (Hariton & Locascio, 2018) this study attempteds to address this by investigating the efficacy of VR induction as a medium for facilitating the SHIP® process. By comparing two groups, where one underwent a standard SHIP® intervention and the other a VR intervention, data were collected and analysed to determine if the VR intervention was as assistive to the overall SHIP® process as the standard intervention. The analysis of the data was used to answer one main research question:

> *How can a simulated virtual environment 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 in SHIP®?*

The remainder of this paper answers the above research question through literature and empirical data to determine whether VR can be used in tandem with SHIP® to assist clients who have difficulty with imagining requested visual stimuli.

2 REVIEW OF LITERATURE

VR aims to create environments and situations that resemble reality or any fictitious reality (Albakri et al., 2022) and generate an experience that is immersive and that feels as engaging as reality when an individual is placed within it (Garrett et al., 2018). A VR experience can be understood with reference to Sherman and Craig's (2003) four main factors of a VR experience, with the addition of Muhanna's (2015) fifth, and are as follows:

1. Virtual world: The environment simulated through computer software (Albakri et al., 2022).
2. Sensory feedback: Input and output devices such as headphones and controllers (de Regt et al., 2020).

3. Interactivity: Having the ability to change a virtual world through manipulating it, such as picking up objects or turning them around (Muhanna, 2015; Sherman & Craig, 2003).
4. Participants: Having at least one person being present in the virtual environment and experiencing it (Muhanna, 2015).
5. Immersion: An objective account of its ability to simulate reality with high levels of fidelity (Wilson & Soranzo, 2015).

Because of the importance of immersion and how it is often confused with presence, it will be discussed in the next section in more detail.

2.1 Immersion and presence

When VR is able to supplant a user's senses with the sensory stimuli of a simulated world and metaphorically remove users from the real world, the VR is considered to be immersive (Riva, 2022). Immersion within a virtual world has been described in several ways, including system immersion (Lønne et al., 2023), mental immersion, physical immersion (Albakri et al., 2022; Sherman & Craig, 2003), and narrative immersion (Nilsson et al., 2016). Immersion can be quantified to a large extent and altered with regards to the level to which a user can explore the virtual world, how realistic it appears, and more technical aspects such as graphic frame rate (Kelly et al., 2023). Presence, on the other hand, comes from the degree to which an individual can respond naturally to the VE (Kober et al., 2012; Slater et al., 2009; Wilson & Soranzo, 2015) and makes the user feel like they are "there" in reality (Albakri et al., 2022; Botella et al., 2017; Wilson & Soranzo, 2015). The psychological response of a user to a simulated environment can be seen as the perceived presence by the user (Kelly et al., 2023; Slater et al., 2009; Wilson & Soranzo, 2015) and differs from immersion (Slater et al., 2009). In other words, depending on the user's specific 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). If a user is self-aware within a VE and able to respond and manipulate their surroundings, they should be considered to be highly present within the VE (Kelly et al., 2023). Although immersion and presence differ from one another, a recent study suggests that immersive VR was more successful in instilling a sense of presence within learners than desktop VR because the participants felt as if they were *"actually there"* in the VE (Lønne et al., 2023).

VR generates a simulated environment within which a user can explore and interact as if it were the real world, forecasting the sensory inputs and experiences one might receive in reality (Riva et al., 2019). This is similar to predictive coding, a popular framework for comprehending how messages are passed around in our brains (Friston, 2012). The feeling of presence or "being there" is the characteristic that separates VR from other traditional media (Garrett et al., 2018; Høeg et al., 2021; Riva, 2022; Rizzo et al., 2015) and can help psychology in many different ways such as exposing a veteran who suffers from PTSD to a traumatic event in a safe and controlled environment (Albakri et al., 2022; Friedrich, 2016).

2.2 Virtual reality exposure therapy (VRET)

Exposure therapy, which is a particular form of cognitive behavioural therapy (CBT), is a psychotherapeutic treatment that has been proven to be effective in the treatment of various psychological disorders (Levinson et al., 2020; Olatunji et al., 2010; Opriş et al., 2012) and PTSD (Bryant et al., 2019). Exposure therapy focuses on changing pathological fear structures by repeatedly confronting the patient with the stimuli that trigger these fear structures and incorporating information that goes directly against the pathological elements inside the fear structure (Rauch & Foa, 2006). This is achieved either through real-life in vivo exposure, where the patient is immersed in real life within the environment that first caused the trauma (if possible), or imaginal exposure, where a patient imagines the events where fear and trauma are experienced (Friedrich, 2016). There are some shortfalls to exposure therapy (Beidel et al., 2019) such as some patients having difficulty with the process of imagining traumatic events (Friedrich, 2016) which motivates other approaches such as virtual reality exposure therapy (VRET) where the feared stimuli are generated through moving imagery, sounds, and sometimes through simulating other senses such as smell within VR (Eshuis et al., 2021). VRET offers an alternative to traditional exposure therapy, and has shown greater success in treating patients with PTSD who did not respond to prior therapies (Volovik et al., 2023).

VRET systems have been as successful as in vivo therapy in the treatment of various phobias (Donker et al., 2019; Suied et al., 2013), and PTSD in veterans of war (Volovik et al., 2023) or survivors of the World Trade Centre attacks in 2001 (Beidel et al., 2019; Friedrich, 2016). More novel interventions have also shown promise in treating PTSD in UK military veterans through multi-modular motion-assisted memory desensitisation and reconsolidation therapy (3MDR) (Hannigan et al., 2023). Where previous research has investigated the use of VR with the treatment of PTSD in war veterans such as the *Bravemind* system (Friedrich, 2016), more recent investigations have also attempted to enhance such systems with the introduction of smells (Freedman et al., 2024), and noninvasive electrical cranial stimulation (van't Wout-Frank et al., 2024).

The main problem with exposure therapy and, by extension, VRET, is that 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 responding with the taught relaxation techniques (Davison, 1968; Markowitz & Fanselow, 2020). The treatment targets only the symptoms (Olatunji et al., 2010) or the elements of the trauma that are directly connected to it (Markowitz & Fanselow, 2020) and not the fundamental cause of the disorder. The efficacy of VRET thus falters because of the context within which the exposure takes place, i.e., the therapist's office, and could lead to returning fear reactions when facing the feared stimuli in a different setting (Markowitz & Fanselow, 2020). Other phobias such as social phobias also don't respond well to exposure therapy, because it assumes in most cases that the only cause of phobias is learning through association (Davison, 1968; McLeod, 2024).

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2.3 Spontaneous Healing Intra-systemic Process

Spontaneous Healing Intra-systemic Process (SHIP®) is a psychotherapy for the healing of the above-mentioned pathological fear structures or, as referred to in SHIP®, for trauma-spectrum manifestations (TSMs) (Steenkamp, 2018). TSM is an integrated SHIP® diagnosis related to trauma (Steenkamp, 2018), which encompasses manifestations such as PTSD (Steenkamp, 2018). SHIP® concerns itself with generating awareness of internal processes within a client to facilitate change by validating those processes (Hoffman & Steyn, 2010). The role of the psychotherapist is thus to facilitate this internal spontaneous healing dialogue for it to 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 (Steenkamp, 2018).

Trauma does not disappear and can resurface because of trauma-activating associations which 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). SHRs are psychobiological responses that are seen as 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 (Steenkamp, 2018). Through trauma-unfreezing, the healing and integration of trauma-material can begin to help an individual to effectively regulate their autonomic responses to the external world (Steenkamp, 2018). The healing and the integration of trauma material have been experientially proven to result in flow and the reciprocal relief from TSM (Steenkamp, 2018).

The key differences between exposure therapy and SHIP® are what motivate this research. VRET leads to unsuccessful treatment in some cases because of its approach to treatment (as discussed in Section 2.2). SHIP®, however, does not aim to habituate the client to the trauma-associative triggers, but rather to allow the trauma to become unstuck and complete its natural process (Steenkamp, 2018). The similarities between exposure therapy and SHIP® motivate investigation into whether VR can be used alongside SHIP® to assist those who do not benefit from VRET.

3 THE SHIP® FRAME: THE DOOR

During the process of SHIP®, the facilitator can select appropriate trauma-activating associations, or activators, to induce opening of the trauma memory and subsequent motion completion/healing thereof (Steenkamp, 2018). The SHIP® Frame consists of a variety of inductively-derived images and contains a wealth of associative information relating to trauma-material, awhich isnd are used primarily used as an associative activators (Steenkamp, 2010). The SHIP® Frame is a medium to transport clients to their internal process of spontaneous healing and makes the process of psychotherapy faster (Steenkamp, 2010). One such image is known

as *"the door"*, which involves a client being asked to lie on a bed with their eyes closed and tasked with imagining a door with different words written on it such as the words *"Emotions"* or *"Identity"* (Steenkamp, 2010). This door image is used most frequently and the words written on the door can be substituted with any word that might help them reconnect with the disconnected emotions (Steenkamp, 2010). The client should experience all the emotions and sensations the image evokes, as well as any and all associations, whether it be from the past, present or future must also be identified and acknowledged (Steenkamp, 2010). In doing so, the imagined environment soon corrects itself in a way that the client can experience it in a positive light (Steenkamp, 2010). However, in some cases the client is unable to visualise the images requested during the phases (Steenkamp, 2010) which means that the feelings that were denied expression by the trauma-activating event are kept from completion leading to unsuccessful or ineffective treatment (Steenkamp, 2018). A simulated environment could thus be used as a tool for igniting subsequent layers of spontaneous healing when clients keep struggling to visualise the requested associative images.

3.1 Designing a VR system to assist in the SHIP® process

The first objective of a VR system to assist in the SHIP® process would be to successfully immerse a user into a VE and control the simulated environment remotely. VRET systems such as the *Bravemind* system (Friedrich, 2016), immerse patients into a controlled, simulated environment through the use of a head-mounted display (HMD) to expose them to their trauma. Because SHIP® relies on the visualisation of images from the SHIP® Frame (Kieser-Muller, 2016), a SHIP® VR system would also be able to utilise an HMD to immerse the client within a VE where the required stimuli can effectively be simulated. A simple, user-friendly interface similar to the sandbox-type public speaking anxiety treatment system (Lindner et al., 2021) would also allow a psychotherapist to control this VE remotely. The door image, as discussed above, can be a predefined scenario such as those designed for the Iraq/Afghanistan system (Rizzo et al., 2015).

Such a VR system would then have to successfully induce physiological and psychological responses from the user. Both SHIP® and VRET use visual associative triggers within a simulated/imagined environment to serve as disrupting activators in order to induce activation of the trauma state of dissociation of the client (Steenkamp, 2018). VRET systems such as the system for the treatment of acrophobia (Nabukenya et al., 2021) exposed users to disrupting activators, i.e., various height scenarios, to treat their fear of heights. For a SHIP® VR system to successfully induce such activation as mentioned above, images that fall under the client's current phase in the SHIP® Frame need to be simulated. For example, simulating something unique to the user on the door, such as their name, could successfully induce activation of frozen trauma (Steenkamp, 2010, 2018).

For a SHIP® VR system it is not enough to simply trigger certain experiences of the client, but the VE should also disrupt the existing TSMs. Various VRET systems are able to disrupt fear structures effectively and even change or replace them (da Costa et al., 2018; Gromer et al.,

2018). These disruptions have led to responses such as increased heart rate, and self-described discomfort (da Costa et al., 2018), suggesting that the existing fear structures were triggered. With one VRET system these symptoms became less severe as they progressed through more sessions suggesting that the fear structures were also altered so that the experienced anxiety became less severe (da Costa et al., 2018). Responses such as the ones described above are similar to SHRs experienced by clients as they undergo emotional processing during SHIP® sessions (as discussed in Section 2.3). This suggests that a similar VR system might be able to trigger the trauma to induce SHRs to "unfreeze" the trauma within the SHIP® process.

Because both SHIP® and exposure therapy rely on an individual's ability to imagine the necessary stimuli, it is reasonable to assume that SHIP® could share other limitations with exposure therapy. VR has been used in tandem with exposure therapy to effectively overcome some of these limitations, therefore this study set out to investigate whether VR can also assist in overcoming similar limitations in SHIP®.

4 RESEARCH METHODOLOGY

To determine the induction efficacy of VR within the process of SHIP®, a RCT design (Hariton & Locascio, 2018; Thiese, 2014) was followed with data gathered of each group's respective experiences through observation, giving this study a qualitative method approach (Pickard, 2013). A total of 28 Participants participants were randomly divided into two groups of 14 participants each, with one group receiving the VR SHIP® intervention and a Control group receiving the standard SHIP® intervention (Machin et al., 2021) and is, as discussed in detail in Section 4.1.

A SHIP® psychotherapist was recruited as facilitator to guide the participants through their sessions using their in-depth SHIP® training in the field of image activation in SHIP® clients. The facilitator was best suited to observe the participant responses during the sessions and in the unlikely event that the participant had an adverse reaction to the stimuli, the facilitator was capable of guiding the participant away from the stimuli and could assist the participant by referring them to the appropriate professional.

4.1 Participants

Purposive sampling was used to gather participants and was implemented twice: once for the initial group of participants, and again to select the low level of imaginative potential group from the initial group. For the initial group, the participants had to adhere to the following criteria to be considered:

1. no prior knowledge of SHIP®,
2. no history of undergoing SHIP®, and
3. no prior trauma or mental disorders.

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This sample was used to reduce the differences between the participants to ensure that the data were more significant (Hariton & Locascio, 2018; Thiese, 2014) and to exclude any potential participants who might experience adverse reactions during their sessions. All participants provided their informed consent before the commencement of the study and the study was approved by the institutional ethics review committee (protocol number: EBIT/30/2022). Clearance was not granted to collect demographic information such as gender and age.

The desired population consisted of participants who exhibited the lowest level of imaginative potential of the initial group, i.e., individuals who struggled to imagine requested stimuli the most. To determine the imaginative potential for each of the participants, an imagination exercise was developed and administered by the facilitator for this specific study using their in-depth knowledge of SHIP®. Because this method was designed specifically for this study, no benchmark existed for what was to be considered a low imaginative potential score. Therefore the facilitator and researcher decided to recruit the 20 participants from the initial group with the lowest levels of imaginative potential for the remainder of the study. During the imagination exercise, each participant was given a score out of 10 for three different criteria deemed necessary by the facilitator to be viable SHIP® candidates:

1. level of engagement,
2. level of authenticity, and
3. level of consistency.

In total, 28 individuals took part in the preliminary imagination exercise. The overall process of the imagination exercise administered to the initial group by the facilitator can be seen in Appendix A. Some of the participants were uncomfortable with lying down flat on the air mattress provided, therefore, the participants were given the option to either lie down on the air mattress flat, sit on the air mattress with their backs against the wall, or sit in the office chair opposite the facilitator. They were also allowed to keep their eyes open during the exercise if they preferred it. This allowed for the participants to feel more in control of the session to encourage higher engagement with the SHIP® activities.

Six participants from the initial group were excluded from consideration to take further part in the study. These exclusions were as a result of previous exposure to SHIP®, unavailability during the designated time frame for the RCT, or exhibiting signs of past or present trauma. Thus, 22 participants were considered for the remainder of the study. The 20 participants who exhibited the lowest levels of visualisation capability were randomly divided up into two groups, namely a ‘standard’ group – who partook in a standard SHIP® session – and a ‘VR’ group – who partook in a VR SHIP® session. The randomisation of the groups was repeated until the mean level of the imaginative potential ratings of the groups were within an acceptable threshold of each other, to ensure that no known difference between the groups existed except for the intervention itself (Thiese, 2014). These groups can be seen in Table 1:

Table 1: The final group divided into two groups based on level of imaginative potential (LIP) rating

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**

4.2 Materials

The PENSIEVE prototype, designed and developed for this study, consisted of a Meta Quest 2 HMD which ran a VR application using Unreal Engine 4 (UE4) via a Windows PC and was controlled using a simple graphical user interface (GUI) as shown in Figure 1.

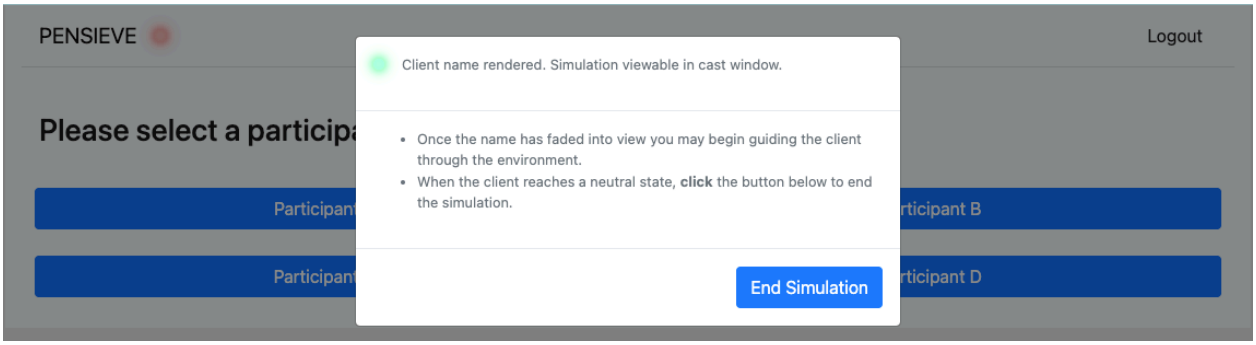

Figure 1: GUI used by the facilitator to start and end the simulation

The facilitator would click on a participant's name via the GUI, and control the VE through a series of prompts, culminating in the door with the participant's name on it fading from view and into black.

The VE was designed using a VR template and starter content, i.e., a door 3D model, provided by UE4. The application was passive (Vergara et al., 2017) in nature and did not allow for any interaction with the simulated world and did not include audio output.

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The main structure of the VE consisted of four walls, a ceiling and a floor that were differentiated through different materials. The main goal of the VE was to instil a high level of presence so as to have the participant respond naturally to it. This was achieved by simulating a realistic 3D model of a door with the participant's name rendered on it and can be seen in Figure 2.

Figure 2: Realistic 3D door with primary investigator's name rendered in large letters

4.3 Procedure

Data were collected via the following procedure: each participant in the initial group was given a written consent form to sign, denoting the potential risks associated with the imagination exercise. The final 20 participants for the RCT trial were recruited after the imagination exercise was given to the initial group. They were given another consent form to sign also explaining the potential risks, and gave permission for the recording of various data throughout the RCT. The participants were informed about the main goal of the RCT. It is important to note that no form of psychotherapeutic treatment was administered to any of the participants.

For the sessions, only a single image out of the SHIP® frame was chosen, namely the door image with the participant's name either imagined or simulated on it. Other images in the SHIP® Frame were considered to be too ambiguous and might not trigger unique experiences within every participant. The general process followed by the facilitator during the sessions once the participant was seated or lying down was as follows:

1. The facilitator asked them to close their eyes and imagine a door.

2. They were then asked if they could see the door, or the door was faded into view. They were then asked if they were able to identify any experienced emotions.
3. The facilitator then requested that they imagine their name on the door or rendered a simulation of their name on the door – again the facilitator asked if they were able to identify any specific emotion.
4. If they were able to identify an emotion, they were asked where in their bodies they felt it.
5. If they were able to pinpoint the feeling, they were tasked with focusing on that specific feeling.
6. During this the facilitator would periodically ask what thoughts, memories, or sensations they became aware of.
7. If they were unable to identify any emotions or sensations, they were asked to just keep focusing on the visualised door or the simulation.

Sessions tended to last between 20 to 30 minutes and varied between participants.

The VR group sessions followed the same process as the Control group's session differing only with regards to the door simulation fading in from black once asked to imagine a door, and fading in the participant's name on the door once asked to imagine their name on the door. The rest of the process as outlined above was then followed.

During each participant's session the facilitator would observe all the responses to fill in a helpful aspects of therapy form (HAT). This questionnaire typically consists of seven open-ended questions given to the client after a therapy session (Elliott, 2002, 2008) and was used, with incorporated VR terminology, to identify assistive or hindering events to the SHIP® process that occurred during therapy sessions. The HAT form used for each session can be found in Appendix B.

A month after the RCT sessions were completed, the first author conducted a semi-structured interview with the facilitator, henceforth referred to as the change interview. A month was chosen to allow the researcher to examine all the HAT forms and transcribe all the audio recordings of the sessions prior to the change interview. The purpose of this interview was to gather insights about the assistive or hindering events observed, what led to these events, and what characteristics were considered to be helpful or hindering (Elliott, 2002). The question list used during the change interview can be found in Appendix C.

The collected data were analysed using thematic analysis by repeatedly going through the collected data, familiarisation with it, generating initial codes, and searching and reviewing recurring themes that appear within the data (Kiger & Varpio, 2020; Nowell et al., 2017; Terry et al., 2017). The full details of how the data were collected and analysed can be found at (Malan, 2024).

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5 RESULTS

Within both the control group and the VR group it was observed that all of the participants experienced some form of emotional, physical, or mental response towards the imagined/simulated stimuli. The emotional responses ranged from feelings of euphoria and empowerment to anxiety and fear, the physical responses included sensations felt in the chest, shoulders, hands, and head, and the mental responses included unique memories and thoughts as well as other unique sensory experiences such as sound. Each participant was kept anonymous and denoted with a letter corresponding to their group and a number. For example C01 refers to the first participant in the control group. Some of the most notable responses of the two groups are illustrated in Tables 2 and 3.

Table 2: Notable responses from Control group

Participant	Response	Quote
Emotional Responses		
C02	Euphoria	*"I guess happy or excited, this particular door's from when I was on holiday, so it was an exciting time"*
C09	Fear	*"I think one thought that comes to mind is, like, unsure and scared to open the door"*
Mental Responses		
C02	Memories	*"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"*
C01	Sensory	*"Hearing crackling sounds of the wood"*
Physical Responses		
C01	Chest: comfort	*"You know, just sort of like in the chest area"*
C08	Hands: fear	*"It's almost more in the hands now"*

Table 3: Notable responses from VR group

Participant	Response	Quote
Emotional Responses		
V09	Euphoria	*"joy"*
V05	Fear	*"fear, uncertainty. I'm too hesitant. Cautious, worried that it might make it worse"*
Mental Responses		
V07	Memories	*"My dad passed away, like, two years ago …"*
V04	Sensory	*"I think of, like, the sounds that you hear, like the birds, but also of the mosquitoes, I was thinking of the itching now"*
Physical Responses		
V10	Shoulders: unease	*"I think in my shoulders and in my chest"*
V02	Arms: empowered	*"In my chest, and my upper arms"*

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It is important to note that even if a participant was able to identify specific emotions, or physical sensations, or experience unique mental responses, it does not necessarily imply an effective SHIP® session. To determine which responses were assistive to the overall process of SHIP® and which ones were hindering, thematic analysis was applied to the HAT forms as well as to the data gathered from the change interview. With regards to the HAT forms, the facilitator scored each session according to the following guidelines:

- 1–4 was considered to be not a useful session at all.
- 5–7 was considered to be a neutral session that didn't advance nor hindered the process of SHIP®.
- 8–10 was considered to be an extremely useful session to the process of SHIP®.

The results of the HAT forms are illustrated in Table 4.

Table 4: 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**

Table 4 illustrates that the facilitator experienced both treatment methods as being assistive to the overall process of SHIP® with no one method clearly perceived as superior by the facilitator. However, the HAT scores also provide insight into the individual experiences had by 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.

5.1 Assistive aspects of VR

The assistive events observed by the facilitator were categorised into two main categories, i.e., induced responses and VR attributes. Induced responses included all the responses directly

associated with the assistive events and were categorised as emotional, physical, and mental responses. Attributes of the VR system that were directly associated with assistive events were categorised as simulation and headset. The 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 3

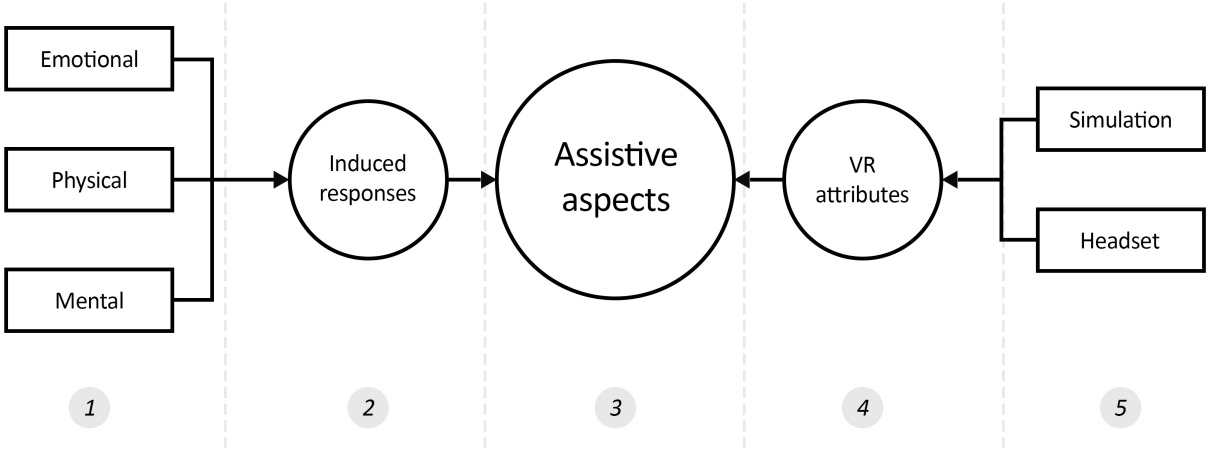

Figure 3: Assistive aspects of the VR group

In the sessions of participants V05, V07, and V09, emotional processing (or disruption as discussed in Section 3.1) took place because the initial emotion that was experienced gradually changed or faded as the session progressed. In the case of participant V05, the facilitator noted 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"*.

Participant V09 *"had a limited experience …"* during their imagination exercise, however during their SHIP® session they *"had a significantly richer and deeper experience"*. The facilitator explained that *"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"*. Within the HAT form, the facilitator stated the following: *"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 …"*. The facilitator explained this visual stimulation during the change interview as being one of the most helpful aspects of the VR group sessions and that it allowed the VR to function as a tool that led to deeper engagement and an enhanced experience

During the imagination exercise of participant C03, the facilitator noted that their description was *"authentic"* and *"detailed"*, although *"rather to the point"* meaning that they *"[might] not have a high visual processing ability"*. This participant received a high level of imaginative potential rating as their description was *"authentic"* and it allowed them to engage the SHIP® activities completely. However, during the Control group sessions, the facilitator noted that participant C03 was *"not expressive by nature"* and that this *"limits the SHIP® process because we*

can express deeply only if we allow ourselves to be vulnerable". Although an inexpressive nature is not directly linked to the success of a traditional SHIP® process, it is worth noting that an individual who is unable to effectively express themselves, as well as being unable to formulate more vivid visualisations, could lead to a very ineffective SHIP® session. Participant V08 was also inexpressive by nature and struggled with visualising the requested stimuli during the imagination exercise. Participant V08's HAT form reads: *"This participant could not visualise a door the first time, this time they could"* referring to the participant's VR SHIP® session. They were able to identify a physical sensation towards the end of their session noting that it *"Actually feels as if my hands and feet are getting numb"*. Participant V08 had a richer experience with the VR intervention than during the imagination exercise. The participant mentioned to the facilitator: *"… I'm not searching for an image, you have the image and you just focus on that"* and during the change interview the facilitator explained that VR *"cut out the physical world … and it forced your conscious mind to get immersed to be present in the virtual reality world … and then your energy becomes more concentrated on the task in front of you … going through all the SHIP processes basically"*. This is mainly because there was no need for the participant to focus their full concentration on imagining the requested stimuli, but only focus and engage with the SHIP® activities posed by the facilitator.

5.2 Hindering aspects

Similar to the assistive events that were discussed above, only the responses and/or attributes of the VR system that were identified to be directly associated with the hindering events, were categorised into induced responses and VR attributes. These categories in turn are what hinder the overall SHIP® process, making it less effective. The outcome of this process of identification and categorisation is illustrated in Figure 4. The main hindering aspects of the VR treatment method for SHIP®, in some cases, was that of the low fidelity of the VE, the point-of-view of the simulation, and the actual VR technology being a distraction for some participants.

Participant V02 noted during their session that *"when I open my eyes and I see this picture, it's, like, such a boring door …"* and agreed with the facilitator that when they closed their eyes, the door they were able to visualise was much more *"vibrant"*. The facilitator noted in the HAT form that the participant was *"often tempted to close their eyes"*. This event was only described as slightly hindering by the facilitator, but nonetheless the lack of a vibrant, more visually appealing simulation reduced the immersion levels, reducing presence, and could result in their responses to the SHIP® activities being less authentic and spontaneous. This could have led to less effective emotional processing.

Additionally, the actual VR hardware seemed to be a distraction in some cases. Throughout the session of participant V07, the weight of the headset started to loosen the straps and caused the headset to sag down on the participant's face. This resulted in the participant having to physically hold up the headset to see the simulation properly. Within the participant's HAT form the facilitator wrote the following: *"Participant preferred to sit up on a chair. The headset*

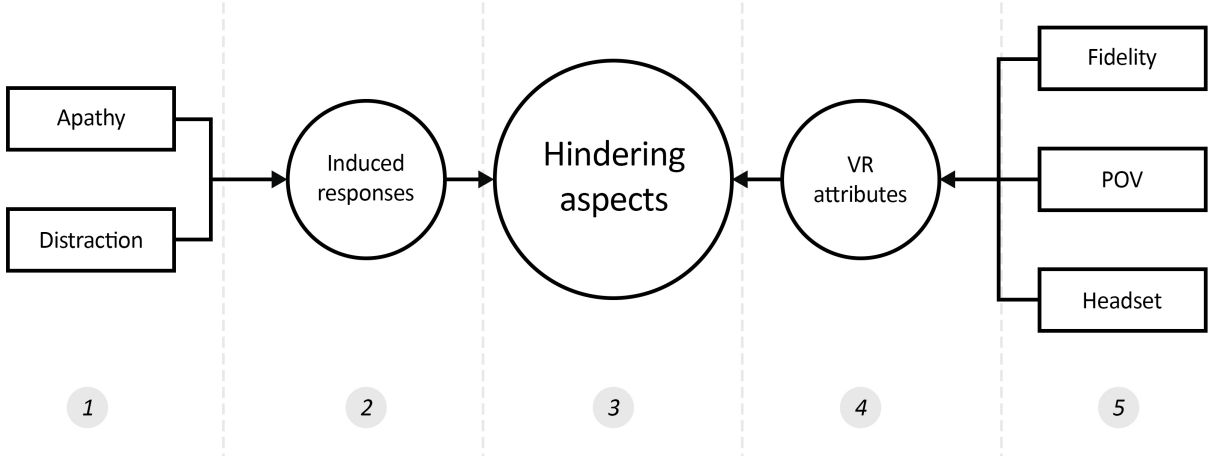

Figure 4: Hindering aspects of the VR group

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". Other distractions related to the VR technology that were noted by the facilitator included a power outage experienced by participant V04, the *"anxious anticipation"* towards VR technology in general by participant V10, and the point-of-view (POV) of participant V05 where they experienced the door as being skewed in the VE instead of upright.

During the change interview the facilitator explained that although the distractions were hindering, they weren't hindering to such an extent that it would completely nullify a SHIP® session. The facilitator said that in practice *"What I try to do with clients is identify the distractor … Whether it's a headset being too heavy that you need to prop up or it's unexpected and avoidable things … I think in real life as within VR you need to be prepared to cope with unexpected things because that is the nature of the human experience"*.

However, the most hindering aspect observed by the facilitator, on a psychological level, was considered to be the height of the air mattress the participants were asked to lie down or sit on. During the change interview the facilitator stated that: *"if you think of very caveman, fight-or-flight- type of thinking [sic], 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"*. With regards to the control group the facilitator noted that some participants *"feel a little bit self-conscious about lying there with their eyes closed … It's a vulnerable position"*. This hindering aspect was however not the case with the VR group according to the facilitator as the VR headset was effective at removing the participant from their immediate reality. VR's ability to 'cut-off' participants from the external world, was beneficial to the SHIP® process and is discussed in more detail in the following section.

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5.3 Immersion, presence, and engagement

The facilitator suggested that the VR group experienced higher levels of immersion, and felt that it was the VE simulated by the VR headset that contributed to this. They noted that they *"…found that the VR group was able to go a little bit deeper … that is accounted for by the additional brain stimulation that the VR headset provided"*. Thus, when considering the most hindering aspect noted by the facilitator across both groups, i.e. the height of the air mattress, it suggests that the hindering aspects of both groups were, in a sense, experienced more vividly by the Control group than the VR group. The VR group was able to escape those hindrances more effectively because of the visual simulation and the nature of the VR headset. Because of the physical nature of the HMD, it effectively *"cuts off"* the user's peripheral vision, removing them from their immediate surroundings.

One implication of 'removing the participant from the real world' was that it empowers an individual to become fully present in the VE. As discussed in Section 5.1, it allows one to focus all one's energy onto the task at hand, in this case the SHIP® activities. According to the facilitator, the VR headset and the simulation were the most helpful contributors 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"*. The facilitator also noted that *"reducing your consciousness to the VR world, I think that was helpful in enhancing presence"*. In Section 2.1, it was discussed that an individual's level of presence experienced comes from the degree to which they can respond naturally in virtual environments. It stands to reason then 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 leads to a greater feeling of *"being there"* within the simulated environment. In the context of SHIP® (as discussed in Section 3), this heightened sense of presence would allow the participants to respond more naturally to the SHIP® activities. 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. Thus, the more naturally a client can respond to their environment, the more authentic their responses are towards the SHIP® activities which could lead to successful emotional processing.

5.4 VR as therapeutic tool

According to the facilitator, both groups engaged the SHIP® activities to *"the best of their ability"* and that the level of engagement was good overall. This is largely due to the role of therapeutic alliance in psychotherapy. The facilitator said during the change interview that *"Therapy requires vulnerability, the therapeutic alliance facilitates the vulnerability … therapeutic alliance, you'll find that it's a massive contribution to absolutely any therapeutic process …"*. 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.

This therapeutic alliance existed between the facilitator and the participants in the VR group as well. For example, in the session with participant V01, the facilitator noted that the participant was *"very much at ease or safe during the session"* within the VE and therapeutic space. This feeling, in combination with the therapeutic alliance, led to the participant sharing *"personal information or thoughts and reflections"*. This therapeutic alliance could also have been enhanced by the physical nature of VR *"cutting off"* the external world. The facilitator elaborated that *"... they don't know what I'm seeing and it's not a shared experience, and that maybe allows them to feel a sense of, of psychological safety"*. The facilitator is alluding to the possibility that a client might experience images and thoughts that are private, and being removed from their immediate environment makes them feel as though their private thoughts stay private. Therapeutic alliance existed between the facilitator and the participants in the VR group similar to the control group, despite the added unfamiliarity of the VR technology.

During this section it was clearly outlined how the VR intervention was able to foster the same level of therapeutic alliance as the traditional SHIP® method. Section 5.2 revealed that the most hindering aspect of both methods was psychological in nature, but that the impact of this hindering aspect was lessened by the technological and physical characteristics of VR as examined in Section 5.1. Why these characteristics were able to reduce the impact was then explored in Section 5.3 and it was found that the physical nature of the HMD and the VE simulated were directly responsible for reducing the impact of the psychological hindrances. VR was thus able to overcome a psychological obstacle faced by the traditional SHIP® method. This, along with the proven induction efficacy of unique memories of the VR group as stated by the facilitator, namely *"the VR induction was able to allow us to stimulate very significant memories"* leads to the notion of VR potentially being used as a tool to assist the existing SHIP® process rather than shaping it.

6 LIMITATIONS

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 determineby making it difficult to determine which of the two intervention methods were more assistive to the overall SHIP® process. These limitations impacted the results as follows:

- *Small sample size*: the final group of 20 participants that took part in the RCT were recruited from a small initial group of 22 individuals. This prevented the researcher from recruiting only participants who truly had 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.

- *Simplistic imagination exercise*: the researcher determined that the oversimplified imagination exercise is what led to most of the participants obtaining high levels of imaginative potential scores. As a result the *"low"* level of imaginative potential group consisted mostly of participants who did not have trouble visualising the requested stimuli. This lessened the credibility of the results as we could not effectively measure an improvement between a participant's ability to visualise before and after the RCT.
- *Shallow SHIP® Frame*: the door image chosen for the current study is quite general, even with the addition of the participant's name on the door. Thus, it is this researcher's belief that a more personalised VE would have garnered even richer data.

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

7 CONCLUSION AND FUTURE WORK

This paper describes the PENSIEVE prototype, a software intervention that allowed a SHIP® facilitator to immerse participants into a VE to experience specific stimuli based on the SHIP® Frame. Qualitative data were gathered of participants' physiological and psychological responses to the imagined or simulated stimuli during a SHIP® session. The results of this study suggests that VR has the potential to stimulate and enhance the visualisation capabilities of the client or act as a proxy for a client's imagination. In other words, VR can aid participants who have difficulty visualising requested images and in doing so aid them in engaging with the SHIP® activities and successfully progressing through the process of SHIP®. Thus, a key difference to consider between the two methods is that the induction of unique memories would be impossible for SHIP® clients with visualisation deficiencies, an obstacle that was overcome by the PENSIEVE prototype.

Simulating a virtual world through the use of an HMD effectively *"cut off"* participants from their immediate environment. Distractions and other hindering aspects identified were reduced or completely removed for participants. This enhanced the existing therapeutic alliance between the facilitator and the participant, leading to high levels of presence, and allowing participants to experience authentic responses towards the stimuli and SHIP® activities. In addition to this, the prototype was able to replicate every aspect of the traditional SHIP® process that is needed for successful treatment. Thus, the prototype was successful in simulating a VE that was able to induce unique memories and responses necessary for the SHIP® process.

Further research might include investigating the extent of VR's role as cognitive proxy for a SHIP® client's imagination by recruiting a larger sample via a more complex imagination exercise to ensure only participants who cannot visualise effectively take part in the study. Other research avenues might include, but are not limited to, a purely experimental approach based

on the induction potential of both interventions and compare them directly with one another. A quantitative study such as this can also take the form of a pre- and post-test comparison to determine if there was any improvement in the imaginative state of a participant. Lastly, a more extensive study could also be carried out focusing on the improvement of a client's disorder by observing the client over the span of multiple SHIP® sessions, while each client is experiencing a personalised virtual world developed specifically for said client. A study such as this would provide valuable insights into the extent to which VR is able to improve a client's specific mental disorder. Another consideration for such an investigation is to determine to what extent collaboration would be necessary between the psychologist and the VR developer/operator. The integration limitations such as the therapeutic space i.e. the psychologist's office (or wherever they administer treatment) and the psychologist's technical capabilities (with regards to operating a VR system) would also warrant thorough investigation.

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A IMAGINATION EXERCISE PROCESS

Step 1: The facilitator asked the participant to lie down on an air mattress and relax their bodies and to try and become aware of themselves within the space.

Step 2: Once the participant was relaxed, the facilitator asked them to imagine a door.

Step 3: After a couple of minutes, the facilitator asked the participant to describe the door in as much detail as possible.

Step 4: Once the participant had finished with their description, they were asked to just relax and keep imagining their door.

Step 5: After about 10 minutes the facilitator asked the participant to describe the door again.

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B HAT FORM

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.

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	

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(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.

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C APPENDIX: CHANGE INTERVIEW QUESTIONS

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 utilizing 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*

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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"?

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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?

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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:

- The participant sessions.
- The virtual environment.
- 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?

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